

How IoT Can Help Your Organization Improve Manufacturing Quality



Gaining Value from the Internet of Things (IoT)

Whether you call it the Internet of Things (IoT), Industry 4.0, the digital transformation of manufacturing, or the Industrial Internet of Things (IIoT), we've entered an era where every device that can be connected will be connected to the Internet and other devices. And IoT has become a core component of the industrial transformation efforts across the globe.

While people in organizations are familiar with traditional IT and its benefits because they experience it firsthand through computers and other systems they interact with, Operational Technology (OT) is often less familiar. Operational technology (OT) is hardware and software that detects, monitors, changes and/or controls physical devices, processes and events in the enterprise. Research has found that approximately 68% of enterprises have either planned or started an Internet of Things (IoT) initiative over the past 12 months. What's more, another 10% are expecting to start down the path in the next 12 months. One major driving force behind this adoption has been the transformative influence that Information Technology (IT) and Operational Technology (OT) have held in reshaping how businesses extract value and benefits from data.

Challenges

In the recent past, IT and OT environments were separate worlds and generally were managed and run by completely separate departments or groups in an organization. OT is involved in the monitoring and scheduling of the manufacturing, production and delivery of products. The primary focus of IT is in the management of software and systems for the entire enterprise. IT and OT often don't interact, so much so that 49% of manufacturers reported having a lack of collaboration across different departments. IT supported Management, Sales, Marketing, HR, and the Supply Chain, while OT supported Manufacturing, Production, Facilities, Development, and Research.

IT networks have changed, moving from wired to wireless, stationary to mobile, and campus-based to cloud or hybrid cloud-based. OT networks have grown, but in many cases, when data is gathered, it is stored and analyzed at the device or equipment level and is not connected to other enterprise networks, analyzed in aggregate or able to leave the operational context.

This turns OT applications into "islands of automation" - disparate systems of data, where data is utilized in situ, but not analyzed or used in a broader business context. Decisions are real-time and mission-critical in OT systems, and there can be major implications if things go awry. Driven by the rapid decline in sensor costs, advances in networking, and the rapid rise of mobility and the cloud, enterprises are now realizing they can now securely integrate OT and IT systems to tap into and realize the potential of vast amounts of data as well as integrate that OT data into business systems. Extending traditional enterprise IT networks to incorporate existing and new OT data, as well as the devices that generate it, creates an Internet of Things (IoT).

Opportunities

With the Internet of Things, successful businesses have the opportunity to unlock the value of their data – both data they have and new data they will generate – using that data to increase efficiency, reduce risk, improve the customer experience, or create new revenue streams and business models.

What's the risk when systems aren't connected, and data isn't analyzed? In unconnected systems, enterprise technicians must wait for a complaint before they know equipment is broken, and by then it's too late, and the damage is done. Technicians juggle a patchwork of disparate systems and data sources with a reported 39% having difficulty coordinating across supply and demand chains. And what's worse, they lack the ROI justifications for much needed improvement investments. But IoT has the power to transform businesses by unlocking the value of data – through the integration of existing business data as well as untapped operational data.

Promises

One of the key values of IoT is the ability to greatly improve product quality. To improve product quality, enterprises need to gather data from connected machines and then analyze that data using both process analytics, which focuses on how things are being manufactured, and product analytics, which focuses on what is being built and what is expected to be built as well as how it is being used in the real world. In order to efficiently gather and analyze both the process and the product simultaneously, enterprises need to be able to collect data from a range of sources and then analyze and act on that data in a timeframe of relevance. The key is "in a timeframe of relevance" – in some cases this may be real-time while in others it may be hours, and still in other cases, it may be even longer.

IoT systems measure, gather and analyze data to create actionable insights enable companies to:

- Improve the speed and quality of their decision making
- Improve production yields across the enterprise
- Keep their manufacturing lines running
- Develop new business opportunities

Things | Insights | Actions

Things

Connected Things

Developing an IoT-enabled, connected product is fairly complex, both during the development phase as well as post launch. In order to develop a connected product and move to an "aaS" (as a Service) mindset, companies need to build strong multi-disciplinary teams that can provide the full range of operational, technical, business and supply chain excellence. Research conducted by James Brehm & Associates shows that over 60% of IoT projects are being driven and led by groups outside of IT and OT, with just 6.25% being led by a dedicated IoT team. What's more, over 50% of all fully funded IoT projects end up failing. Not having a well-rounded team leaves an organization vulnerable to missed deadlines, lengthy delays, and even product failure.

And while multiple challenges abound, the possibilities unleashed by deployment of IoT systems in product manufacturing are endless and can provide a significant return on investment (ROI) to enterprises that connect, analyze, and use their connected product data to inform future development and innovation. The key to developing a well-coordinated and efficient IoT system lies in thoughtful data metric selection with a focus on effective data collection, transmission and processing, the ability to nimbly analyze data, and turn insights into intelligent action. Using data effectively can provide enterprises with the ability to detect issues with their products early, determine exactly what the problem is, and make adjustments or service the connected products before problems cause damage or customer dissatisfaction.

Insights

Improving the speed and quality of decisions

Historically, product maintenance in the traditional manufacturing realm has been based on quality metrics determined before production, combined with quality measurements after production used in combination with failure rates in the field and return rates. Using IoT systems that use manufacturing equipment sensors to create real-time insights, manufactures are better able to monitor the production process, allowing the detection and prioritize of problems early – reducing waste and rework. In addition, connected products in the field can be monitored and remotely managed, including remote upgrades to firmware to resolve issues, add features and extend product lifecycles.

Improving production yield rates across the entire enterprise

By combining IoT systems, manufacturers can monitor and control the entire process across the enterprise. Initial source materials and parts can be monitored and measured prior to their being added or installed during the production process. During the manufacturing process enterprises can use a combination of equipment sensors and real-time insights to monitor equipment parameters, such as temperature, pressure, speed, and humidity, in real-time to identify when they are moving out of calibration. Once those perturbations are noted, systems can deliver alerts and prescribe immediate actions allowing real-time maintenance or adjustments to made before equipment failure – even automatically ordering maintenance and parts prior to a major malfunction. Over time, machine learning can enable the IoT system to learn and thus predict when maintenance is needed, so that technicians can be scheduled to work on equipment at times that avoid disruptions to the production cycle.

Actions

Optimizing up-time

Predictive maintenance is believed by most to be one of the largest and most valuable uses for IoT solutions. Traditional systems practice preventative maintenance that is conducted at regular scheduled time or usage intervals. These schedules tend to be conservative and based on the judgement of equipment operators and/or recommendations by the equipment manufacturer, rather than real-world conditions. Using traditional methods virtually guarantees repair rates will be higher or more frequent than necessary resulting in increased maintenance costs and more equipment down time. IoT presents an attractive alternative. Using the combination of equipment sensors and real-time insights to predict when equipment will need service or parts replaced can head off problems before they occur – maximizing up-time and helping maintain product quality by keeping equipment operating optimally. In addition, scheduled maintenance times can be optimized to reduce down time based on data, rather than human judgement or time “guesstimates”.

Developing new business models

In addition to optimization, using IoT systems to manage product quality provides enterprises with a number of new business models for themselves as well as the ability to take advantage of vendors' new business models. Warranty and service contracts are a high mark-up business and anything companies can do to reduce these costs directly affect the bottom line. Companies that own connected and monitored manufacturing equipment have the ability to contract for service and maintenance based on real-world data that indicates when service is needed, rather than the traditional time-based model, thereby reducing warranty costs. In addition, companies can turn data streams from their new connect IoT products or equipment into a revenue source, providing manufacturers back information they need to develop better products and prolong the life of their assets.

Inventory Control Improves Industrial IoT ROI- A Case Study

Using connected systems for remote monitoring and maintenance is a key application that can provide a major return on investment for manufacturers. By connecting and monitoring systems, vendors can optimize inventory and machine up-time – providing increased sales and a better hand on spare parts inventory.

A perfect example for how IoT can improve manufacturing is illustrated by how automated inventory replenishment systems can help to manage lower-value items to ensure optimum productivity and keep order costs to a minimum.

Inventory is often split up via the A, B or C classification, with A referring to the most expensive and important parts, B for parts of mid-level importance and C for the least expensive and least important parts. Management of these parts often follows the same structure with more attention typically paid to managing A-parts compared with C-parts due to the individual value attributed to them.

C-parts, usually consumables, such as screws, nuts, bolts and washers, are lower value and easily replaceable items used in production facilities. Due to their lower value, these items are often maintained with looser control and are more easily accessed. C-parts are not always front of mind in an industrial environment, where more attention is paid to more expensive items. Despite the greater focus being on parts deemed more important, a production line can still come to a stand-still if C-parts are unavailable.

And while A-class items may be counted multiple times per year, C-part items are often only counted once – and sometimes not even that often. They are usually restocked at a similar frequency and a lack of knowledge of the supply and demand levels of each low-value item means items are frequently over-ordered to avoid running out of stock. Too much inventory of stock means more money than needed is being spent on inventory, and too little means risk of production line shut down.

Although these consumables are lower value items, they should be readily available at all times so that productivity and efficiency are not affected, and workers can get on with the tasks required of them. Ideally, a business needs to be able to predict usage, and automated dispensing solutions, based on smart bins, can provide the answer to stock replenishment.

These intelligent industrial vending systems are able to manage consumable stock by sending automated stock alerts and re-order notifications to suppliers to eliminate the need for regular counting trips, safety stock and emergency orders – cutting inventory costs by up to 30 percent and improving productivity.

IoT Solutions from Microsoft

Microsoft has the most comprehensive IoT portfolio with a wide range of IoT offerings to meet organizations where they are on their IoT journey, including everything businesses need to get started — ranging from [operating systems](#) for their devices, [cloud services](#) to control them, [advanced analytics](#) to gain insights, and [business applications](#) to enable intelligent action. Microsoft Azure IoT offerings include:

- Microsoft IoT Central, a fully managed IoT (SaaS) solution which can easily be configured to enable organizations to easily create and manage connected products;
- Azure IoT solutions, fully customizable (PaaS) solutions for common IoT scenarios, such as Remote Monitoring, Predictive Maintenance and Connected Factory; and
- Azure IoT technologies, a range of cloud services, such as Azure IoT Hub, Azure IoT Edge, Azure Time Series Insights, Azure Machine Learning and more, that enable organizations to develop an IoT solution that is designed and created for their unique business needs.

Conclusion

Companies looking to implement IoT solutions often start by developing simple systems that are aimed at simple data gathering with some analysis to reduce costs. In the long term, successful businesses must unlock the value of their existing and untapped data to increase efficiency, improve customer service, or create new revenue streams

and business models to remain competitive. Innovative companies will realize that the power in IoT is in connecting their systems to gather data and then analyzing and taking intelligent action based on insights created from that data to improve the quality of their products and services. By actively using IoT sensors, devices and analytics, enterprises can increase yields, reduce downtime, and deliver products and services that delight their customers.

At Microsoft, we want you to make decisions that improve manufacturing and product quality, so you can improve your business, your operations and your bottom line. This paper is intended to help you jumpstart your thinking around the strategic and technological requirements necessary to improve the manufacturing process. If you have further questions about using IoT to unlock the value of data, please reach out to a [Microsoft IoT specialist](#) to learn more about how our offerings, platform, and partner ecosystem can help your business start realizing the incredible potential of the Internet of Things.

Learn more about Microsoft IoT offerings at www.InternetofYourThings.com.

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