
DIGITAL INDUSTRIES SOFTWARE

# Four pillars of the industrial IoT

## Enabling manufacturers to significantly enhance operational efficiency

**Executive summary**
The fourth industrial revolution is making manufacturing faster, smarter and leaner. Known as Industry 4.0, this wave sweeping across factory floors takes automation to the next level. Using the industrial Internet of Things (IoT), manufacturers can connect the physical world with the digital and take complete control over systems as never before. Manufacturers can harness data to cut costs, improve performance and increase productivity by leveraging an open, industrial IoT as a service solution like Siemens' MindSphere.

# Abstract

Plugging into the industrial IoT brings manufacturers a network of new ways to cut costs, improve performance and increase productivity. Although a digital transformation may seem overwhelming, the transition can be achieved in just four phases, known as pillars: connectivity, control, digitalization and augmentation.

The first pillar, connectivity, involves connecting physical devices and enterprise systems to the IoT to foster system integration, increase transparency and improve processes remotely across plants. Control, the second pillar, allows a company to use data from connected devices to gain complete transparency and control the performance of assets.

Digitalization, the third pillar, takes control a step further by using data to create a digital twin of a product or system to find efficiencies, troubleshoot problems, test solutions and improve product development. Real-time performance data from the field is fed back into the digital twin for continuous innovation.

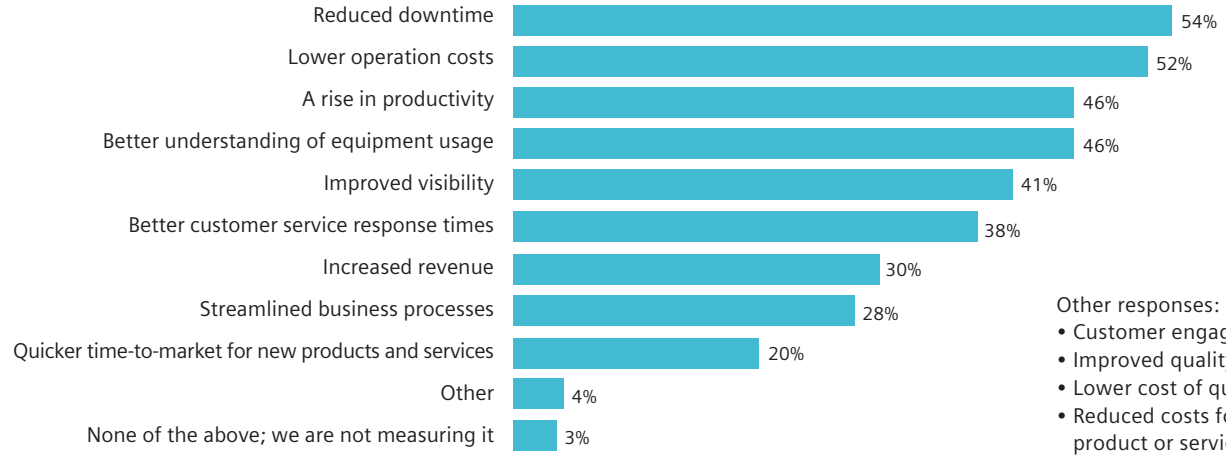
In the final phase, augmentation, IoT and artificial intelligence (AI) are combined to create smart machines that can use data to operate independently of human influence. Although few companies (4 percent) are fully integrated now, more than 70 percent have already completed at least one IoT project or are researching and implementing a project; and nearly 90 percent of those who have completed a project are looking into additional projects[1].

Those who have finished an IoT project report achieving reduced downtime, lower operating costs, increased productivity and a greater understanding of equipment (see chart below) and how to optimize it.

The following steps detail how to make the digital transition and take full advantage of the opportunities offered by Industry 4.0.

## Measuring the success/impact of IoT projects

Respondents are most likely to measure the success/impact of their IoT project by reduced downtime (54%) and lower operation costs (52%), followed by a rise in productivity (46%) and better understanding of equipment usage (46%).




**Source:** *IndustryWeek*
**Question:** How do you measure success/impact of your IoT project(s) to date? (Select all that apply.)
**Base:** Respondents who have completed at least one IoT project, or have their pilot project underway.

# Pillar 1 – Connectivity: connecting and monitoring assets

*Connectivity involves connecting physical devices and enterprise systems to the IoT to foster system integration, increase transparency and improve processes remotely across plants.*

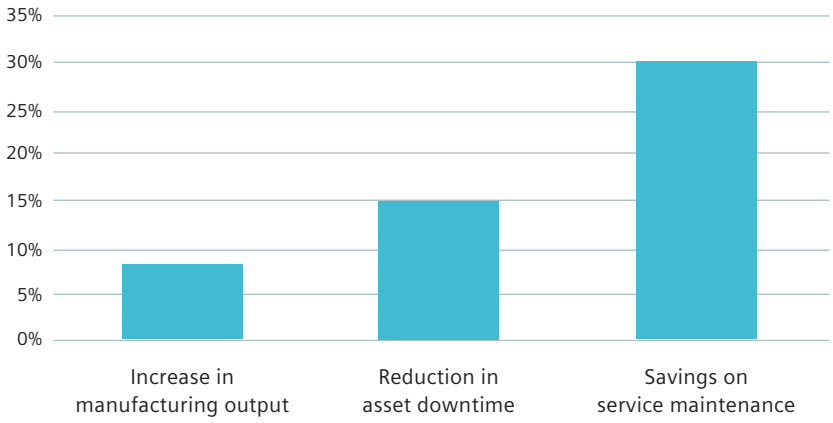
The first step in a digital transformation is connecting physical devices and systems to the IoT. Even companies with legacy machines can do this with sensors and hardware investments. Assets in multiple locations can be connected and their condition monitored remotely. Once machines are connected, real-time operational data can then be collected, and alarms can be set to notify the manufacturer when an asset isn't performing properly, removing the likelihood of a costly and urgent emergency repair.

Condition monitoring reduces downtime and gives manufacturers the opportunity to continuously improve machine performance using real-time asset data. Siemens' MindSphere customers report cutting service costs 30 percent, reducing downtime 15 percent and increasing output 8 percent.

**Connectivity and monitoring in action:** A German supplier of pneumatic and electrical automation technology used MindSphere asset management tools to transition from just selling products to also providing services. The supplier now offers their customers value-added service: They can use MindSphere to monitor device and machine data to optimize performance and can perform their own maintenance and contact the supplier as needed.

### Productivity gains due to monitoring

Siemens' MindSphere customers saw improvements in machine performance with reduced downtime and maintenance.



# Pillar 2 – Control and transparency: optimizing maintenance predictability

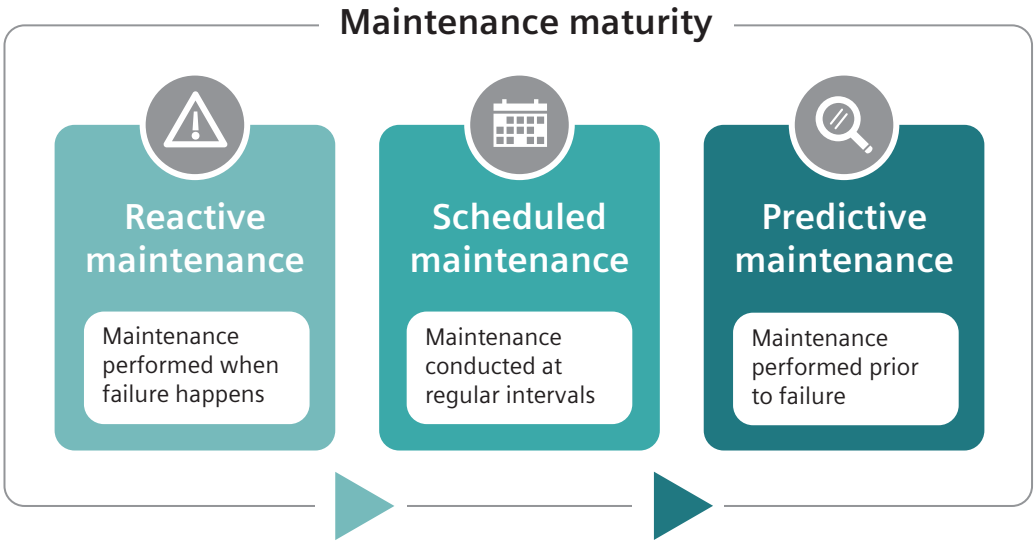
*Control allows a company to use data from connected devices to gain complete transparency and control the performance of assets.*

The second step in a digital transformation is using the data being collected to optimize asset maintenance, using predictive maintenance. This involves replacing traditional maintenance methods – reactive and scheduled maintenance – with evolving, data-driven approaches.

Predictive maintenance involves servicing machines at the right time to predict and prevent service failure. This eliminates ill-timed maintenance, reduces unnecessary downtime, allows the manufacturer to remotely monitor machines and enables the manufacturer to identity the root cause of production issues.

Predictive maintenance saves 12 percent in costs compared to scheduled repairs, reduces maintenance costs 30 percent and decreases breakdowns by 70 percent, according to a report on operational efficiency prepared by Pacific Northwest National Laboratory for the U.S. Department of Energy.

**Control and transparency in action:** A provider of autonomous condition monitoring and real-time location solutions used MindSphere to deliver performance analysis to customers. The company's smart sensors automatically transmit data to MindSphere about potential motor failures, allowing customers to prevent machine failures. Customers using MindSphere report a 15 percent reduction in downtime.



# Pillar 3 – Digitalization: closing the loop with digital twins

*The digitalization process uses data to create a digital copy – known as a digital twin – of a product or system to find efficiencies, troubleshoot problems and test solutions, and improve product development; then feed real-time data from the field back into the digital twin for continuous innovation.*

There are three types of digital twins: product, production and performance. A digital twin of a product allows a manufacturer to test out variations of a proposed product before creating a physical prototype. That can shorten development cycles, allow for more innovation and cut costs on product development.

A digital twin of production recreates the entire production process. This allows the manufacturer to find flaws in the process without affecting plant output. A digital twin of performance gathers real-time data from operational products and the production line to enable manufacturers to identify ways to improve the product or process. That data also can be fed back into the digital twins of product and production for continuous improvement.

**Digitalization in action:** A German manufacturer of electrical enclosures employed Siemens' MindSphere industrial IoT as a service to find ways to improve the efficiency and cost effectiveness of its energy efficiency climate-control unit.

The company created a digital twin that fed data from the cooling units into the design and product lifecycle management (PLM) systems, allowing it to improve designs. They also used real-time operational data to service machines at the right time and predict service failures, which led to maintenance cost savings.

A digital twin of a product allows a manufacturer to test out variations of a proposed product before creating a physical prototype.

# Pillar 4 – Augmentation: extending outcomes

*Augmentation is when IoT and AI are used together to create smart machines that can use data to operate independently of human influence.*

The final step in the digital transformation is using data gathered from the IoT to inform machine operation without human interference. AI makes sense of the data collected from the IoT by using ML to predict outcomes and react accordingly.

By automating the operation of machines, manufacturers can increase productivity, reduce errors and gain a competitive edge over those with less operational efficiency. Bringing AI and ML onto the factory floor gives companies a way to disrupt existing business models and find new opportunities.

**Augmentation in action:** Siemens and an analytics company are working together to embed enhanced analytics in MindSphere to create ML and AI capabilities in IoT environments. By streaming these enhanced analytics, they along with Siemens provide customers with nearly real-time AI for connected machines. Using predictive maintenance, companies can increase productivity and reduce operational risk.

# Conclusion

As industry heads full speed into digitalization, manufacturers need to be prepared for disruption. The industrial IoT can completely transform how a company does business. Seventy percent of companies already have completed at least one IoT project or are considering one, and 4 percent of companies are already fully integrated with the IoT. Sticking with the traditional ways of operating while competitors move into Industry 4.0 will leave manufacturers behind in the race for better operational efficiency[1].

Now is the time to implement a strategy to start benefitting from IoT data. The four pillars of industrial IoT – connectivity, control, digitalization and augmentation – give companies a competitive edge by allowing them to use data to cut costs, improve performance and increase productivity. Using real-time data, manufacturers can prevent and predict maintenance problems and figure out ways to optimize systems.

As much as 42 percent of unplanned downtime in a factory is the result of equipment failure. Customers who have used MindSphere report a 15 percent reduction in asset downtime and an 8 percent increase in output. It's not surprising that among those who have implemented IoT projects, 71 percent were trying to find ways to reduce equipment downtime[1].

The industrial IoT allows companies to take control of their factories as never before. By connecting devices and systems, manufacturers can learn more about their machines and how to manipulate them to work smarter – cutting costs and reducing errors.

**References**

1. Siemens and *IndustryWeek*. (2018). "2018 IoT Implementation Trends in Manufacturing: Survey Results from the Front Line," [survey report]. Siemens trend report. Retrieved from *https://www.iotworldtoday.com/2018/12/04/implementation-trends-in-manufacturing/*

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