Leveraging the IoT and Smart Technologies to Modernize Mid-Sized Manufacturing Operations

Subtitle A: The latest manufacturing technology is not limited to the biggest players

Subtitle B: Choosing the tools and technologies that make sense for mid-sized businesses

Subtitle C: Overcoming resistance to get the most out of smart factory technology

Image source

Smart technologies and the internet of things (IoT) are transforming the manufacturing industry in new and exciting ways. Leading organizations in the aerospace, automotive, medical device, and logistics industries are leaning into what is now known as the fourth industrial revolution, or "Industry 4.0," but the transformative potential is not limited to these industrial giants.

In this blog post, we examine the scope and capabilities of smart manufacturing technologies, including the IoT, and how they can impact mid-sized manufacturing operations. We also review the strategies

and practices that can make these transformations both practical and affordable.

What are smart technologies?

Smart technologies are the devices, systems, and applications that allow factories, warehouses, buildings, or even cities to operate in a more interconnected and autonomous fashion. Artificial intelligence (AI), wireless communication, and remote sensing capabilities form the core of these smart operations.

The term SMART originated as an acronym for "self-monitoring, analysis, and reporting technology," but the definition has since expanded to include machine learning and other innovations that have taken us from self-monitoring to *self-regulating* in recent years. The key features and capabilities of smart technologies include:

- Connectivity to exchange, transport, and analyze system data in real time.
- Automation to allow tasks to be performed without human intervention.
- Adaptability to incorporate feedback and learn from errors and mistakes.
- Data-based decision-making to produce actionable insights.

Typical applications of smart technology in manufacturing include data being transmitted from robotic assembly equipment in real-time to optimize programmed motions, or processing machines that automatically correct for unplanned material changes to prevent scrap or line down conditions. The many benefits of smart manufacturing are expected to propel the market value to $658 billion by 2030.

What is the IoT?

The internet of things (IoT) is a concept that originated over 40 years ago, when a group of college students attempted to track the contents of soda machines remotely. While the results were mixed for these IoT pioneers, the goals and benefits remain unchanged: Sensors embedded within everyday objects can now communicate everything from heart and blood pressure rates to equipment position and utilization.

The inclusion of the word "internet" is somewhat misleading—unlike the world wide web, the internet of *things* also applies to closed networks of devices that can only communicate with their host and each other. The industrial internet of things (IIoT) refers to the interconnected sensors within factories that

help to improve quality, worker safety, and operational efficiency. Technologies supporting the IoT include:

- Cloud computing resources to make data storage scalable and augment the processing of high-volume IoT data.
- [Private 5G networks](#) to securely transmit data up to 100 times faster than the previous generation of private or public 4G LTE networks.
- Edge computing technology, consisting of small data centers placed close to their use cases to improve response times and minimize congestion in the cloud.
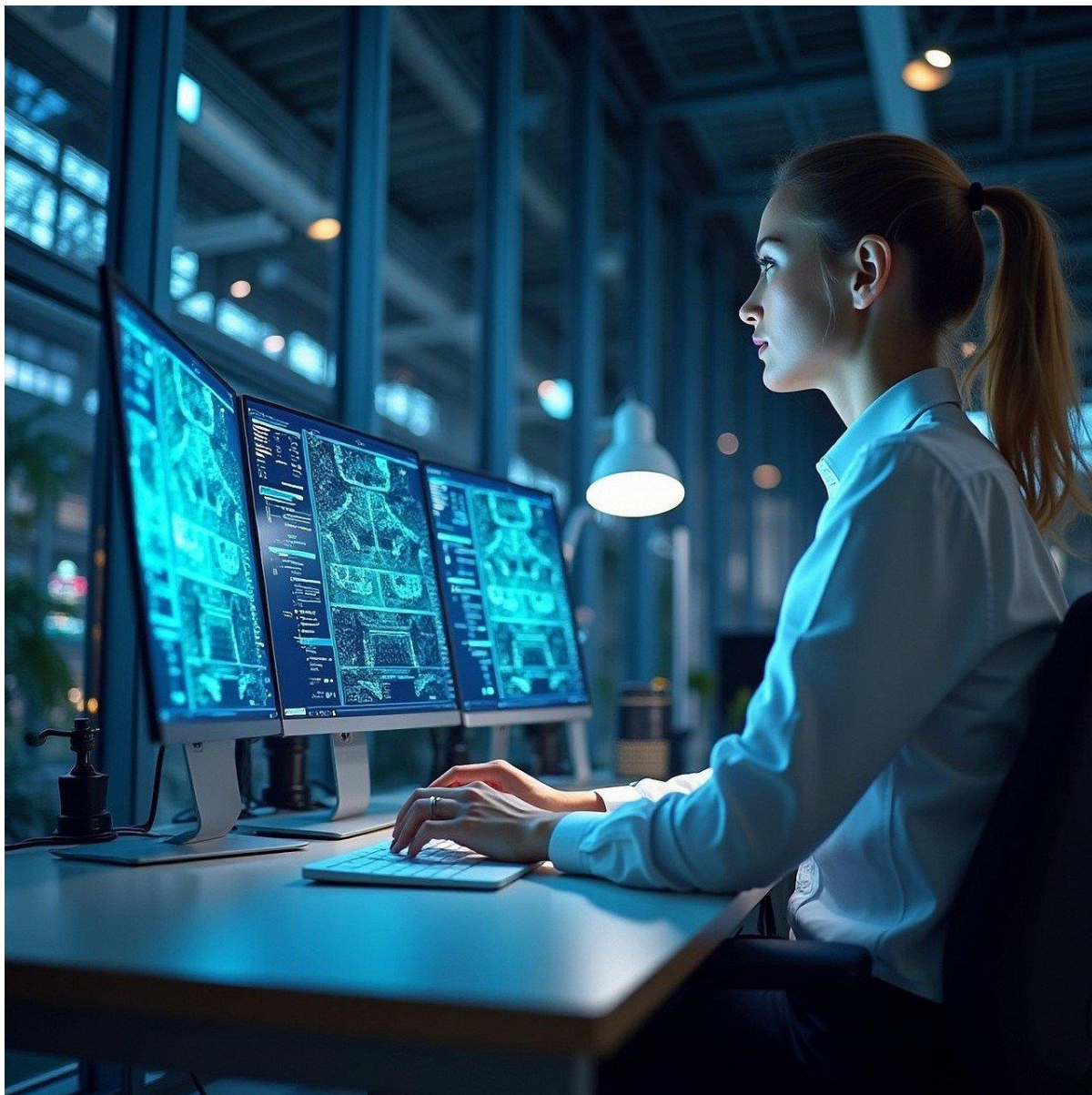
Keys to smart technology adoption in manufacturing

Middle-market manufacturers can find the integration of smart technologies and the IoT formidable, due to potentially high upfront costs, [lack of internal expertise](#), resistance to change, security concerns, and many other factors. Overcoming these obstacles begins with a realization that technology adoption is not an all-or-nothing prospect. The IoT, wireless communication, and artificial intelligence lend themselves to a phased approach that includes:

- **Cost vs. benefit analysis:** Weighing the cost of smart technology implementation vs. the expected benefits makes it easier to decide where to focus. For example, a complex machine that disrupts production by breaking down frequently might be a good candidate for a pilot IoT monitoring program.
- **Stakeholder engagement:** Overcoming resistance from both managers and operators can be difficult, especially when perceptions of smart technology and automation are linked to human obsolescence. Educating and engaging key stakeholders helps to minimize these objections.
- **Timeline creation:** A phased approach to smart technology implementation should follow a structured plan that explains how, when, and why new tools will be deployed. A detailed roadmap also makes it easier to plan for additional financial or [human capital](#) that might be required.

Benefits of smart technologies and the IoT for manufacturers

Smart technologies and the IoT improve operational efficiency through real-time monitoring and data processing. AI and machine learning (ML) can be leveraged to optimize production settings and resolve complex problems without human intervention. Predictive maintenance is another key benefit, with equipment properties monitored through the IoT to identify issues before they impact production. These advantages apply to mid-sized companies as well as their larger counterparts.

Smart technologies also promote the real-time inventory awareness required to complete accurate forecasts and minimize the [bullwhip effect](#) that can cause overproduction when inventory visibility is impaired. The IoT and advanced tracking technologies such as radiofrequency identification (RFID) tags provide a more reliable source of inventory status than manual counting methods.

Technology implementation strategies for mid-sized operations

While the benefits of manufacturing modernization are universal, the implementation strategies for mid-sized companies must be prioritized based on the available resources. A successful smart technology integration for a mid-sized operation often includes:

- Subscription-based [cloud IoT services](#) that do not require additional infrastructure.
- Strategic deployment of AI-based vision systems to detect defects.
- Low cost IoT sensors that can work with existing tools and equipment.
- Workforce and inventory management software tools with built-in AI and ML capabilities.

The adoption of [lean manufacturing principles](#), such as one-piece flow, pull-based production, and continuous improvement, is a recommended prerequisite for smart technology adoption, since these practices build a foundation of efficiency in mid-sized operations. In this way, smart technologies are applied to optimized systems, rather than amplifying the problems inherent to inefficient or disorganized processes.

The future of smart technology

Smart technologies have only scratched the surface of their enormous potential. Like all major breakthroughs, the cost of new software and hardware is likely to normalize as more companies leverage these tools. AI and ML are already permeating production and inventory management software platforms as the demand for intelligent features increases. This bodes well for mid-sized companies seeking to add these capabilities to their platforms.

The IoT is also experiencing unprecedented growth, with the number of connected IoT devices expected to reach [40 billion by 2030](#). This is yet another positive sign for mid-sized operations, since the increase in device volume will be accompanied by greater variety and lower prices. Sustainability mandates will contribute to the growth, since IoT sensors are leveraged to capture data on energy consumption, carbon emissions, and water quality.

In conclusion

The world's largest and most successful manufacturing companies already rely on the power of the IoT and smart technologies to drive their operations forward and remain competitive. The time is fast

approaching when small and mid-sized operations will also consider interconnected and autonomous factory operations mandatory. The evolution of available software platforms, IoT devices, and factory management systems will soon make it easier to adopt the latest technology without breaking the bank. This transformation will allow new companies to weave smart technologies into the fabric of their operations and build in quality and efficiency from the start.