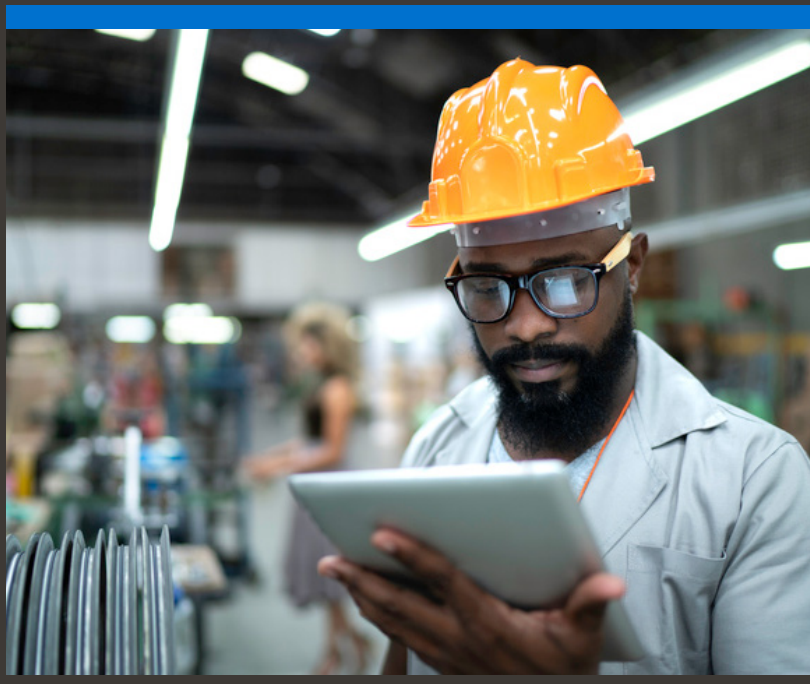
Kelly Engineering

Manufacturing and Industry 4.0 trends:

Keeping up with an interconnected world of work



One of the most exciting trends in manufacturing is the ongoing and accelerating move toward a more interconnected, automated, and data-centric transformation of the traditional manufacturing and industry practices called "Industry 4.0."

According to BCG, Industry 4.0 will "make it possible to gather and analyze data across machines, enabling faster, more flexible, and more efficient processes to produce higher quality goods at reduced costs." As a result of this transformation, there will be increasing levels of productivity, industrial growth, new sources of revenues, and a shift in talent and profile of labor toward more specialized skill sets.

A number of contributing technologies have enabled Industry 4.0—the main ones being Industrial Internet of Things (IIoT) platforms, smart sensors, big data analytics, 3D printing, 5G proliferation, autonomous robots, and augmented and virtual reality.

At the heart of the new industry lies four core drivers:

1. **Interconnectivity.** Previously, traditional manufacturing processes relied on siloed and manually monitored and controlled devices. Today, with the growth of widely available and high bandwidth internet access (5G), internet-enabled devices (IoT), and cloud and edge computing—industrial machinery, devices, sensors, and people are able to communicate with each other in real-time. The ability to gather data from more sources and the comprehensive visibility across the supply chain allows for better and more responsive decision making.

   Use case in action: A consumer electronics manufacturer can monitor electricity usage, temperature, vibration, pressure, etc., of its equipment through smart sensors to ensure safety and performance, while reducing energy costs.

2. **Automation and predictive analytics.** With more data sources to collect and analyze, decision making can be automated through the use of artificial intelligence. Of increasing importance will be leveraging edge computing to allow the processing of data where the data is actually collected, "at the edge," rather than needing to send the data back to the cloud. This provides the benefit of faster responses to the operational conditions and increases performance and reliability. Artificial intelligence and machine learning can also allow companies to perform predictive maintenance on capital equipment to monitor and address potential issues before they become critical events.

   Use case in action: Edge computing can allow remote monitoring and automated control of equipment in hazardous environments, especially in industries such as mining and construction. By programming predefined routines and implementing machine learning to improve responses over time, the machinery can operate safely and efficiently in dangerous or otherwise inaccessible areas.

3. **Rapid prototyping.** Rapid prototyping refers to the ability to quickly design and build a model of a physical part, model, or an assembly. With the increased capabilities and cost reductions of 3D printing, prototypes can be built much faster and at a lower cost when design precision is not a requirement. With a faster concept to prototype, more design iterations can be performed which can result in more functional, reliable, and lower cost mass production products.

   Use case in action: A medical device manufacturer can quickly prototype prosthetic equipment and test patients for fit and function using 3D printing. As prosthetic fit is highly subjective, patients often need multiple changes before committing to a final design. Using 3D printing, patients can test multiple prototypes quickly at a minimal cost to the manufacturer.

4. **Software simulations and visualization (VR/AR).** One aspect of Industry 4.0 is the ability to simulate products and operations digitally before implementation. Through the use of software-defined simulations of plant, machinery, or product, firms can understand how the simulated equipment may behave in the real world before making changes or investments. This simulated environment provides a safe operational model and identifies where improvements can be made.

   Further, virtual and augmented reality can help technicians visualize what the product will look like, or it can help them with contextual information as they're monitoring plant operations.

   Use case in action: A solar panel manufacturer can simulate how varying conditions like weather patterns, placement, PV cell material, etc., will impact energy generation to ensure the highest efficiency and lowest cost system for a large customer.

While Industry 4.0 will have broad and high-impact effects across manufacturing, undoubtedly there are challenges that must be met. The enabling technologies of Industry 4.0 are complex, require specialized knowledge, and involve closer work across multidisciplinary engineering and business teams.

According to the American Society of Mechanical Engineers (ASME), "mechanical engineers must collaborate with electrical and electronic engineers to add embedded capabilities, manufacturing engineers to optimize design for production, and professionals in purchasing and marketing to ensure the product meets cost, service, and functional goals."

With the pandemic-related operational expense reductions across the industry, there will be an even greater focus to "do more with less" through automation enabled through smart sensors and artificial intelligence. Companies will be looking to pre-emptively identify and address inefficiencies and problem areas through software simulations and predictive maintenance, while accelerating the design process through technologies like VR/AR and 3D printing.

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- **Process Engineers**
- **Predictive Maintenance**
- **Controls & Automation**
- **Data Science, Integration & Visualization**
- **Sensor Design**
- **Robotics**
- **Embedded Systems**

References: BCG, Embracing Industry 4.0 and Rediscovering Growth
Hitachi, 10 Trends that will dominate Manufacturing in 2019
ASME, 7 Biggest Trends for Engineering in the 2020s

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