# The Evolution <sup>A</sup> of Autonomous Manufacturing

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The next phase of manufacturing is to evolve automated systems into autonomous systems. The difference between the two may seem small, but the inclusion of artificial intelligence and machine learning propels today's manufacturing systems far into the future.

Automated systems today are fixed processes that operate continuously until a human operator intervenes. These include a die-cut machine, a packaging conveyor belt, or a robotic arm sorting product. These systems are programmed to run a predetermined loop, alleviating human workers from dull, dirty, and dangerous tasks.

As we move forward into autonomous systems, these tasks begin to utilize the power of Industry 4.0 fully, and the systems become flexible and customizable. In countries like the U.S., where the demand for custom goods is increasing and labor costs are high, autonomous systems can provide on-demand and flexible manufacturing at a lower price point and are sustainable. Laborers can transition from repetitive work to higher functioning positions, providing more value to the supply chain.

Let's explore six key technologies that compromise autonomous manufacturing systems.

### **Artificial Intelligence and Machine Learning**

The backbone of autonomous manufacturing is AI and machine learning. Industry 4.0, cloud-based data systems, and connected devices are now capable of computing at the edge in real-time, moving closer to the factory floors. In turn, manufacturing decisions are predicted instead of reactionary. AI can avoid failures at the end of the line by predicting the failure before building and implementing corrective actions before production begins.

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#### **Modular Manufacturing**

A modular production line differs from a traditional production line by being connected vertically throughout the organization. Modular production consists of robots, storage vehicles, and flexible production flow that allows immediate reaction based on supply and demand. If the demand for a product increases across the country, connected manufacturing lines can ramp up production. According to ABB, by 2029, companies with modular manufacturing lines will see an average 12 percent increase in revenue.

#### **Autonomous Robots**

The main difference between a standard industrial robot and an autonomous robot is that they are self-learning and adaptable. According to Deloitte, autonomous robots will have increased mobility, dexterity, and intelligence to take on high-risk tasks previously not possible with industrial robots. They will have enhanced haptic sensors, use AI to learn from their surroundings, and program their own routines.

## Self-Driving Transport

The Los Angeles Times predicts that by 2025 1.7 million trucks will be self-driving. Future commercial trucks are modernizing into autonomous and electric vehicles. CALSTART, a nonprofit organization focused on clean transport, estimates that newgeneration trucks will increase by 80 percent by 2023. Self-driving trucks could help make up for a lack of drivers, an estimated 160,000 by 2030.



## **Digital Twin, Modeling, and Simulation**

Autonomous manufacturing provides greater flexibility to meet the requests of the customer. This is facilitated by digital engineering. Advanced modeling of products and their testing before production helps reduce errors during manufacturing, and greater customization evolves rigid product lines into flexible ones. Deloitte predicts a growth of 38 percent annually in the digital twin market, reaching \$16 billion by 2023.

## Blockchain

Blockchain as a service has seen increased use in the connected factory. The electronic ledger system can be used to track goods across several business units. As products are created and entered digitally into the system, other digital participants must approve and digitally sign the inventory. The new digital records of materials, parts, and products become visible and traceable to all within the system, providing greater inventory control.

