



# Manufacturing in 2021 and Beyond

Succeeding in Uncertainty with Industry 4.0 and IoT

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# 01 Introduction

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Before the pandemic, manufacturers continuously strive to improve processes by scaling their digital transformation initiatives beyond the PoC stages. However, the beginning of 2020 brought unprecedented challenges due to which manufacturers switched their focus from optimizing their operations to resolving new challenges. These challenges include disrupted supply chains, skilled labour gap, implementing social distancing, unavailability of raw materials and essential product components, and execution of remote working.

To succeed in the new normal, manufacturers need to embrace technology such as Artificial Intelligence (AI), data analytics, and the Internet of Things (IoT). This not only helps in improving manufacturing processes but also in building resilience and agility for the post-pandemic landscape. Leveraging the trends and foundational technologies of Industry 4.0, manufacturers can focus more on remote capabilities, productivity gains, improved service levels, and better customer management to drive value to the business.

# 02 What are Manufacturing Units, and How do They Operate?

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Manufacturing is a process that transforms raw materials into final products with particular properties based on given requirements. This process of transformation is achieved using various processes such as discrete, batch, and repetitive. Individually these processes are known as manufacturing units and require resources, energy, technology, and supplies.

## Types of Manufacturing Units/Processes

### Repetitive Manufacturing

Repetitive manufacturing is a process in which the products are manufactured in bulk and at a greater speed. Manufacturers use this process for products that look similar in their functionalities. Moreover, the process follows a strict schedule to achieve the desired product quality. The key advantage of this manufacturing process is that the setup time is lower compared to other processes.

### Discrete Manufacturing

Discrete manufacturing is a process that is used to create different parts of a product. Later on, these parts are merged to build the final and finished product. This process involves a series of steps such as Make to Stock (MTS), Make to Order (MTO), Assembly to Order (ATO) that are independent of each other. With its advanced functionality and flexibility, discrete manufacturing allows manufacturers to track production workflows easily. The process follows some common trends to automate, simplify, and streamline the production flow.

- **IoT:** Implementation of IoT in discrete manufacturing allows manufacturers to derive important data from machines connected via the Internet. Thereby increasing production efficiency and offering better customer services.
- **Virtual/augmented reality:** With this trend, manufacturers can experiment with the products virtually.
- **Predictive maintenance:** Predictive maintenance saves the time and efficiency required to resolve production issues.
- **Supply chain optimization:** Discrete manufacturing processes can be optimized with efficient planning to drive more value to the business.

### Batch Manufacturing

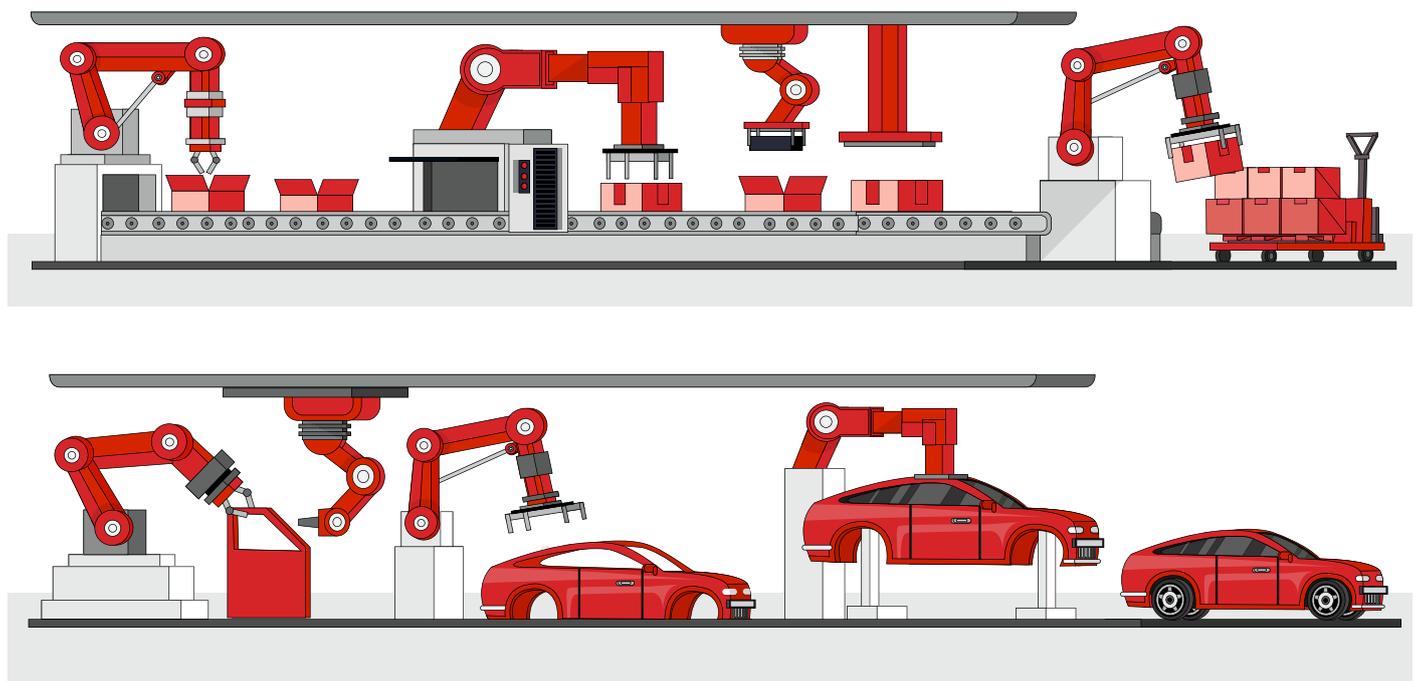
Batch manufacturing refers to the mass production of products manufactured in batches or specific amounts. To achieve the desired quality of product, each batch goes through a series of steps. This process is generally used to manufacture products such as molds, machines, material coating, newspaper, software, and more. Moreover, it increases the efficiency of machines and equipment, reduces waste by producing the desired number of goods, lowers production cost by utilizing machines only when required.

### Job Shop Manufacturing

Job shops are small manufacturing processes that help manufacture a wide variety of quality products in small batches, also known as jobs. In this process, the machines that perform similar functions are grouped for better utilization, quick manufacturing of products, and adequate supervision. To achieve maximum flexibility, job shops include unique process steps to offer personalization.

### Continuous Manufacturing

Continuous manufacturing is a process that manufactures goods and materials 24/7. This process continuously works from one production flow to another without any disturbance in between different manufacturing stages. Continuous manufacturing is generally used for producing high-scale products, including gas, oil, steel, and chemicals. The benefits of continuous monitoring include increased production rates, consistency, decreased labour costs, fewer human interventions, enhanced quality control, and more.



# 03 How are Industry 4.0 and IoT Revolutionizing Manufacturing Processes?

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Industry 4.0 is a seamless combination of advanced technologies and manual processes that transforms manufacturing into smart manufacturing. It combines advanced communication technologies, IT, and manufacturing processes to bridge the gap. This intelligent and flexible integration of manufacturing systems, production processes, and digital technologies forecast unique opportunities for manufacturers to leverage data and machine learning capabilities. It also helps in facilitating sustainable growth while eliminating production issues.

## Four Foundational Technologies of Industry 4.0

### Advanced Engineering

Advanced engineering helps leverage advanced manufacturing techniques such as 3D printing and nanoparticles to improve output, increase product quality, and reduce time-to-market. Advanced manufacturing includes flexible production methods that are efficient, effective, and responsive. These methods allow manufacturers to create innovative and high-quality products. Moreover, advanced manufacturing relies on three leading groups: efficient production, smart production, and effective organization of products.

### Data and Connectivity

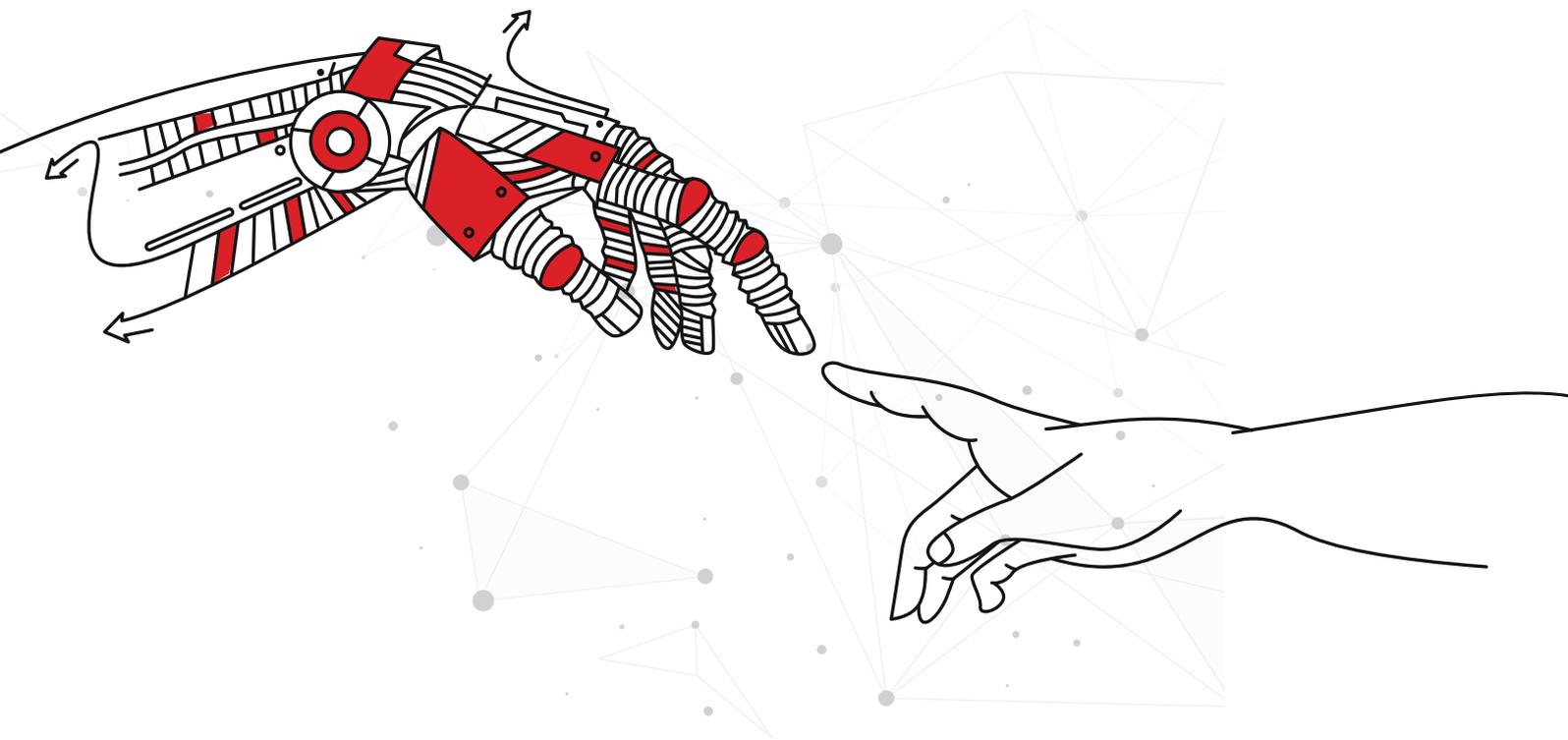
Utilizing the right foundational technology in your manufacturing plant across all the protocols, systems, and machines. It focuses on collecting data points from various sources, including workforce productivity, manufacturing components and machinery, maintenance activity for industrial connectivity. This industrial data helps break down data silos, connect to legacy equipment, and improve manufacturing KPIs through asset performance analysis. With data and analytics, manufacturers can connect to multiple production systems, leverage technology like sensors, IoT, and cloud to make the manufacturing process more efficient, empower teams with role-based, real-time data to prevent downtime and boost efficiency.

### Analytics and Intelligence

Intelligence and analytics are data management solutions implemented to collect and analyze historical and current data with the help of software solutions. This domain provides deeper insights into the data collected from multiple data streams such as consumer activity, production costs, machine sensors, energy consumption, and more. It utilizes intelligent automation not only to reduce manual interventions but also to optimize manufacturing operations.

## Human-Machine Collaboration

Human and machine collaboration is a model in which humans and Artificial Intelligence (AI) systems work together rather than using them as tools. Augmented and virtual reality are some good examples of human-machine collaboration. It helps engineers remotely monitor maintenance activities performed via robotic automation. With human-machine collaboration, manufacturers can rely on robotic systems to perform delegate, dangerous, laborious, and repetitive manual tasks to improve accuracy and decision-making, provide end-to-end efficiency, reduce manufacturing or labour costs, and boost productivity.



## Applications of IoT in Manufacturing Plants

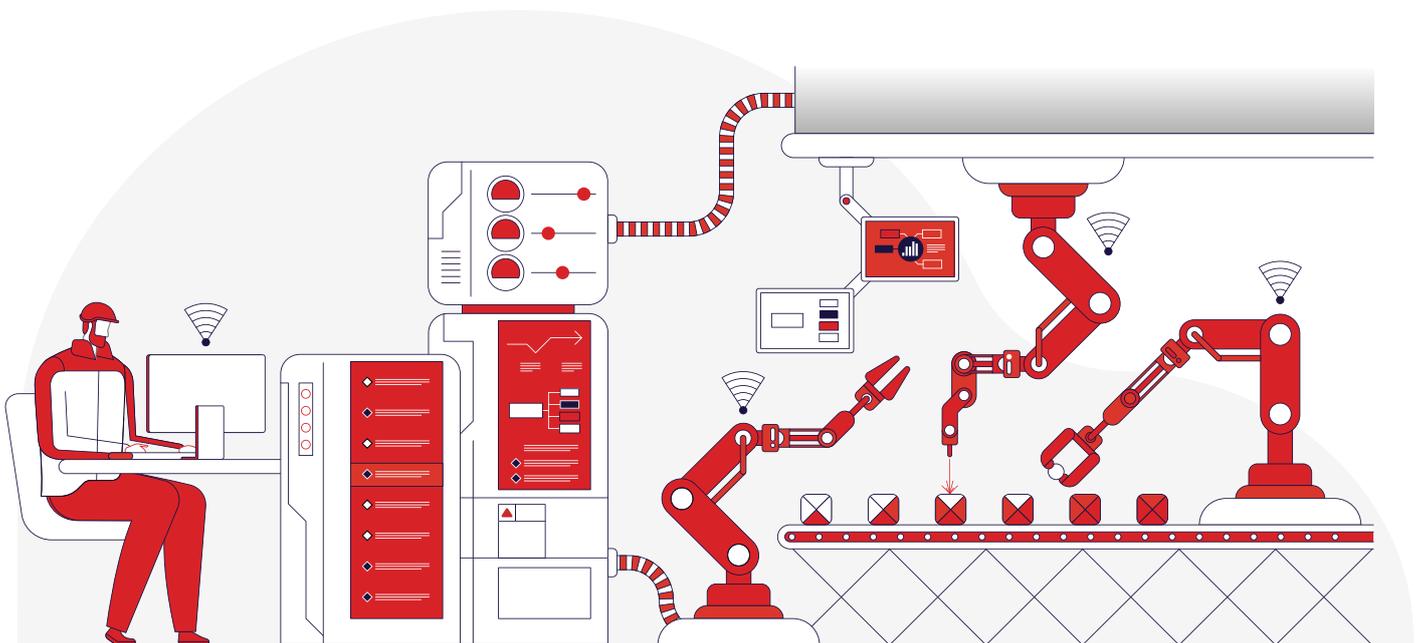
IoT is the next industrial revolution with various applications in manufacturing plants that helps in facilitating the production flow. IoT devices like sensors and ubiquitous connectivity, when combined with data and analytics, open up new opportunities for manufacturers in quality control.

Moreover, IoT makes inventory management an efficient and seamless process by assigning Radio Frequency Identification (RFID) and Unique Identification Number (UID) to each product in the inventory. This encoded digital information is further utilized to gain valuable business insights.

Additionally, IoT also provides cross-channel visibility to supply chain managers about the realistic estimate of available materials or the products in transit. With this information, managers can improve handling times and enable efficient processing of the materials for production.

# 04 Industry 4.0 Trends Shaping the Future of Manufacturing in 2021

Manufacturing companies are increasingly adopting Industry 4.0 trends to unlock advantages in production optimization and gain a competitive edge in revenue generation. Outlined below are the Industry 4.0 trends shaping the future of manufacturing in 2021.



## Digital Twins

A digital twin uses a simulation technique to virtually represent an existing real-world product, asset, or system to understand its current state. When used with IoT sensors, it can receive continuous and real-time data from the system, which can further be utilized to monitor and analyze the system. Digital twin helps to improve situation-based awareness and enables manufacturers to test future scenarios by performing what-if analysis. The technology can also be utilized to manage and improve the effectiveness, performance, and quality of manufacturing assets such as machines, plants, and more. The digital twin also offers various opportunities for manufacturers such as quick production, simplified operations, and more.

## Artificial Intelligence

Implementation of Artificial Intelligence (AI) in manufacturing is expected to reach [USD 16.7 billion](#) by 2026 at a CAGR of 57.2%. The major drivers for AI implementation are the evolving Industrial IoT and automation and an increasing number of large and complex datasets often known as big data. In the manufacturing sector, the Industrial Internet of Things (IIoT) plays a significant role in adopting AI-based technology. Although IIoT makes the manufacturing processes highly productive and efficient, providing real-time information about operations and business systems, the data generated needs to be converted into instructions to make it easier for machines to perform a specific task. AI-based solutions can learn human behaviour and patterns via deep learning, contextual awareness, and NLP to work 24/7 continuously, eliminating errors. This helps in improving the efficiency of manufacturing operations and helps in business growth.

## Machine Learning

To meet customers demands, it is important for manufacturers to reliably provide products with optimum quality. However, this requires regular maintenance of equipment and ensuring that they are up-to-date and functional. Machine learning is one of the most effective technologies that offer predictive maintenance, market assessments, inventory forecasting, rapid prototyping and keeps the manufacturing business running. Both AI and Machine Learning can help improve several aspects of a manufacturing operation, such as:



Inventory Management



Asset Tracking



Warehousing Cost Reduction



Transportation Cost Reduction



Forecasting Accuracy



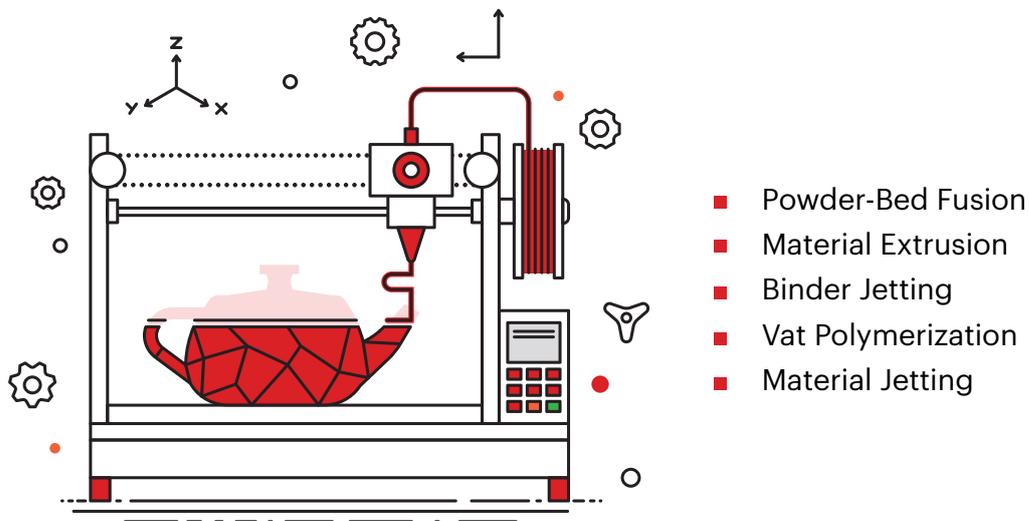
Supply Chain Visibility

## IoT and IIoT

The Internet of Things (IoT) and Industrial Internet of Things (IIoT) are the leading technologies in the digitization revolution. According to McKinsey, the economic impact of IoT applications will reach around [\\$11.1 trillion](#) per year in 2025. These technologies help connect numerous devices and pieces of equipment such as sensors and adaptors with all stages of production through the Internet. They combine real-time data received from multiple sources such as machines, factories, facilities, artificial intelligence, and human insight to provide efficient and cost-effective production. Manufacturers have started utilizing these innovative technologies for predictive maintenance, real-time asset monitoring, connected operational intelligence, and more.

### 3D Printing/Additive Manufacturing

Additive manufacturing or 3D printing refers to the computer-aided process of creating three-dimensional objects through a layering method. It is an approach to industrial production that involves the layering of materials in geometrical shapes. It adds materials such as composites, ceramics, and thermoplastics to create lighter and stronger objects. Additive manufacturing is the fast-growing trend in the manufacturing industry that saves time and cost. 3D printing and rapid prototyping are the subsets of additive manufacturing. There are a variety of different additive manufacturing processes that manufacturers are using, such as:



### Collaborative Robots (Cobots)

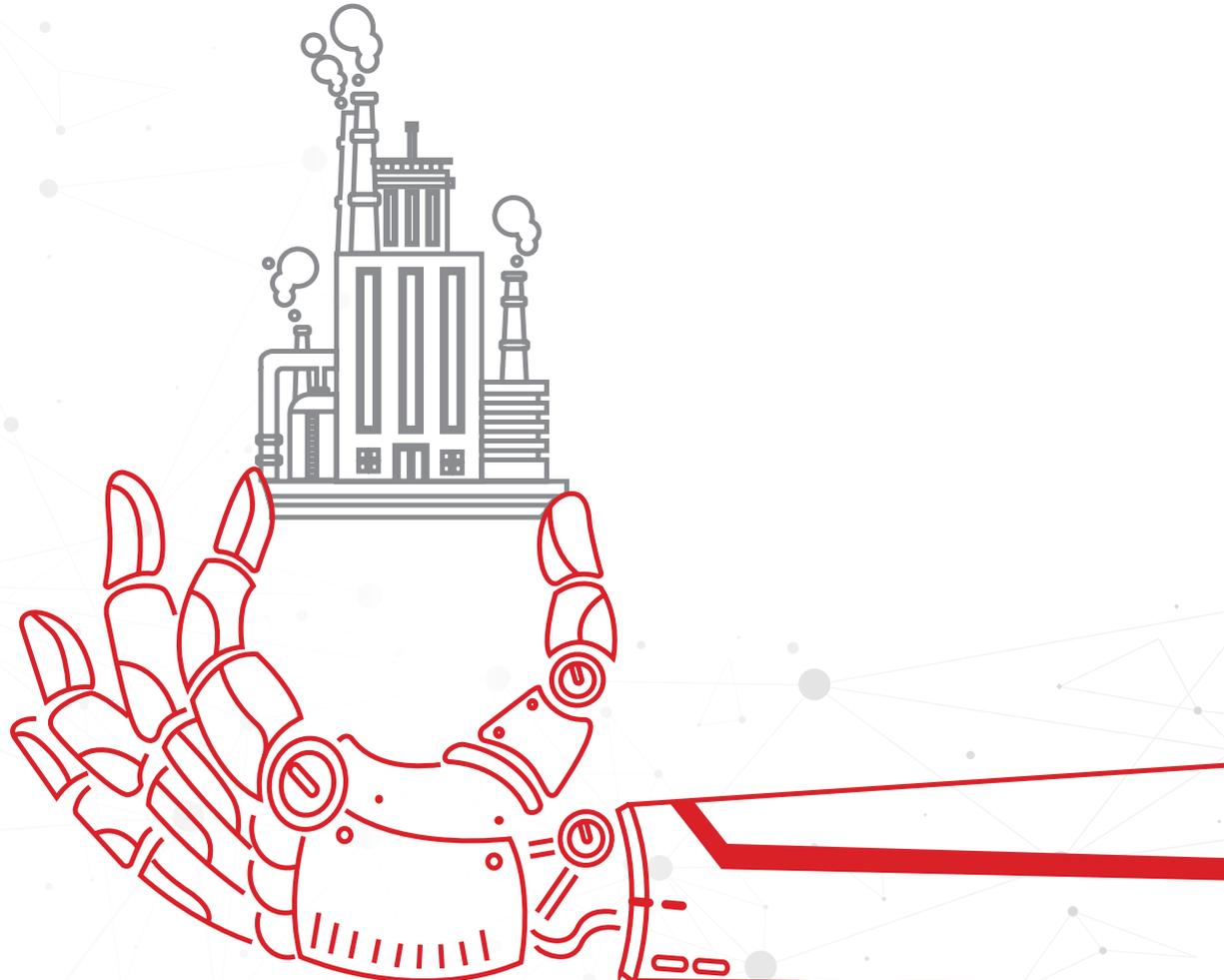
The combination of robotics and automation is known as Cobots. Cobots are safe, cost-effective, and flexible. They are used in factories and warehouses to make various manufacturing processes faster and easier. Manufacturers have started utilizing this uniquely-tailored technology to improve overall efficiency and consistently perform non-value-added work. They can move heavy products, work on items like circuit boards that require fine motor movements, and more. The major benefit of using cobots is that they provide the accuracy required for finishing jobs such as polishing, grinding, and deburring.

## Hyper Automation

Hyper Automation is known as the next level of automation. It focuses more on automating the knowledge beyond RPA. It not only leverages advanced technologies such as AI, Machine learning, predictive maintenance, Natural Language Processing (NLP) but also uses advanced analytics to measure the business impact of automation and the ROI delivered. Moreover, it also focuses on employing process discovery tools to uncover workflows intelligently through automation to achieve greater speed, efficiency, and superior quality control.

## Supply Chain 4.0

The advances in high mix, low volume (HMLV) manufacturing have a huge impact on overall supply chain operations. It is vital for manufacturers to effectively adopt and leverage Industry 4.0 technologies to save cost and time while delivering quality products to the customers within a specific time. Industry 4.0 helps to reorganize traditional supply chain processes such as distribution, logistics, design, and planning to deliver faster and better services. It integrates a multitude of digital supply chain services to reduce delivery time and offer greater flexibility. Moreover, it helps manufacturers achieve mass customization and micro-segmentation to speed up the delivery process and satisfy increasing customer expectations.



# 05 **Advantages of Industry 4.0: Reimagining Manufacturing Operations**

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Industry 4.0 refers to manufacturing 4.0 that utilizes key automation drivers such as IoT, data analytics, Artificial Intelligence (AI), and Machine Learning to boost operational efficiency, eliminate human interventions, and digitalize manufacturing. The use of these digital technologies also helps mitigate the challenges of COVID-19 in multiple ways, such as focusing on employee safety, enhancing asset productivity, and improving product quality.

## **Improves productivity and performance management**

In various small-to-medium-sized manufacturing companies, the data is gathered manually, making it more prone to errors and inaccuracies. Digital solutions or Industry 4.0 trends are helping manufacturers to be more productive. The solutions allow them to utilize smart devices such as sensors and machine Programmable Logic Controllers (PLCs) to automatically collect data from machines and centralize it on live dashboards for better and quick analysis. This way, manufacturers can monitor the real-time performance of manufacturing units remotely, conduct performance-related meetings, and improve labour productivity. Additionally, implementing process automation and robotics eliminates the need for a manual workforce, thereby preventing close contact between production and material-handling employees.

## **Boosts employee safety and operational continuity**

Collaboration through remote working has become a necessity during the pandemic. Digital technologies like video-conferencing applications, and advanced solutions such as machine-vision algorithms and AR/VR, are helping employees to be safe, efficient, and productive. Moreover, automation, analytics, and machine learning have eliminated the need for manual interventions. These technologies are promoting operational continuity with fewer human resources required to monitor and maintain the systems.



# 06 How can Motherson Technology Services Transform the Manufacturing Units into Smarter Units?

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Motherson Technology Services Limited, a division of Motherson Group, helps manufacturing companies transform digitally with Industry 4.0 solutions. These manufacturing companies can leverage multiple technologies that Motherson Technology Services offers, such as IoT, automation, AI, Machine Learning, sensors, the cloud, and advanced analytics to enhance traditional legacy systems. It helps businesses simplify operations, boost revenue, and lower production costs to compete in the fourth industrial revolution. Motherson Technology Services offers the most suitable technology based on the need and priorities of the business to achieve the desired outcomes.

## Smart and Connected Enterprises

Motherson Technology Services helps to transform manufacturing units into intelligent and connected enterprises by leveraging Industry 4.0 solutions. It helps to implement smart assets or devices, cloud-based applications, advanced analytics, and monitoring solutions to optimize manufacturing processes and supply chain aspects. It involves retrofitting of non-smart equipment processes via automation, cyber-physical systems, sensors, IoT, and the cloud. This enables manufacturing companies to gain real-time data, insights, notifications, and alerts through multiple devices and make informed, smarter, and faster decisions.

## Digital Transformation via IoT

Motherson Technology Services facilitates end-to-end IoT solutions and industrial IoT gadgets to help businesses streamline and simplify their shop-floor operations to be more efficient. Moreover, Motherson Technology Services enables manufacturers to utilize its Telematics capabilities, including vehicle tracking, geofencing, and odometer, to make the fleet operations safer, greener, and cost-effective. Motherson Technology Services empowers manufacturers to digitize nearly every part of the business via IoT solutions such as:

- **Speed of Transmission:** It refers to the rate at which the data is moved across a communications channel. Mobility, accessibility, and connectivity are the standard ways to measure the effective transmission onto various data networks.
- **Data of Intelligence:** It refers to the applications or smart devices that help collect and process data. This enables smart manufacturing units to understand, detect, and analyze the changes in physical status of things.
- **Data of Things:** It refers to the intelligent devices, systems, or solutions such as RFID, barcodes, PLCs designed explicitly to identify, capture, and track business-critical data.



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