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SIEMENS DIGITAL INDUSTRIES SOFTWARE

Smart Manufacturing

Drive quality and sustainability through intelligent production
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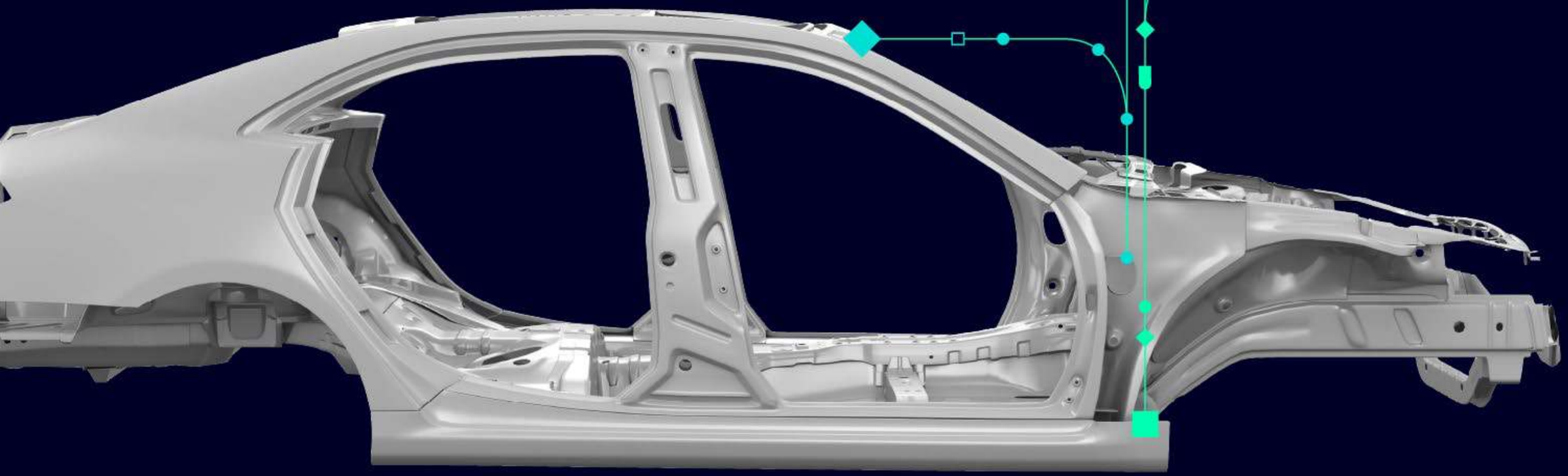


Because launching and producing a vehicle has always been an incredibly complex and costly endeavor, the automotive industry has been driven over the years to continuously improve manufacturing efficiency. According to statista.com, the first instance of transformation can be traced back to Henry Ford, who introduced the moving assembly line in 1913, reducing manufacturing time by 90%.

As today's market changes rapidly due to new technologies, increased competition, customer demands, and escalating sustainability regulations, manufacturers find that their current processes are not agile enough to keep up.

The shift from internal combustion engine (ICE) vehicles to electric vehicles has opened the market to smaller, technology-focused manufacturers who are attracting fresh talent and developing electric vehicle architectures quickly. They are also able to take advantage of a supply chain already producing ICE components that overlap by up to 90% with EV components. The absence of previous entry barriers like experience, patents, and component tooling has accelerated their speed to market, putting pressure on OEMs to keep up.

As consumer demands for personalization, connectivity, and autonomous vehicle technologies increase, manufacturers must scramble to incorporate them quickly. Such changes to designs require adjustments in production that increase the risk of quality issues and launch delays that affect both experienced and new manufacturers.

Faced with a rapidly changing industry today, how can you guarantee a flawless launch and efficient, high-quality production tomorrow?

Trends

Trend #1

Globalization

Trend #2

Time to market

Trend #3

Complexity

Trend #4

Sustainability

Key drivers

- Increasing demands for higher fuel efficiency and lower emissions requires rapid innovation and introduction of alternative powertrains.
- Higher levels of personalization increase the number of components and vehicles variants.
- Maintaining secure global manufacturing requires improved data exchange.
- Adding EV, AV and ADAS to a current portfolio requires significant upfront investment and revamped manufacturing processes.

Turn data into action

Make better decisions in real time with smart manufacturing.

In today's market, production volumes are smaller, manufacturing complexity has increased, and the time available to bring new products to market is shorter. The ability to pivot quickly in the plant in response to fluctuating internal or external factors is critical. If the production mix changes or a machine begins to fail, for example, manufacturers must be able to make real-time decisions and adjustments on the shop floor to ensure continued successful production.

Updating legacy equipment with sensors and edge computing devices that can be used to implement new technologies like the internet of things (IoT), artificial technology (AI), and machine learning (ML) is a step many automotive manufacturers have already taken. Unfortunately, most of them are not extracting the full potential value from the large quantities of data being generated.

By employing a manufacturing execution system (MES) as part of a smart manufacturing approach, the data can be processed at the source in real-time to provide continuous visibility into the production operations. Acting as a production data backbone in the plant, the MES connects people, operations, and machines. It creates a fundamental data bridge between the plant automation layer and the centralized enterprise business (ERP)-product lifecycle management (PLM)-quality management systems. This bridge of connected data ensures that manufacturers are consistently producing the correct parts on time to meet the expected quality, throughput, and productivity targets.

The elements of smart manufacturing

Modernization

By updating legacy equipment with sensors and edge computing devices to incorporate new technologies like the internet of things (IoT), artificial intelligence (AI), and machine learning (ML), you will establish a foundation for smart manufacturing while avoiding significant capital investments and lengthy construction periods.

Virtual Development

With a virtual replication of the manufacturing environment, known as a digital twin, you can create and assess work cell and production line layouts. You can also commission your equipment virtually before physically commissioning it in your plant, which allows you to resolve issues and debug offline to ensure that your launch goes as planned.

Intelligent Production

The final step to smart manufacturing creates a truly intelligent production environment by leveraging technology and your digital twin to form a complete loop of communication that monitors and optimizes your production processes. With closed-loop manufacturing, your plant will become a self-organizing entity that automatically predicts and resolves issues in real time.

Intelligence drives efficiency

Continuous improvement through closed-loop manufacturing

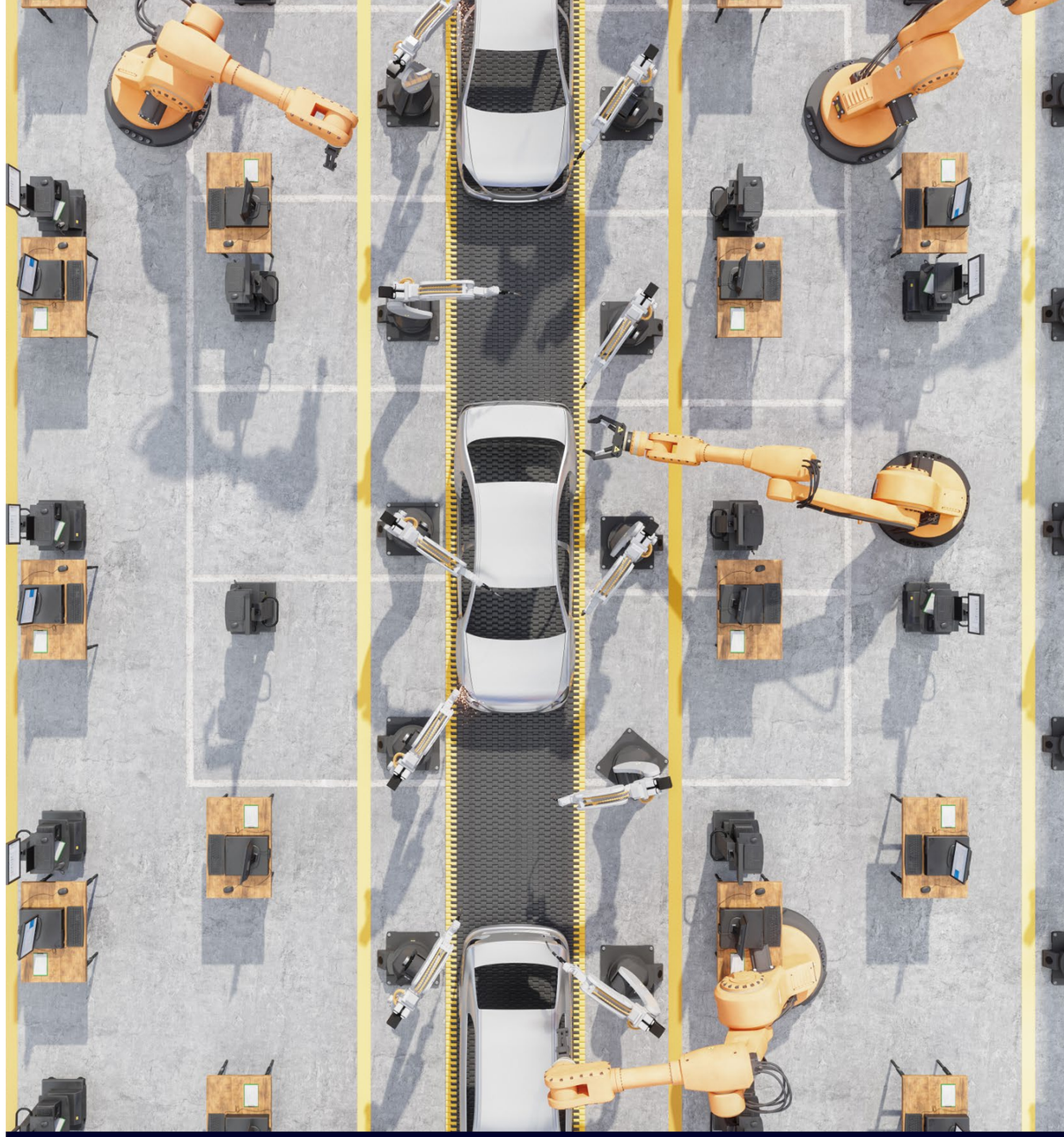
According to a 2021 Boston Consulting Group study of 895 companies that have attempted a digital transformation, 70% achieved results that fell short of their objectives. Many companies take steps to add digital capabilities to their manufacturing facilities but struggle to connect information technology (IT), which manages data, to operational technology (OT), which controls the physical equipment to create a self-organizing production environment.

A complete integration of communication, also called closed-loop manufacturing, can be formed by adding intelligence to machines using the IoT, artificial intelligence (AI), and machine learning (ML). Edge computing devices collect data that can be used, along with simulation and a comprehensive digital twin, to monitor machine performance, predict operational issues in real-time, and drive efficiency and sustainability into production processes.

By performing real-time statistical process control, closed-loop manufacturing can predict tolerance issues and initiate corrective actions before they occur. It tracks the manufacturing environment and makes automated adjustments to reduce waste and energy usage. Additionally, when problems arise, a digital backbone of data provides the traceability needed to perform a root cause analysis quickly and accurately.

Siemens' Smart Manufacturing portfolio creates an intelligent production environment with an open architecture that works with legacy equipment and third-party software. Self-organizing lines that manage themselves help manufacturers meet aggressive quality and throughput targets from launch into production.

Using a comprehensive digital twin of the production environment, manufacturers will drive efficiency and continuous improvement by simulating launches and design changes before implementing them to eliminate unexpected issues and unnecessary delays.



With closed-loop manufacturing, you will:

- Constantly monitor your lines with edge-based IT/OT automation
- Automatically initiate corrective actions with a self-organizing lines
- Prevent quality failures with advanced QMS (quality management systems)
- Track the manufacturing environment to reduce waste and energy usage
- Achieve sustainability and throughput targets from launch into production

About Siemens Smart Manufacturing solution:

With Siemens' open and scalable smart manufacturing solutions, intelligent production is achieved by connecting the IT and OT through edge-based devices, the IoT, AI, and ML to provide complete visibility and automated management of the manufacturing line.

A comprehensive digital twin enables simulation from design through production, providing the flexibility to optimize efficiency, productivity, and sustainability in the factory and then replicate it anywhere in the world. Manufacturers can leverage simulation, virtual commissioning, and a digital backbone to convert production lines into intelligent, self-organizing environments that optimize sustainability and reduce costs.

The actionable insights gained through the digitalization of manufacturing prevent expensive errors, eliminate time-consuming rework, and produce first-time quality parts at launch and throughout the entire product lifecycle.

Siemens' Smart Manufacturing solutions portfolio is a fully integrated, scalable approach that combines edge technology and cloud flexibility to revolutionize automotive manufacturing processes and drive success today while building a foundation for tomorrow.

For more information on Siemens Smart Manufacturing, visit siemens.com/sm or follow us on LinkedIn and Twitter.

Siemens Predictive Performance Engineering,

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