



**SIEMENS**

*Ingenuity for life*



In the fast lane  
with digitalization

Solutions for the automotive industry

[siemens.com/automotive](https://www.siemens.com/automotive)

# Digitalization changes everything

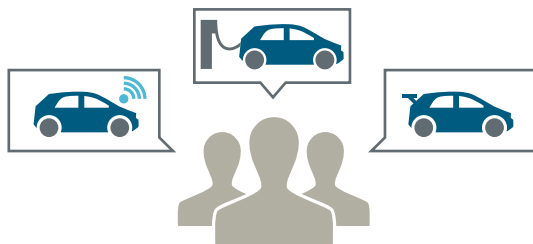
The automotive industry is facing dramatic changes in the years to come, inside the car as well as in production. There is a huge shift occurring from traditional engine concepts to e-cars to self-driving cars and autonomous production systems, as well as to composite materials that require innovative production processes. In addition, customers want highly customized vehicles. Automotive manufacturers must be able to respond quickly to these changing market demands, which will require the industry to ramp up to highly flexible and efficient production systems.

A holistic approach is needed to connect formerly separated processes and achieve the required flexibility. Siemens is the only company that provides products and solutions for all aspects of the production process – from the design to the finished vehicle.

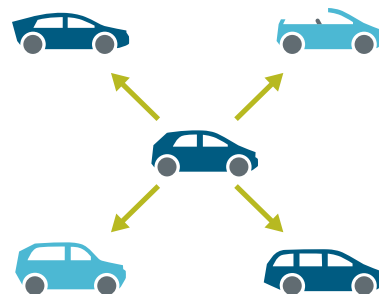
This is made possible by the Digital Enterprise Suite (DES) and associated hardware, to which industry-specific services are added to provide end-to-end digitalization along the entire value chain.

## Challenges in automotive manufacturing

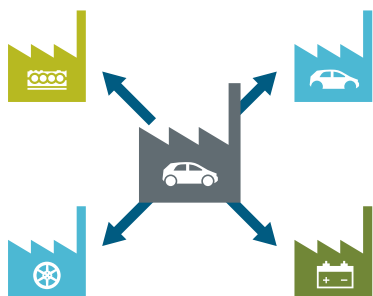
Customer demands are increasing,



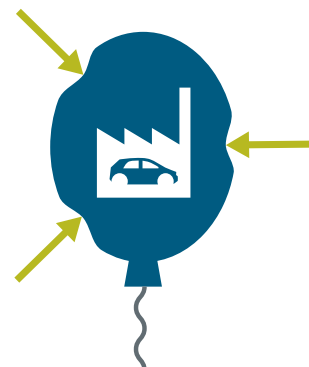
complexity is growing,



the supplier network is expanding,



and market pressure is rising.



# Our solution



## Digital Enterprise Suite – Our unique portfolio for digital transformation

The Digital Enterprise Suite offers integrated software and hardware solutions for discrete industries to seamlessly integrate and digitalize the entire value chain, including suppliers. The result of this is a perfect digital copy of the value chain – the Digital Twin. Simulation, testing, and optimization in a completely virtual environment allows for reduced time to market, increased flexibility, quality and efficiency.

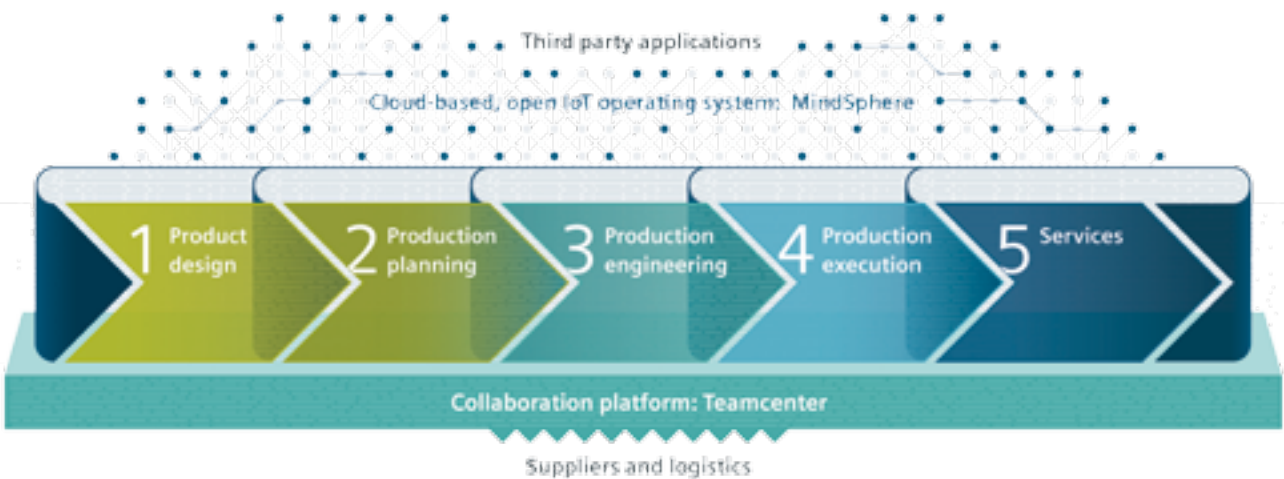
With the Digital Enterprise Suite (DES), Siemens integrates Product Lifecycle Management (PLM), Manufacturing Operations Management (MOM), Totally Integrated Automation (TIA) – all based on Siemens collaboration platform, Teamcenter, and being connected to MindSphere, the cloud-based, open IoT operating system.

## Holistic approach to optimizing the entire value chain

When automotive companies want benefit from digitalization, they have to take a holistic approach. Product design, automation technology, and production must be connected. By simply focusing on the automation part of manufacturing processes, it will be impossible to meet the upcoming requirements.

The holistic approach allows manufacturers to integrate and digitalize their business processes with a digital thread, including suppliers, and to create a digital twin of their entire value chain.

Now is the time to begin innovating and operating in a more flexible, cost-effective, and sustainable way.



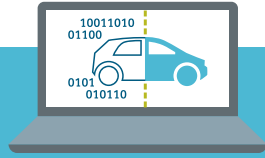
## Continuous optimization

MindSphere allows to analyze production assets and

products as they perform and feed back the insights into the entire value chain for continuous optimization.

# Every step brings a benefit

## 1 Product design



### Challenge

Designing a new car is expensive. Numerous parts, materials, functions, and external factors have to be considered, even before the first prototype is being built. Prototyping itself is a time-consuming and cost-intensive task, which is being followed by thorough testing on test tracks.



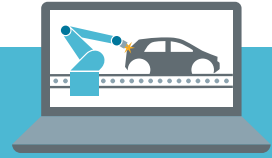
### Solution

Designing a car digitally allows to create a digital twin of the real car. This virtual version of the automobile represents every detail and aspect and can be used to simulate, test, and optimize the vehicle before production. For example, it is possible to simulate the driving behavior of a car even before the first prototype is built.

During the design process huge amounts of data are created. This data needs to be available for all following process steps to ensure that the results of the simulation and optimization processes are being optimally used in production planning, production engineering, and production.

Siemens NX is a leading design software that covers all aspects of the design process, and the integrated simulation allows optimization and testing with Simcenter.

## 2 Production planning



### Challenge

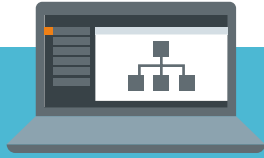
Planning the production line involves a variety of production equipment, e.g. like robots and conveyor belts. The production line needs to be set up perfectly to ensure maximum output and efficiency. For example, in a welding cell all the sheet metal parts have to come together in the right order. Robots need to be programmed, and the cycle time must be optimized for high production output.



### Solution

To enable production planning in parallel with product design, Siemens' Tecnomatix software allows robots and other production equipment to be positioned in a virtual production line. It also enables the simulation and optimization of the manufacturing process in order to achieve the cycle times required for mass production. Plant Simulation software simulates the material flow and helps eliminate bottlenecks in production. Using the data from product design during production planning helps to reduce the efforts during the automation engineering.

## 3 Production engineering



### Challenge

The growing manufacturing complexity and the increasing number of car variants call for a faster time-to-market and require a flexible production environment. Connecting the virtual world of product design and production planning with the real world of automation is a major task. Automotive manufacturers also have to find new ways to reduce engineering time and effort. Consistent data is crucial, and any inconsistency has to be detected even before the start of production.

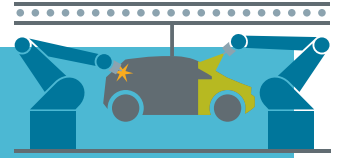


### Solution

With Production System Engineering, Siemens connects the mechanical design process to the electrical data so that programs for PLC and corresponding E-CAD layouts can be generated automatically. When all mechanical, electrical, and automation data are integrated, it is much easier and faster to manage a change. Controllers, distributed I/O, HMI, drives, motion control, and motor management are also seamlessly integrated into a single engineering environment – Totally Integrated Automation Portal (TIA Portal). Its integrated library concept supports global standardization for automotive manufacturers.

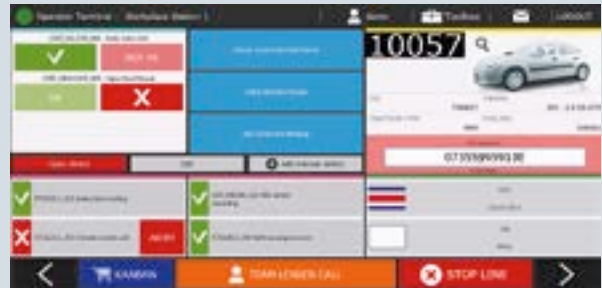
TIA Portal opens the door to the world of Totally Integrated Automation (TIA). It includes powerful and scalable automation hardware that works seamlessly with other elements of the system. A virtual commissioning makes it possible to simulate and validate the engineering before the start of operation.

## 4 Production execution



### Challenge

The production of a car is a complex task. When the actual production process begins, both automated and manual production and assembly steps are needed to produce the car from many thousands of parts. Agile supply chains, synchronized production operations, and real-time plant visibility are required to respond to market fluctuations and to keep product quality high.



### Solution

The Manufacturing Operations System helps to achieve that. It consolidates all production processes to improve manufacturing execution process, quality management, and advanced planning and scheduling. SIMATIC IT, Siemens' Manufacturing Execution System, sends information about any individual configuration to the right stations on the production line. It continuously monitors the production process to ensure that all components can be manufactured and assembled in the right way, on schedule.

# 5

## Service



### Challenges

For automotive manufacturers, maximizing production plant availability and OEE while optimizing the Total Cost of Ownership are the crucial success factors to maintain long-term competitive advantage. In addition, entering the digital era means utilizing machine and system data to master asset uptime, predict energy cost and make data visible across the entire production lines. The key question is: how to turn big data into smart data, gain insights and make better decisions?



### Solution

With our automotive-specific Digital Services, the data comes to life by applying smart analytics. The evaluation of data indicates where and why energy is being wasted. The analytics of machine data, e.g. vibration, temperature, etc, can predict when a motor, component or machine will fail. This is a service that Siemens offers with Digital Services – turning big data into comprehensible recommendations for action – helping to save energy and improve asset utilization. Derived from that, Siemens provides the suitable corrective and preventive maintenance activities throughout the entire lifecycle of products, machines and plants worldwide.



Bernd Mangler, Vice President Solutions  
Siemens Digital Factory

“Digitalization makes complex production processes significantly more manageable.”

The benefits of digitalization can be achieved when all interfaces between the separate steps along the value chain are eliminated. Interfaces make the process prone to error, therefore a common data backbone is needed that can serve as a consistent communication and innovation platform. Teamcenter PLM software from Siemens is the leading data management solution in the automotive industry. It serves as a consistent data backbone, offering access to all data from all areas involved.



"In engineering, the introduction of TIA Portal has brought certain advantages: first, faster system access time and second, easier handling of the shared data platform in the system. As a result, we are able to save about 10 percent on our engineering effort."

Jens Baumann, Production Planning at AUDI AG, Neckarsulm

"There are no two cars the same. Each Maserati client has their own wishes. Thanks to SIMATIC IT we can manage all the requested components in real time with the suppliers."

Anna Adilardi, Information & Communication Technology Manager at Fiat Chrysler Automobiles, Grugliasco



"As a service partner Siemens is responsible for the maintenance management of our entire paint shop. One of the most important demands is that the paint shop maintains at least 95 percent of availability. Siemens has achieved a long-term success here by providing us with 98 percent availability."

Pavel Mizera, Head of Paint Shop at Škoda, Kvasiny

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