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Inside the Digital Factory

Integrated digital tech can greatly improve even efficient operations.

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MindSphere is Siemens' cloud-based ecosystem for digitally viewing, engineering and commissioning production lines.

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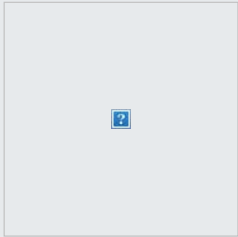
Siemens PLM Software

"Digitalization changes everything," says Raj Batra, president of Siemens USA's Digital Factory Div. ([siemens.com/businesses/us/en/digital-factory.htm](https://www.siemens.com/businesses/us/en/digital-factory.htm)). The company has developed what it calls a completely integrated end-to-end "digital ecosystem" that connects product design through simulated production, with the potential for breakthrough productivity gains in the real manufacturing world.



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Research says the number of connected devices will approach 1 trillion by 2030. While thermostats and smart appliances are on the rise, the bulk of these connected devices will be in the manufacturing enterprise. Within this framework, the most important driver remains improving time to market, Batra says. Creating a digital twin of the entire value chain—modeling and simulating product design, production planning, production engineering, production execution on digital machine tools, and related services—will create a common data backbone that will go a long way to eliminating mistakes, redundancies and trial-and-error in all these areas when things are actually produced.

This is not just talk. Siemens has invested approximately €10 billion over the last 10 years in both acquisitions and internal efforts building its Digital Enterprise approach, which includes a suite of simulation, communication and services-based software products, all under an open, cloud-based operating system Siemens is calling "MindSphere."

Beginning At Home

Siemens is a manufacturer, too, so it is using the tech in its own factories. For example, a facility in Bad Neustadt, Germany, was efficiently producing 500,000 servo motors annually. But simulating both old and new equipment and connecting these digital twins to electronic production planning and engineering uncovered significant new efficiencies. Setup times for new machine tools were reduced 60 percent; cycle times for several parts were reduced by up to 20 percent and plant utilization, at 70 percent for fiscal year 2016, is forecast to hit 90 percent by 2020. And the plant is now producing 700,000 servo motors annually.

All this integrated design, engineering, production planning and production simulation takes place under MindSphere, a cloud-based operating system open to integrating both Siemens-developed and third-party applications for production improvement. "MindSphere is the means to provide agility and informed decision-making, leading to integrated execution," says Rajiv Sivaraman, vice president, [Siemens PLM Data Services](#), U.S. It quickly connects the digital world to real things, it is an open platform-as-a-service (PaaS) for third-party partner integration, and it enables closed-loop innovation by creating a complete digital twin of a production operation. "This isn't happening because it's cool," Sivaraman says. "It's because it's efficient. It can handle big data."

Also within the infrastructure are MindApps, both Siemens and third-party applications for related tasks, and MindConnect, secure plug-and-play connections of the apps to various sources on the shop floor—motors, robots, machine tools and other software packages, such as enterprise resource planning (ERP) and manufacturing execution systems (MES). "It works like a cable box," Sivaraman says. Users obtain a MindSphere user account that directly integrates into Siemens' SINUMERIK CNC control on a machine tool or to a connector box. Users then confirm data acquisition and MindSphere connectivity, then it is a matter of monitoring machine status and production details through such MindApps as Manage

MyMachines or Fleet Manager

Production team members can choose from different production setups, virtually commission machine tools and validate machining processes through such apps as Siemens' NX Virtual Machine or Analyze MyWorkpiece, all before a single chip is cut. Users can store, compare and use different setups as needs arise, stored either in the cloud (MindSphere), on site (SINUMERIK Integrate) or on the device (SINUMERIK Edge, offering high-speed "edge" data processing). Siemens reports more than 40 MindApps are available to choose from.

Running virtual production lines and entire virtual factories will also revolutionize worker training, Siemens predicts. Users can design their own interface screens on touch-sensitive monitors that eliminate separate buttons. Work instructions for operation, assembly or maintenance can be embedded in videos or screen text on tablets as well as workstations, not only eliminating the familiar laminated instruction sheets or job-ticket drawings at every machine tool, but they can be automatically updated as jobs change.

"All this is designed to turn data into business value quickly," Raj Batra says. Whether small or large, enterprises can level the playing field and reap the benefits of productivity advantages by embracing the digital frontier. Those who don't run the risk of being digitally disrupted.

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