

DIGITALIZATION AND CONTINUITY:

4 GAME-CHANGING APPROACHES FOR MANUFACTURERS

HOW DIGITALIZATION IS REVOLUTIONIZING THE WAY MANUFACTURERS INNOVATE, PRODUCE, SELL AND SERVICE THEIR PRODUCTS.



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Digitalization is enabling a reinvention of manufacturing. It's a core component of a new Industry Renaissance—the merger of automation, the Internet of Things (IoT), artificial intelligence, business processes, big data and cloud computing. It's reshaping how manufacturers innovate and respond to customer demands.

Customers want more personalized products in today's on-demand economy. Manufacturers that embrace digitalization can transform from a traditional mass-production model to mass personalization. They embody the four key characteristics of modern manufacturing, which include:

- **Creative**, enabling new business models with cost-effective mass personalization
- **Smart**, improving speed and agility with real-time learning
- **Value**, connecting value end-to-end from ideation through manufacturing to ownership and eliminating unwanted waste
- **Human**, empowering collaboration and augmenting human creativity

Digitalization enhances collaboration across the enterprise by enabling digital continuity from ideation to production through post-sales service. It's a phenomenon that's taking hold globally as more manufacturers move from mass manufacturing to a new era of digitally informed production.

For example, more than 60% of respondents from China, Germany and the U.S. are more optimistic regarding the potential of digital manufacturing.¹ Respondents from these countries expect this potential to generate double-digit revenue and cost improvements over the next three years.²

In this e-book, we'll explore the four key attributes of a fully digitized manufacturing environment and how manufacturers can win the global race for gaining new customers and enriching existing customers.



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¹ McKinsey & Co., [Digital Manufacturing: Capturing Sustainable Impact at Scale](#), June 2017.
² McKinsey & Co., June 2017.

1. MANUFACTURING IS CREATIVE

Creativity isn't exclusive to Silicon Valley. Traditional manufacturers are bringing high-tech, innovative products to market with the help of advanced technologies, such as 3-D printing, IoT, artificial intelligence and robotics. In the past, complex, unique products required time-consuming changes to the design and operation of a manufacturer's production system. Now, everything about designing, engineering and building a product can be digitalized and synchronized with the actual physical production assets. Dassault Systèmes calls this digital environment the **3DEXPERIENCE Twin**.

In the **3DEXPERIENCE Twin**, users can model the manufacturing process without investing in physical equipment to determine if a concept can become "manufacturing ready." This increases a manufacturer's ability to respond quickly to market demands and minimizes related production costs.

Joby Aviation is one example of a manufacturer that is on the verge of redefining an entire industrial sector through digitalization. The Santa Cruz, California-based company is in a race to introduce the world's first "flying car." Bringing these vehicles to market requires an innovative approach to manufacturing.

"We see ourselves as more of a mobility company (rather than an aviation company)," says Alec Clark, mechanical engineer, Joby Aviation. "When we set out to design this, we knew we needed to create a new vehicle."

The Joby team wanted to develop the product quickly. The challenge: The company needed to bring together many different technologies in a succinct manner while adhering to stringent aviation regulations. Simulation and 3-D technologies allow the company to test different versions in a virtual environment and make adjustments without the costs of a physical build.



The process includes the creation of prototypes for specific parts using additive manufacturing. 3-D printing gives Joby designers the freedom to feed a highly iterative loop that constantly improves their designs, enabling them to build structures that tightly couple the simulation during the concept phase and empower the designer to optimize for weight.

Many of these structures would have required extensive tooling to create, and the 3-D printing process saves cost and time. By leveraging the **3DEXPERIENCE Marketplace**, they can drag-and-drop

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CATIA data and instantly get quotes and lead times from the available supplier network. This allows Joby designers to focus on their core responsibilities rather than tasks that are not design related.

Joby uses apps on the **3DEXPERIENCE** platform on the cloud to design products, manage the release process, and program, simulate, and optimize its machining processes. The cloud enables Joby to grow as they go. For example, the company can quickly add new users or easily add additional design- or PLM-related apps.

“As we have been growing, we can call up our reseller and say we want to grow a little bit in this direction,” Clark says. “We need a little more specialty in simulation; what apps can we get? Or, six months later we’re pushing more manufacturing. We want to start using these tools to simulate how much square footage do we need for building the airplane we want to build. So it’s really scalable in the direction that we want and when we want it. As the prototyping phases mature, we are more interested in building the process of building vehicles that conform to strict regulations.”

In addition, an on-premise solution would have required a team of IT personnel to set up the system. “(Now), when I onboard somebody, it’s a matter of just getting another license, and tagging it right to them,” Clark says.

The company plans to eventually tie the platform to its ERP and MRP systems. This will help streamline data flow for regulatory reporting purposes.

The cloud will play a major role in helping more companies take advantage of similar advanced capabilities because, until now, virtualization and simulation technologies were only practical for large organizations that could afford expensive on-premise solutions.

Another example of a company leveraging creativity to deliver personalized products faster is truck and bus manufacturer Scania AB. The Swedish manufacturer is one of the few companies in the transportation sector that has developed its business based on the concept of quickly delivering highly configured and customized products.

The number of product variants and ongoing design changes necessary to deliver on this customer experience requires a comprehensive repository of designs that can be joined together to build the customer’s order. In 2017, the company deployed the **3DEXPERIENCE** platform to validate its vehicles more quickly.

“It will enable full traceability and digital continuity from design through manufacturing throughout our unique virtual product-development processes,” says Michael Thel, engineering director, Scania.

The company’s time from order to delivery is now about eight weeks, with a wide range of possible configurations available for their customers. This allows the company to sell its user-configured trucks in a highly competitive market at a premium price compared to the competition—and at a cost that is nearly the same as that to produce standard trucks.

This is what’s possible when manufacturers apply the right architecture for their products (modularization) with digitalized processes for advanced configuration capabilities and continuity between engineering and manufacturing.

These are two examples of how the **3DEXPERIENCE** platform unleashes extreme creativity and innovation in manufacturing.

2. MANUFACTURING IS SMART

What does “smart manufacturing” mean? It’s a term that’s often used interchangeably with automation or the Internet of Things. But truly smart manufacturing uses data to build predictive models that help manufacturers optimize their business strategy and increase operational agility.

The latest simulation tools now include behavioral functionality that supports the most powerful human knowledge attributes, according to Dr. Michael Grieves, co-director of the [Center for Advanced Manufacturing and Innovative Design](#) at the Florida Institute of Technology.³ They include:

- Conceptualization
- Comparison
- Collaboration

“Taken together, these attributes form the foundation for the next generation of problem solving and innovation,” Grieves writes.

Conceptualization in the 3DEXPERIENCE Twin means manufacturers can see the physical and virtual product data simultaneously. For instance, instead of using plant performance reports to build a model of how the product moves through individual stations, the Twin simulations show the actual product as it moves through production as well as information about its design characteristics. The process helps identify problems more efficiently because it eliminates the need to manually translate data to visually conceptual information.⁴

Comparison is the ability to view actual measurements vs. design specifications and identify any deviations. “We can view the ideal characteristic—the tolerance corridor around that ideal measurement, and our actual trend line to determine for a range of products whether we are where we want to be,” Grieves writes.

Collaboration is one of the most important activities humans engage in to solve problems and improve decision-making. The 3DEXPERIENCE Twin model enables shared conceptualization so everyone across the enterprise sees the exact same information.⁵ For example, one large auto manufacturer is using the platform to

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— *Dr. Michael Grieves, co-director, Center for Lifecycle and Innovation Management, Florida Institute of Technology*

³ Dr. Michael Grieves, [Digital Twin: Manufacturing Excellence through Virtual Factory Replication](#), 2014.

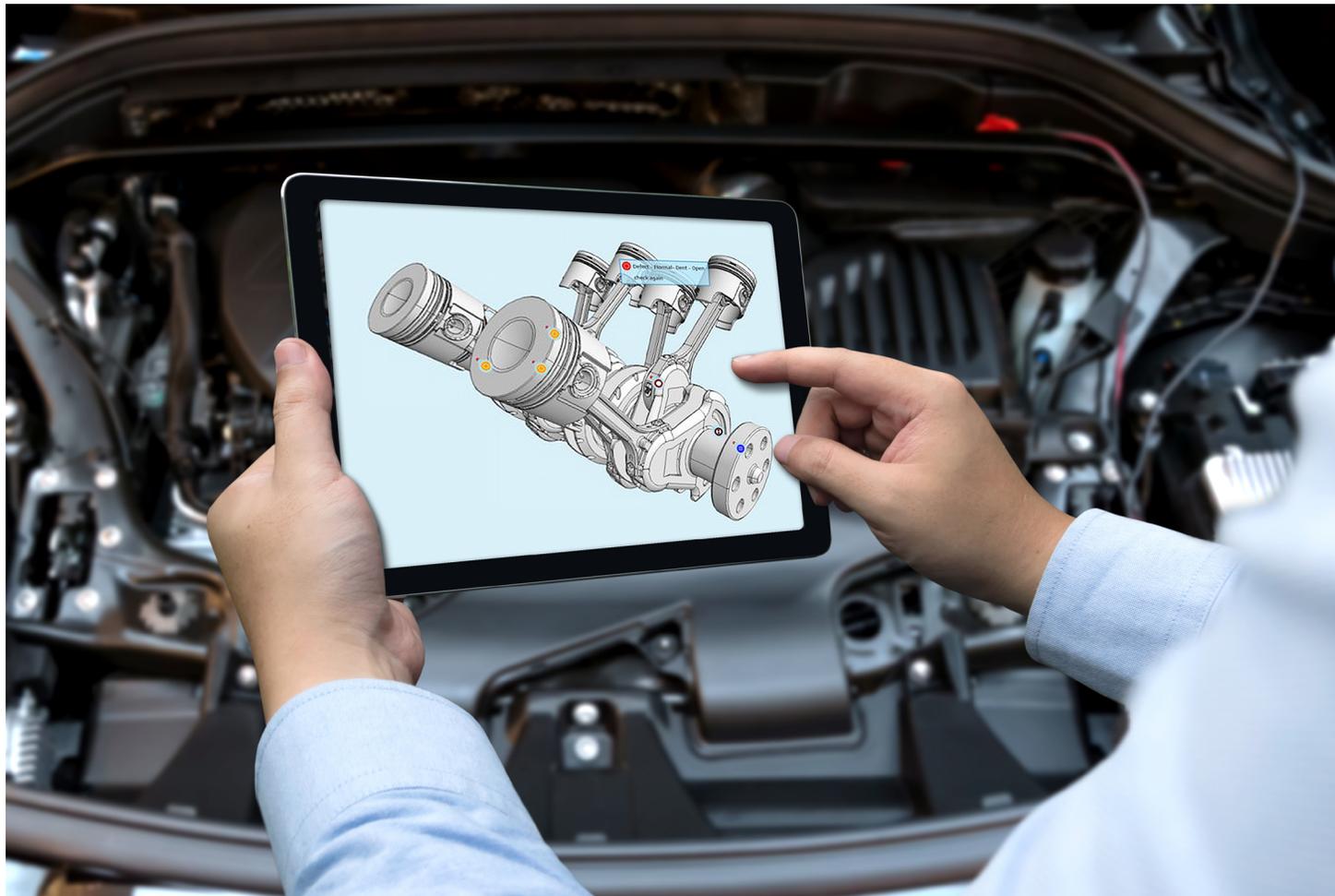
⁴ Dr. Michael Grieves, [Digital Twin: Manufacturing Excellence through Virtual Factory Replication](#), 2014.

⁵ Dr. Michael Grieves, [Driving Digital Continuity in Manufacturing](#), 2017.

simplify data reporting and analytics. Previously, the data existed in silos. Different departments would manipulate the data to represent what an executive wanted to see. They stored and circulated the report in Excel or PowerPoint, but nobody actually knew if the data was true or relevant to the stated purpose of the report.

With analytics digitally connected, nobody can manipulate the data. They have “digital continuity,” a concept we’ll explore more in-depth in the next section. The organization can update the data in the underlying system much faster because there is only one place to see it.

In addition, managers don’t have to spend an excessive amount of time preparing a report to ensure the data represents what their boss wants to see. Everyone has the same understanding of the key performance indicators, which increases efficiency and enables faster decision-making.



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3. MANUFACTURING IS VALUE

Smart, creative manufacturers drive value for their customers, suppliers and employees. Manufacturers maximize value creation when they have end-to-end connectivity from product ideation to ownership. True end-to-end visibility requires digital continuity. This is when everyone and every system across the organization receives “singular or the exact same information.”⁶

Digital continuity within the product lifecycle is particularly critical. It ensures the operations team has the information it needs from engineering to meet design specifications. It also means information is fed back to designers, so they can continually assess and improve products.⁷ In addition, increased visibility into how different functions impact each other helps manufacturers adapt to customer needs.

Chinese steel producer HBIS Group Tangsteel Co. turned to a digital platform to enable a demand-driven supply chain. In 2014, the company restructured its IT system to meet increasing demand and specialized customer requirements, says Zhenrui Zhao, director of the information and automation department for Tangsteel.

“For a company with a large payroll, only (the) information system can enable employees to work with consistent methods and standards,” says Zhao, whose company has more than 30,000 employees.

In the past, the company structured its IT system around a make-to-stock model. Tangsteel couldn’t adapt to customer demands, Zhao says. Digitalization helps the company improve its inbound schedules, delivery of the products and the workflow. “We can instantly take into consideration changes to the market price, the on-time and downtime of the machines and even tell customers exactly which production line is making their product,” he explains.

Other benefits include improved work-to-order capabilities and capital utilization, a higher rate of material reuse, and inventory-management optimization, Zhao says. The company’s customers can access the scheduling system for visibility into deliveries. In the future, the company plans to extend visibility to equipment and material suppliers. Zhao explains this will allow Tangsteel’s entire supply chain to collaboratively realize IoT benefits.



⁶ Dr. Michael Grieves, *Driving Digital Continuity in Manufacturing*, 2017.

⁷ Dr. Michael Grieves, *Driving Digital Continuity in Manufacturing*, 2017.

4. MANUFACTURING IS HUMAN



The digital transformation means roles across the organization will change. Analytics, artificial intelligence and automation tools are going to provide plant workers with more autonomy and actionable insights. While many manual tasks will disappear, workers will be freed to focus on more value-creating activities.

The digital transformation opens the doors to creativity. Employees have the tools and information they need to be more engaged and drive bottom-line results. Digitalization provides a lab of opportunities and possibilities to investigate and validate all the possible ways to improve the business and industrial processes that manufacturers want to optimize.

It also helps address skilled workforce challenges. If manufacturers want to attract the best talent, they need to demonstrate they have the technology, know-how and creativity of a modern manufacturing environment. Unlike deployments of standard, transactional systems, digitalization cannot be an IT-driven initiative. Executives must be the champions of change because they're the only people who can articulate how everyone in the organization will benefit and how their roles will evolve.

Leaders must assess where the company stands, how much change is possible and the steps involved. They should focus on quick, incremental improvements to demonstrate the benefits of change immediately. Communication is critical during this stage because middle management will transition from a role of information ownership to data sharing. They will be responsible for leveraging the data to drive results.

Chinese train producer CRRC Tangshan Co. has embarked on a digital transformation that's led to a new workforce training strategy. The company has relied heavily on human labor to perform manual tasks and is now shifting to a higher level of automation, using a Manufacturing Operations Management system. CRRC Tangshan is digitizing all paperwork and integrating new systems across product, assembly and examination lines, says Chunming Liu, deputy chief engineer for the company.

It's also moving toward a cellular manufacturing model where workers perform multiple tasks at each work station. This means while some processes are becoming more automated, employees must enhance their skill sets. "Previously, our workers only completed one specific job task," Liu explains. "Now he needs to complete the tasks of a whole workstation. This requires him to expand his skill, and for us, it means training more multi-competency workers."

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Digitalization is advancing at such a rapid pace that markets are undergoing a “technology renaissance.”⁸ Digital continuity strategies are already having a major impact on the way manufacturers design, produce, sell and service their products. Expect digitalization strategies to continue driving improvements in five key areas, including:

- **Innovation:** Additive manufacturing, virtualization, IoT and other advanced manufacturing technologies will continue to play a key role in manufacturer’s ability to bring disruptive products to market. Manufacturers must understand what consumers want today and also predict their future needs. Digital platforms help manufacturers analyze, predict and plan for new products.
- **Customization:** Customer demands for unique products will drive more manufacturers toward a mass-personalization model. The days of a single configuration for all customers are waning. This includes everything from cars to footwear.⁹ Modern digitalization platforms are flexible and scalable, which helps manufacturers manage increasing product complexity.
- **Continuous-improvement initiatives:** Lean manufacturing is not a new concept. But manufacturers are using technology to complement or ramp up their Lean initiatives. Digital platforms house the most important business functions in one place—improving productivity and efficiency by automating tasks and increasing visibility across the enterprise. Engineering, manufacturing, sales, marketing and aftersales will all be woven together.
- **Supply chain management:** More manufacturers will use digital platforms to enable a demand-driven supply chain. They will take advantage of a singular platform resident and continuity that creates a traceable stream of available information. In fact, the National Institute for Standards and Technology has launched the Digital Thread project to define and standardize methods to enable easy integration of smart manufacturing systems.¹⁰
- **Workforce engagement:** Advanced manufacturing technologies are freeing employees to focus on more value-creating activities. Repetitive, lower-skilled tasks are being automated while employees access IoT-enabled data to drive improvements. Digital platforms encourage a more collaborative environment, providing more opportunities for disruption.

To remain competitive, manufacturers will need to adopt at least some form of digitalization and transform. Frost & Sullivan predicts that B2B digital platform commerce could result in sales of \$6.7 trillion by 2020, double the amount it projects for B2C business.¹¹

Leaders will differentiate themselves with innovative products, improved productivity and exceptional service. They will be more agile and able to meet customer demands for customized, on-demand products.



8 U.S. Chamber of Commerce, (video) “Emerging Technologies and Torts of the Future - Michael Steep,” 2017.
9 <https://blogs.3ds.com/northamerica/the-adidas-partnership-behind-its-sole/>
10 IndustryWeek, “Why Adopting a Platform Strategy =Game Changer,” Oct. 13, 2017.
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