



The transformation of manufacturing

CHANGES are sweeping the world of manufacturing. Advanced materials and innovative production technologies are maturing. Digital manufacturing techniques are gaining adoption. These technology trends are offering manufacturers new ways to compete, innovate, and grow profitably even as they face challenges from volatile energy costs, workforce shortages, proliferating regulations, and a host of evolving risks. While analysts and consultants have heralded these trends over the past few years, they are now emerging with more clarity and attracting significant investment.

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- Ten of the top fifty US manufacturers have announced programs to use innovative materials or new production processes.¹
 - Workers on a Steelcase assembly line operate in an “augmented reality” environment.²
 - 3M, GE Appliances, Caterpillar, and other manufacturers have moved some production to the United States.³
 - Motorola’s new Moto X is the first smartphone to carry the “Assembled in USA” designation.⁴
 - Siemens created an apprenticeship program for high school graduates in North Carolina in cooperation with a local community college.⁵
 - Siemens and Dassault have invested billions acquiring companies to expand their manufacturing software portfolios.⁶
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As the United States emerges from the Great Recession, a broad array of technological and societal trends is shaping the future of manufacturing, which accounts for over 10 percent of all US economic activity.⁷

The **technology trends** that present new possibilities and questions for manufacturers include:

- **New production processes:** New processes such as additive manufacturing (for instance, 3D printing) are influencing everything from product design to material selection to supply chain configuration. Additive manufacturing is already a \$2 billion market globally.⁸
- **New materials:** Advanced materials with high performance characteristics, such as carbon fiber composites, ceramics, and

nanomaterials, are increasingly finding uses in large consumer-oriented markets such as automobiles, building materials, and clothing. Global demand for carbon fiber-reinforced plastic, for instance, is expected to grow 15 percent annually through 2020.⁹

- **Digital manufacturing:** A new generation of digital design and collaboration tools is enabling manufacturers to digitally simulate the appearance, performance, interoperability, and even manufacturability of products, saving time and money throughout the product development and production process. Dassault Systèmes, a leading provider of software to manufacturers, reports that its revenues in this business segment have increased more than 60 percent in the last year.¹⁰ In a cutting-edge example of digital manufacturing, Steelcase is employing augmented reality on an assembly line to boost the productivity of its workers.¹¹

Manufacturers are increasingly looking to take advantage of these technology trends to help them navigate the economic and business challenges they face, including increased labor costs in developing countries, a talent gap at home, the intellectual property risks of global operations, and a growing regulatory burden.

Manufacturers are facing new questions

These trends raise many questions for our manufacturing clients:

- How can manufacturers use advanced materials to **differentiate themselves** and improve product performance? BMW aims to differentiate itself using its new i3 electric vehicle, which makes extensive use of carbon fiber to enable light weight, energy efficiency, and distinctive styling.¹²

- How can clients use new production processes such as additive manufacturing to **boost efficiency**? GE is using 3D printing to make one-piece fuel nozzles for its next-generation jet engine that are up to five times more durable than the 18-part nozzles made using traditional processes.¹³
- How can clients implement **new manufacturing IT solutions** to reduce the cost of product development? Can the resulting savings free significantly more funds for innovation?
- Where should manufacturing clients **locate production facilities** in light of shifting demand patterns and increasingly complex determinants of cost and risk? Though smartphone manufacturing is firmly rooted in Asia, Motorola Mobility decided to assemble its new Moto X phone in the United States to allow US customers to design their own phones and speed the phone's delivery.¹⁴
- How will clients need to **redesign supply chains** to take advantage of new materials and production processes such as additive manufacturing? Redeye, a subsidiary of 3D printer maker Stratasys, operates 3D printing service bureaus in seven locations globally, manufacturing parts to meet the regional needs of its industrial customers.¹⁵
- How can clients **gain access to workers with the skills required** for increasingly sophisticated production facilities? Facing a scarcity of qualified workers at a North Carolina plant, Siemens created an apprenticeship program in conjunction with a community college in North Carolina.¹⁶
- How will **audit practices**—including methods of valuing inventory—need to change as additive manufacturing becomes more widespread?
- What **tax strategies**—such as R&D credits and transfer pricing—become important as manufacturers invest in innovations such as additive manufacturing and new materials?
- How can clients **manage growing cyber risks** and the risks of global expansion, including geopolitical instability, corruption, and immature control systems?¹⁷

A new basis of competition

Collectively, these questions reveal that macroeconomic and technological shifts are changing the basis of competition and value creation in manufacturing. Success is no longer guaranteed for the manufacturer with the lowest costs. New materials and new processes give manufacturers across all sectors the opportunity to provide more value to their customers—including improved performance, faster delivery time, customized products, and flexible productive volumes—and capture more profits for themselves. In this dynamic environment, manufacturers cannot afford to stand still. Innovation enabled by new technology is a path to a successful future in manufacturing.

Endnotes

1. Deloitte analysis.
2. Natan Linder, Rony Kubat, Pattie Maes, and Ben Weissmann, "LuminAR Lens," Fluid Interfaces Group, MIT Media Lab, <http://fluid.media.mit.edu/sites/default/files/poster-final-small.pdf>, accessed November 18, 2013.
3. Dee Depass, "Some jobs are shifting back to Minnesota in 'Reshoring,'" *Star Tribune*, July 30, 2012, <http://www.startribune.com/business/164214466.html>, accessed November 18, 2013; John Kotten, "A revolution in the making," *Wall Street Journal*, June 10, 2013, <http://online.wsj.com/article/SB10001424127887324063304578522812684722382.html>, accessed November 18, 2013.
4. Associated Press, "First US made smartphone, just as cheap to produce" *CBS DFW*, August 28, 2013, <http://dfw.cbslocal.com/2013/08/28/first-us-made-smartphone-just-as-cheap-to-produce/>, accessed November 19, 2013.
5. Becky Bereiter, "Perdue attends ceremony marking Siemens expansion in Charlotte," *News 14 Carolina*, <http://charlotte.news14.com/content/news/649639/perdue-attends-ceremony-marking-siemens-expansion-in-charlotte>, accessed November 18, 2013.
6. Siemens, "Simulation software: The key to competitive advantage," *Pictures of the Future*, spring 2013, http://www.siemens.com/innovation/apps/pof_microsite/_pof-spring-2013/_html_en/acquisitions.html, accessed November 18, 2013; Bernard Charlès and Thibault de Tersant, "Analyst meeting Q2 & H1 2013," Dassault Systems, <http://www.3ds.com/fileadmin/COMPANY/Investors/Earnings/13Q2/13Q2-Earnings-Presentation.pdf>, accessed November 20, 2013.
7. National Association of Manufacturers, "Facts about manufacturing in the United States," 2013, <http://www.nam.org/Statistics-And-Data/Facts-About-Manufacturing/Landing.aspx>, accessed November 18, 2013.
8. "Additive Manufacturing Handbook" (Deloitte internal document).
9. Research and Markets, "Carbon Fibers & carbon fiber reinforced plastics (CFRP)—A global market overview," Yahoo Finance, September 30, 2013, <http://finance.yahoo.com/news/carbon-fibers-carbon-fiber-reinforced-150430957.html>, accessed November 18, 2013.
10. Charlès and de Tersant, "Analyst meeting Q2 & H1 2013."
11. Linder, Kubat, Maes, and Weissmann, "LuminAR Lens."
12. Jim Henry, "The BMW i3 electric vehicle updates the graduate: 2014—one word; fibers," *Forbes*, July 31, 2013, <http://www.forbes.com/sites/jimhenry/2013/07/31/the-bmw-i3-electric-vehicle-updates-the-graduate-to-2014-one-word-fibers/>, accessed November 18, 2013.
13. Kotten, "A revolution in the making."
14. Wailin Wong, "Motorola Mobility betting big on Moto X production in Texas," *Chicago Tribune*, September 11, 2013, http://articles.chicagotribune.com/2013-09-11/business/ct-biz-0911-motorola-manufacturing-20130911_1_dennis-woodside-motorola-mobility-moto-x, accessed November 18, 2013.
15. @RedEyeOnDemand, "How many 3D printing locations do you have globally," Twitter, November 19, 2013, <https://twitter.com/RedEyeOnDemand/status/402847398818365440>, accessed November 20, 2013.
16. Julie Bird, "A big investment in Charlotte youth," *Charlotte Business Journal*, June 17, 2011, <http://www.bizjournals.com/charlotte/print-edition/2011/06/17/a-big-investment-in-youth.html?page=all>, accessed November 18, 2013.
17. Steve Culp, "New threats to supply chains call for new approaches to risk management," *IndustryWeek*, June 7, 2013, <http://www.industryweek.com/supplier-relationships/new-threats-supply-chains-call-new-approaches-risk-management?page=2>, accessed November 18, 2013.

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