

A Transforming World



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Themes shaping the investment landscape

Stayin' Alive: Manufacturing in America

Whatever the latest views on the cyclical outlook for American manufacturing, the structural trend is clear—retrenchment. Its impact on U.S. economic growth has declined over the past four decades, with its contribution to gross domestic product (GDP) falling from 30% in the 1970s to a mere 12% today.

Not all manufacturing is down and out, however (see Exhibit 1). While trade-sensitive sectors remain challenged, manufacturers that leverage technology, focus on entrepreneurs as customers and make direct contact with consumers are among those managing to stay competitive. Investing in this new manufacturing world requires an understanding of areas like cloud computing, social media and e-commerce, in addition to robotics.

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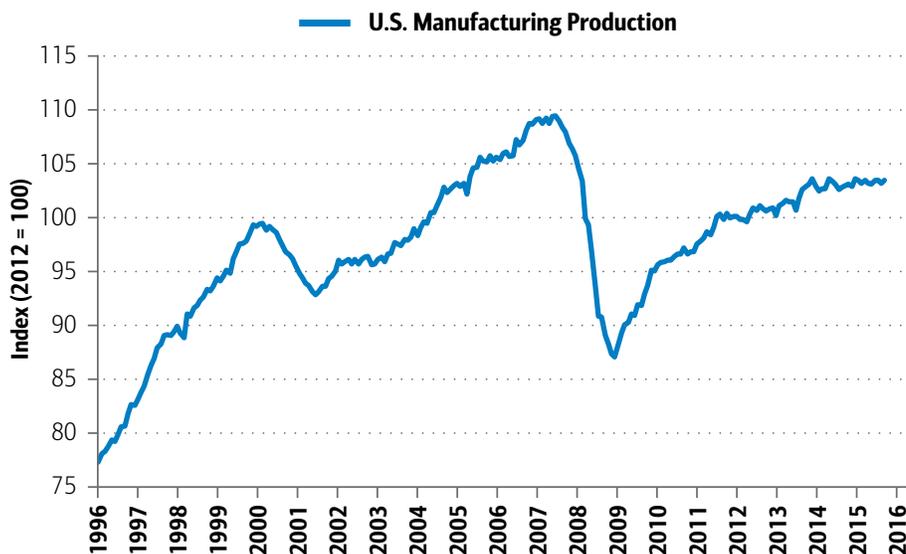
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SUMMARY

Not all manufacturing is down and out. While low-value-add and trade-sensitive sectors remain challenged, manufacturers that leverage technology, focus on entrepreneurs as customers and make direct contact with consumers are among those managing to stay competitive. Investing in this new manufacturing world requires an understanding of areas like cloud computing, social media and e-commerce, in addition to robotics.

Exhibit 1: Output is up despite a shrinking share of GDP



Source: Federal Reserve. Data through April 2016.

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Old versus new manufacturing

Fifty years ago the largest manufacturers were on average larger, lower-value-add and more sensitive to changes in the value of dollar and commodity prices than they are today¹. Where the traditional manufacturer might have produced cotton fabric, the new one manufactures revolutionary fibers five times stronger than steel, or fabric that can conduct electricity, is chemically resistant or integrates solar cells. Old manufacturing tended to require long lags between order and delivery and mass production that reduced average unit costs but inflated inventory expenses. Such low-value-add manufacturing has moved away from the U.S., probably for good.

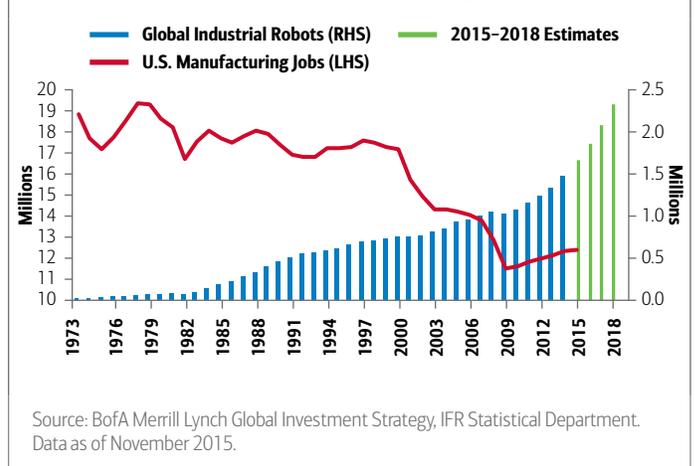
Now, a wide variety of technologies are helping U.S. manufacturers compete. They're lowering costs, not just through labor savings, although that's a major factor, but also by improving quality control, inventory management and logistics, among other functions. They're also reducing barriers to entry, bypassing economies of scale and enabling manufacturers to integrate services with their products.

These companies do "advanced manufacturing" by combining technology, extensive research and development, and replacement of low-skilled workers with a smaller number of more technologically sophisticated employees to transform processes and products. They use automation, sensors, information technology, cutting-edge materials, nanotechnology and other scientific advances both to manufacture established products in new ways and to make new products². According to the labor market data provider EMSI (Economic Modeling Specialists International), nearly half of the 600,000 manufacturing jobs created since 2011 are in this area.

Manufacturing, meet technology

Robotics features prominently in this new manufacturing world. As it takes over more repetitive tasks, experts estimate that there are as many as 1.5 million robots globally engaged in tasks that once were performed by people³ (see Exhibit 2). Technology and robotics can improve quality control and inventory management, allowing firms to gain more profitability even if labor costs are hurting competitiveness.

Exhibit 2: As robots proliferate, employment has tumbled



Adoption of technology is also lowering some basic supply chain costs. Firms can operate at smaller scale because the inputs to production are more flexible. Supply chains are shorter, with less reliance on distributors and more direct contact with the end user.

Joining e-commerce platforms can enable firms to access more potential customers, reduce barriers to entry and accelerate time to market⁴. The information sharing and advertising that social media provide can expand awareness and adoption of products. Faster dispersion of new ideas through social media and quicker adoption of new styles and techniques lower marketing costs. Websites let manufacturers speak directly to consumers more affordably. Big data helps them understand consumer preferences.

Manufacturing becomes a service

Some so-called New Manufacturers are less oriented to selling products than providing services. Manufacturers offering online fabrication, for example, allow entrepreneurs to design and build prototypes of their ideas. As consulting firm Booz Allen Hamilton notes, when manufacturers provide a service-like product, it links the consumer directly to the manufacturer in a way that was unthinkable half a century ago⁵. Manufacturers call this customer-centric manufacturing. Using technology to shorten lead times and shrink supply chains enables faster production and more competitive

¹ Choi and Spettzer, Bureau of Labor Statistics, 2012.

² National Institute of Standards and Technology.

³ *Manufacturing the Future: The next era of global growth and innovation*, McKinsey Global Institute, November 2012.

⁴ A network barrier to entry occurs when the producer requires a minimum number of people to use the product to achieve a competitive state.

⁵ "High-Tech Manufacturing Trends for 2016," *Viewpoints*, December 2015, Booz Allen Hamilton.

products on a smaller scale. As a result, enterprises like i.materialise and Sculpteo offer the buyer—often a small entrepreneur—specialized production at small scale.

Advanced manufacturing also allows for more fragmented and customized production processes. Modern consumers want unique items, or partially customized products that offer a bespoke experience. This development reflects the tastes of the millennial generation and trends like greater affluence and the diversification of preferences.

Manufacturers are also linking directly to consumers as they take part in the sharing economy. Imagine you want to buy a part for your camera. Traditionally you would contact the camera manufacturer to order it and wait for delivery. Today you can download the design for the part and produce it at home with a personal 3D printer. The chain from desire to delivery shrinks from weeks to hours.

Take this concept one step further: Imagine you have an idea for an adaptation of your camera, say a special lens extension. You may be able to find the design on an open source site and download it at no cost to your 3D printer. Now the price has shrunk to zero. This scenario exists on open source websites.

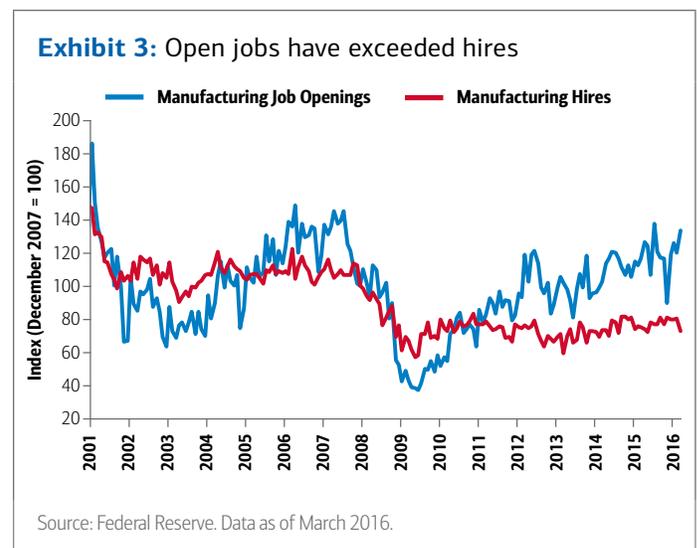
Robots are taking AND creating jobs

Robots are disruptive. According to BofA Merrill Lynch Global Research analyst Sarbjit Nahal, they are currently estimated to account for about \$14 trillion of disruptive impacts on manufacturing through lower salary costs and efficiency gains and are projected to perform 45% of all manufacturing tasks by 2025⁶. They do a better job than humans at repetitive manual tasks with fewer errors, higher output and of course no benefits, vacation and illness. An Oxford University report estimated that nearly half of all U.S. jobs could be automated within 20 years⁷. Robots and algorithms are also increasingly utilized for non-manufacturing work such as journalism, banking and, soon, driving. As economist Andrew McAfee notes, machines enhanced our physical power in the industrial age and now are expanding our mental power.

Robots will also create jobs. Most obviously, look to the current need for programmers and engineers to run them. A new field of study combining mechanical and electrical engineering called “mechatronics” is shaping the area of creating, programming and repairing robots. The starting salary for a mechatronic technician with a two-year associate’s degree is \$53,000 while a mechatronic engineer with a four-year undergraduate degree can earn \$95,000⁸. It’s estimated that three jobs are created for every industrial robot in place⁹. It might be foolish to imagine that increased leisure time won’t spur some people to innovate in other ways, creating new industries that generate jobs.

So many job openings, so few skilled applicants

Now firms seek workers with the technical skills to operate computerized machinery and who can adapt as the machinery becomes more advanced. Ironically manufacturing firms currently cite finding qualified labor as their biggest challenge. A recent White House report said 80% of manufacturers currently claim a moderate or serious shortage of qualified applicants for skilled and highly-skilled production positions¹⁰. Job openings at manufacturers remain elevated while the number of jobs filled lags (see Exhibit 3). Going forward the biggest challenge to manufacturing here might not be energy or the dollar, but the lack of a skilled labor market.



⁶ Sarbjit Nahal, “Robot Revolution—Global Robot and AI Primer Picks,” November 3, 2015.

⁷ Oxford University, *The Future of Employment: How Susceptible are Jobs to Computerisation?* Carl Benedikt Frey and Michael A. Osborne, September 17, 2013.

⁸ Bureau of Labor Statistics, *Electro-mechanical Technicians Occupational Outlook Handbook*, December 17, 2015.

⁹ International Federation of Robotics, Metra Martech, *Positive Impact of Industrial Robots on Employment*, February 21, 2011.

¹⁰ Executive Office of the President, National Science and Technology Council, *Advanced Manufacturing: A Snapshot of Priority Technology Areas Across the Federal Government*, April 2016.

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