



A SPECIAL REPORT

Smart Manufacturing and Competitiveness

How technology-driven productivity improvement
is shaping the future of U.S. industry

In
cooperation
with

SIEMENS

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About IW Custom Research

IW Custom Research is an operating unit of *IndustryWeek* magazine that provides insight into executives' opinions and manufacturing trends. *IndustryWeek* connects decision-makers within manufacturing enterprises to share ideas and tools that inspire action. In print, online and in person, the *IndustryWeek* community is the leading resource for manufacturing operations knowledge. *IndustryWeek* is a property of Penton Media Inc. For more information, go to www.industryweek.com.

About Siemens

Siemens is a global powerhouse in electronics and electrical engineering, operating in the fields of industry, energy, healthcare, and infrastructure. For more than 165 years, Siemens has built a reputation for leading-edge innovation and the quality of its products, services and solutions.

With 370,000 employees in 190 countries, Siemens reported worldwide revenue of about \$78.3 billion in fiscal 2012. Siemens in the United States reported revenue of \$16.7 billion and employs about 60,000 people throughout all 50 states and Puerto Rico.

Siemens Industry is the world's leading supplier of innovative and environmentally friendly products, solutions and services for industrial customers. With end-to-end automation technology and industrial software, solid vertical-market expertise and technology-based services, the company enhances its customers' productivity, efficiency and flexibility. For more information, go to www.usa.siemens.com.

About This Report

This is a report on the findings of the survey *Smart Manufacturing Research: Opportunities for Growth & Competitiveness**. The survey goals were to determine the outlook among manufacturers for the industry as well as their company; investigate the challenges facing the manufacturing industry; and examine how manufacturers are responding to the challenges they are facing. To that end, on Feb. 28, 2013, Penton Research emailed invitations to participate in an online survey to *IndustryWeek* subscribers. By March 18, 2013, Penton Research received 388 completed surveys.

* Due to rounding and some multiple choice questions, not all responses add up to 100%.



Executive Summary

The U.S. Manufacturing Resurgence: Fueled by Investment, Innovation and Advanced Manufacturing Practices

The manufacturing sector is undergoing a radical transformation. Old ideas about production processes are being pushed aside, as are previous notions about how globalization is shaping the sector. Smart Manufacturing is revolutionizing process and product innovation, productivity and resource efficiency by combining the physical and virtual worlds.

It's an opportunistic moment for U.S. manufacturers to lead the highly complex, highly digital and high value-add industrial future.

Some companies already have emerged as leaders, and software is enabling their performance. These organizations are achieving shorter time-to-market through efficient innovation and production cycles, and they have enhanced flexibility using more data to "individualize" mass production. This is what we mean by Smart Manufacturing.

Strategically and economically, the time is ripe for U.S. manufacturing growth as well. As the world's diverse markets demand more (faster delivery, the latest designs, better service), producers are responding. Large manufacturers are starting to favor a regional approach, i.e., producing where the market is, and as they build this model for the North American market, all tiers of U.S. manufacturing will benefit from

increased demand. Additionally, costs are on the rise in traditionally low-cost overseas labor markets, as wages improve and transportation costs increase. This, too, makes the United States more attractive.

At the same time, however, U.S. manufacturers face a host of challenges that could inhibit them from seizing the moment—a shortage of highly skilled, trained workers, an uncertain regulatory landscape, heightened cyber threats, and ongoing pressure to control costs and increase productivity. This report—which is based on a survey of 388 manufacturing executives—closely examines which challenges manufacturers are most worried about and what they are doing to address them.

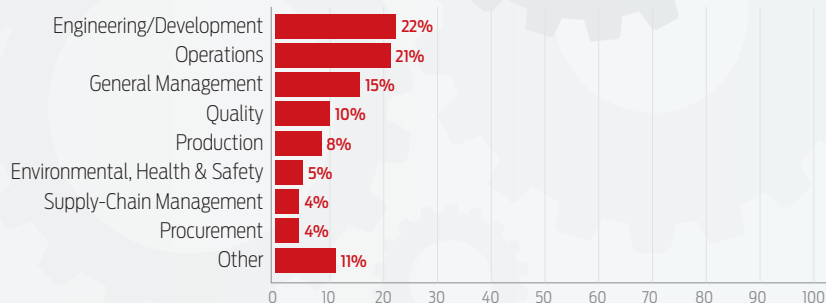
Respondents are mostly optimistic about the future of U.S. manufacturing. Sales have been growing, and most respondents expect the upswing to continue. Their companies are investing in technology, plants and advanced production processes, and these investments come at a time when new technologies are enabling significant improvements in productivity, speed-to-market, product quality, manufacturability and process cost control. So, the ROI for these and other companies that invest in advanced manufacturing technology, high-skills training and asset-protecting investments will be substantial—today and into the future.

“This reallocation of global manufacturing is in its very early phases . . . But we believe it will become even more pronounced over the next five years.”

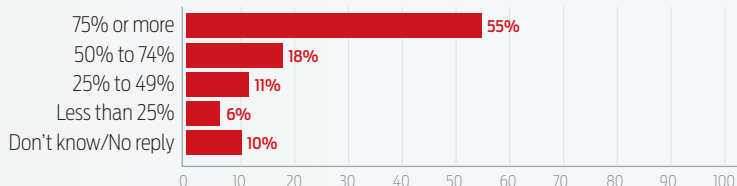
— Boston Consulting Group, “*Made In America, Again: Why Manufacturing Will Return to the U.S.*”

Outlook: Growing Demand and New Technology Fuel Optimism

Job Function

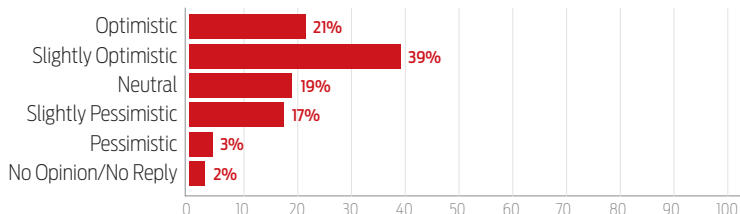


U.S.-Based Production



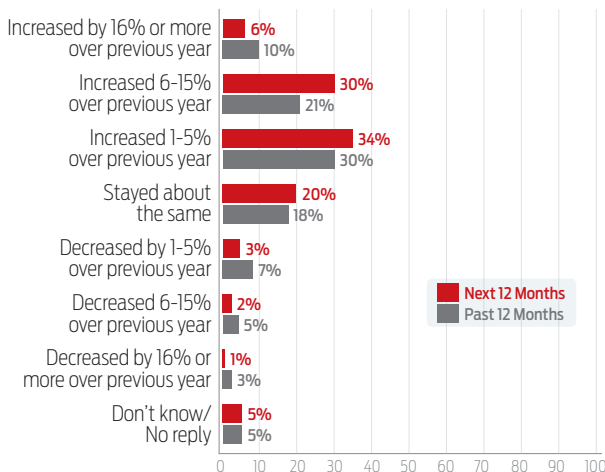
The survey pool was comprised of Executives and Directors (31%); Managers (46%); and Individual Contributors (22%). Top industries represented were Basic Materials (24%); Consumer Goods and Medical (23%); Industrial Machinery (18%); Automotive (10%); and Aerospace and Defense (10%). More than half of respondents indicated that 75% or more of their business is supported by U.S.-based production. Respondent companies have a median \$241 million in annual revenues and a median 602 employees. Nearly one in three respondents (31%) have revenues of \$1 billion or more, while an additional 24% have annual revenues of \$100 million to \$999 million.

Positive Outlook For Most



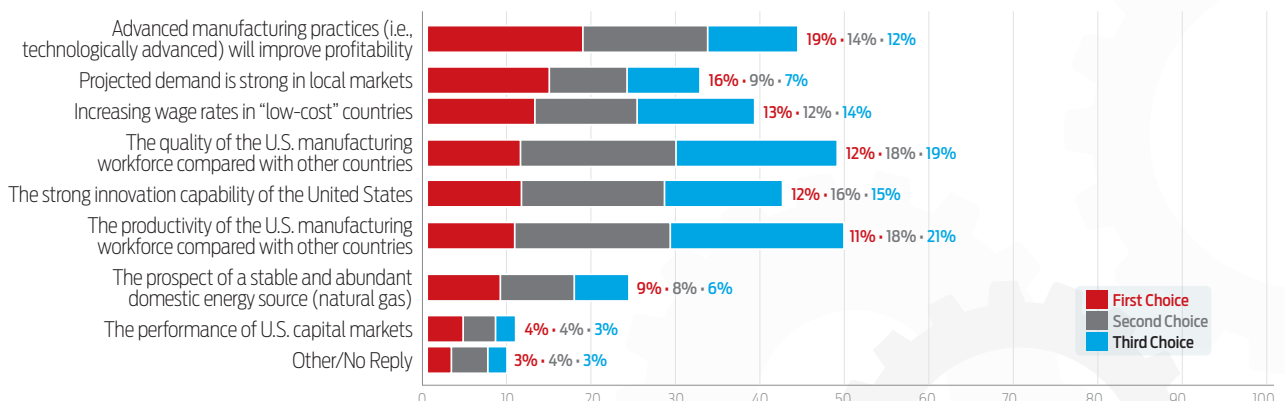
Sixty percent of respondents are optimistic about U.S. manufacturing in general, and 74% are optimistic about their company's five-year outlook specifically. The No. 1 reason cited for optimism is potential improvement made possible by advanced manufacturing technologies such as virtual prototyping; software-driven product and process planning; rapid jumps in productivity; and plant and equipment upgrades that reduce the cost of expensive inputs.

Sales On The Rise



- When companies such as Space X use technology to design and virtually test the most advanced heat shields, successes such as the first commercial flight to the International Space Station become possible.
- Nissan, which has three production plants in the United States, is using product lifecycle management software technology as part of its V-3P (Value Up for Product, Process and Program Innovation) to improve its product development performance. With this technology, Nissan has been able to reduce its development cycle from 20 months to 10.5 months; decrease design changes by 60%-90%; and experience 80% fewer problems after vehicle release.
- Engineering time can also be reduced significantly—30% to 40%—by using innovative, intuitive software at the control level. This reduces time-to-market and production costs so that companies can achieve a first-mover advantage, a price advantage, or both.
- BMW recently took a close look at innovations that reduce engineering time by 30% and decided to standardize globally for the next 15 years on its automation platform, knowing that it will evolve even further but will always take into account the installed investments. This will enable BMW to consistently take advantage of platform strategies not only for their automobiles, but also their production facilities.

Reasons For Optimism



“The idea that manufacturing is about brawn over brains, that it is a low-value-added commodity activity that requires low-skill workers unconnected to innovation that can easily be sourced from anywhere in the world, no longer reflects current reality.”

— Helmuth Ludwig, CEO of Siemens Industry Sector North America

Addressing Challenges with Smart Manufacturing

Respondents' top two concerns both relate to workforce, a topic that has received a lot of attention recently. But the survey also shows that companies are not making the right choices to address this challenge, which is one that has a direct impact on other top challenges, such as productivity improvement and cost-based competition.

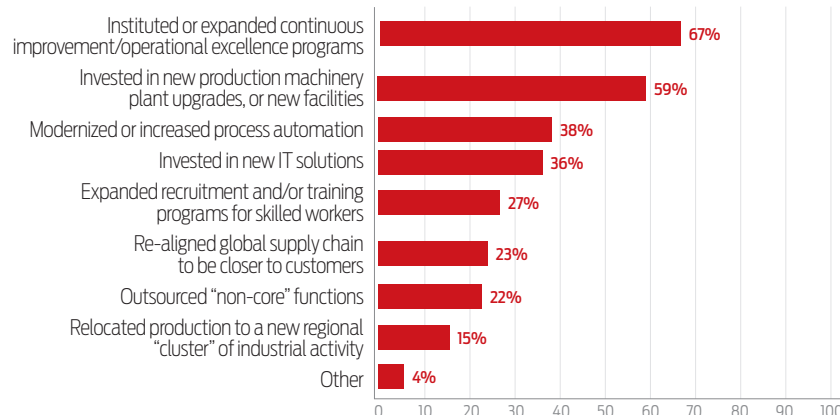
While 41% of respondents identified attracting and retaining skilled workers as a top concern, and 28% are concerned about knowledge transfer as employees leave, less than 30% have expanded recruitment and/or training programs for skilled workers in the past 24 months.

“America has a training gap,” says Eric Spiegel, CEO of Siemens USA. “I know it’s more common to say that we have a skills gap, at a time when American industry is struggling to fill thousands of open positions. But in truth, it’s not a skills gap—it’s a training gap. Until we put the burden on those who train rather than those who need to be trained, we’ll never solve it.”

Challenges: What’s Stands In The Way Of Company Goals?



Protecting Profitability, Growth: What Have You Done?



Adequate skills training is essential as manufacturers invest in new production equipment and the advanced software that is driving equipment and processes to perform at higher and higher efficiency levels.

"It's a challenge because manufacturing has become knowledge work," says Helmuth Ludwig, CEO of Siemens Industry Sector North America. "The idea that manufacturing is about brawn over brains, that it is unconnected to innovation and a low-value-added commodity activity that requires low-skill workers that can easily be sourced from anywhere in the world, no longer reflects current reality."

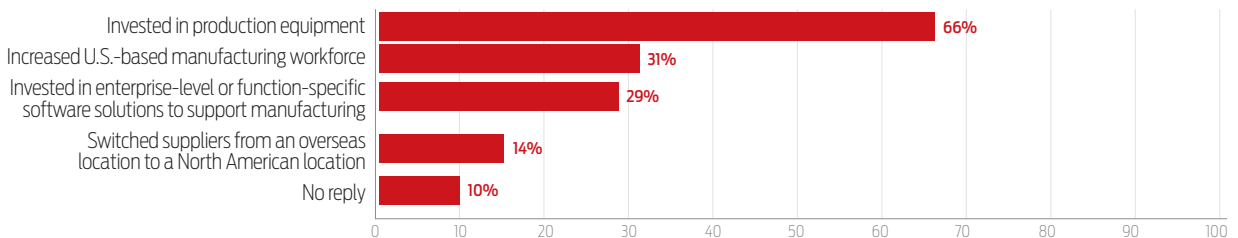
Modern factories that produce advanced goods such as cars, aircraft engines, gas turbines, semiconductors, flat-

panel displays and medical devices are intensely complex. They require highly skilled employees with specific training: employees who can work with sophisticated machines that include mechanical elements, electronic elements and software in a highly integrated fashion.

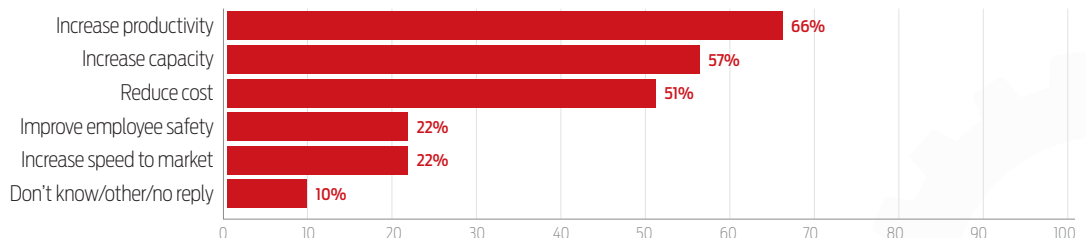
If employees are not trained, the advantages that advanced manufacturing can provide will not be fully realized.

"What's different today is that we have additional opportunities to drive productivity beyond those traditionally driven through lean continuous improvement," Ludwig says. "In short, at the company and plant level, we are seeing tremendous improvement potentials in productivity and efficiency thanks to software technology."

Investments: Where Have You Made Them?



New Equipment: Why Did You Invest?



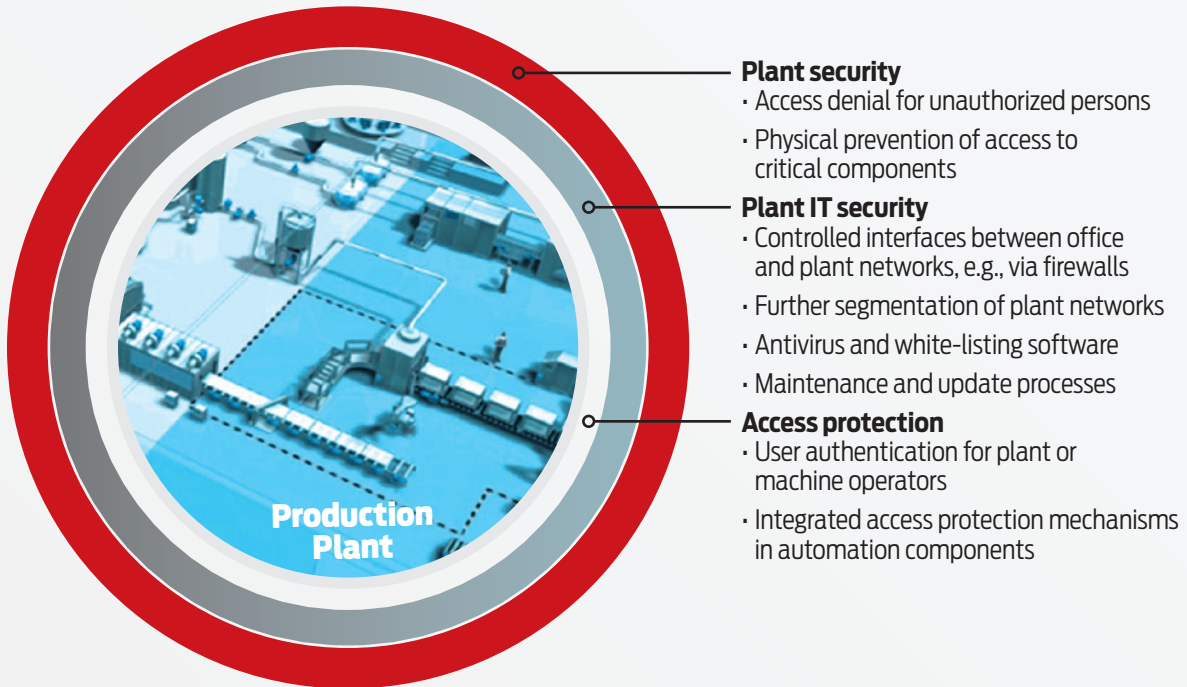
There are many outdated automation systems still in operation—systems that were designed even before the Internet was invented.

Smart Manufacturing Case Studies

The game has changed. The business of producing goods is a much different business than it was even 10 years ago. Leading companies are more focused on productivity and efficiency than ever before.

- Industry leaders such as NASA and JPL are using PLM software for the design and simulation of the largest Mars Rover ever.
- Automakers such as General Motors, Daimler, BMW and Ford are using advanced software to achieve a shorter time-to-market through efficient innovation cycles and enhanced flexibility using more data to “individualize” mass production.
- GM was able to realize a “weeks-to-hours” reduction at its Toledo, OH, powertrain plant. How? Through Flexible Assembly Configuration Systems (FACS) and control and communication. GM flattened engineering costs by standardizing on the hardware, software and communication protocols used.
- Ford is able to manage billions of theoretically possible variations of the F150 using advanced software—quite a change compared with the first mass-produced Ford with only one well known color choice.
- Crawford Technical Services, a leading provider of water-management systems for hydraulic fracturing, has reduced engineering time by 50% using a combination of hardware and software and is winning new business because of its ability to track key metrics.

Taking Cyber-Security Seriously



Industrial Security Levels according to Current Standards and Regulations

Source: Siemens

Cyber Security: Essential for Protecting Assets and Fulfilling Demand

Manufacturers are increasingly integrating their control systems with Intranets that are themselves connected to the Internet. This increased integration is fully intentional, as it allows decision-makers in the respective companies to receive highly valuable production data in real-time and in highly usable forms. Unfortunately, it also makes it easier for someone to inject malicious code into a control system from thousands of miles away. If this happened, a plant's operations could be severely disrupted—with all the consequences of production loss, damage to customer relationships or even theft of intellectual property.

Because of this, we asked the survey participants what actions they had taken in the past 12 months to ensure the

security of their manufacturing process against cyber attacks. Nearly two in three respondents (64%) have taken some action to protect their security against cyber attacks. The largest percentage have turned to vendors and updated their software according to recommendations or followed vendor security guidelines. Only one in five has invested in modern equipment and only one in ten has used cyber security consulting services.

Unfortunately, there is no “silver bullet” or one product that will solve all of today's cyber security issues; therefore, an in-depth approach, as depicted above, is generally recommended.

Although no one is expecting a huge upswing in the number of manufacturing jobs in the U.S., the value of manufacturing as a contributor to GDP is expected to grow, which means everyone employed within the sector should benefit from a more stable long-term outlook.

Looking to the Future

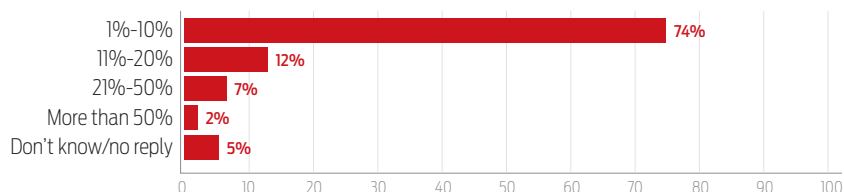
Finally, let's take a look at what the research says about the near-term outlook of U.S. manufacturing. Not surprisingly, there remains concern about taxes, regulations, the trade imbalance and other factors that manufacturing leaders can't directly control.

But the good news is that undoubtedly, the trend to engage closer suppliers is benefiting the U.S. manufacturing sector, and that should continue based on the wide differences in where this reshoring is happening. Among companies that relocated their supply chains in the past 12 months, 85% reported relocating them to the U.S.

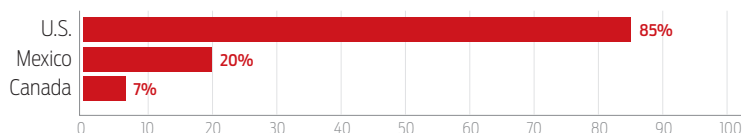
The other good news is that although no one is expecting a huge upswing in the number of manufacturing jobs in the U.S., the value of manufacturing as a contributor to GDP is expected to grow, which means everyone employed within the sector should benefit from a more stable long-term outlook.

Our research certainly shows that the U.S. manufacturing sector is healthier and wealthier. What remains to be seen, is whether or not companies will be wiser and invest in advanced manufacturing to meet ongoing challenges and growing demand.

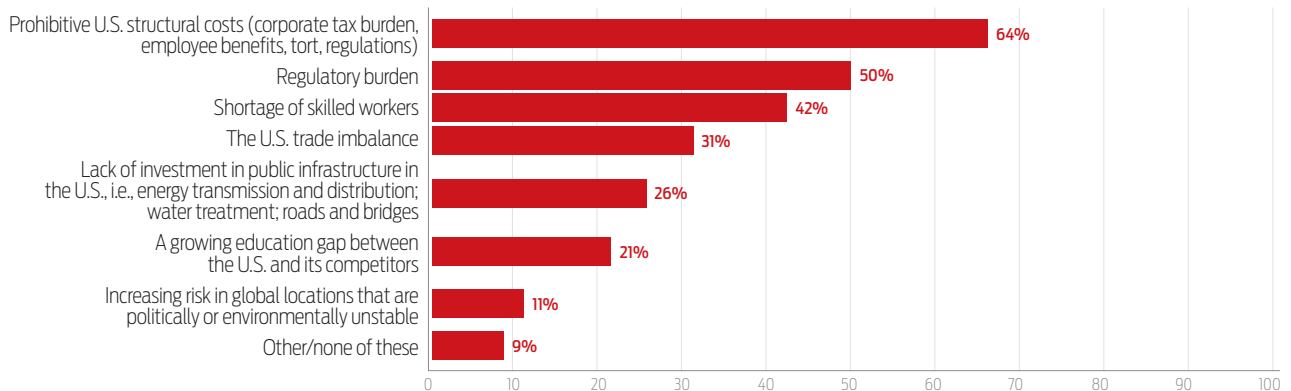
Job Growth Slight: U.S. Hiring In The Last 12 Months



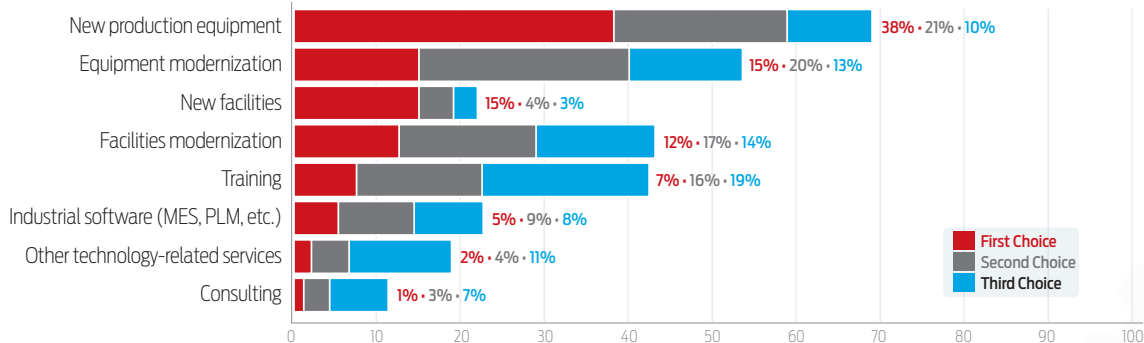
U.S. Ahead in NAFTA Reshoring: New Supplier Locations



Persistent Concerns: What Worries You The Most?



Investments Continue: Top 3 In Next 12 Months



The Siemens logo is displayed in a teal, sans-serif font within a white rectangular box in the top left corner.

SIEMENS

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A large-scale industrial scene featuring a worker in a blue uniform and safety glasses, reaching into a massive, circular metal structure with blue-painted internal rings. The setting is a factory with overhead lighting and structural beams.

“Made in America” is making its way back.



Somewhere in America, the most forward-thinking companies turn to Siemens every day for groundbreaking answers that are redefining the way the country looks at manufacturing. Answers that aren't just about making things, but making things right.

Answers that help companies become more productive while reducing their costs and their ecological impact, like the advanced software systems that helped a state-of-the-art chemical plant in Salisbury, NC, cut its production time in half.



Answers that give demanding businesses a competitive edge with faster innovation and faster-to-market methods, like the automotive factory in Tuscaloosa that's now on the road to leadership.

Answers that inspire forward-thinking industries to blaze new trails, like supporting NASA's mission to explore Mars.



Today, pride, confidence and the ability to compete on the global stage are making their way back.

Because manufacturing is making its way back.

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