



Conducted in collaboration with
The Manufacturing Institute

Accenture 2014 Manufacturing Skills
and Training Study

Out of Inventory

Skills Shortage Threatens Growth
for US Manufacturing

A photograph of a male worker in a dark, short-sleeved button-down shirt and safety glasses, focused on his work. He is wearing grey work gloves and is using a pair of red and black wires to test or work on a component on a workbench. The background is a blurred industrial setting.

High performance. Delivered.



More than

50%

of companies report plans to increase US-based production by at least five percent in the next five years.

More than

75%

of manufacturers report a moderate to severe shortage of skilled resources.

US manufacturers face reduced earnings of up to

11%

annually due to increased production costs and revenue losses resulting from skills shortages.

Skills shortages are a major threat to strong performance in manufacturing

These are, by and large, good times for the United States manufacturing industry, which has shown steady growth in recent years. According to a new study from Accenture, in collaboration with The Manufacturing Institute, more than 50 percent of companies report plans to increase US-based production by at least five percent in the next five years, with nearly a quarter of respondents planning to grow US-based manufacturing roles by over 10 percent in the next five years.

However, this new report—the Accenture 2014 Manufacturing Skills and Training Study—also points to storm clouds on the horizon that could dampen growth: shortages in the skilled talent required to perform essential tasks today and to innovate for tomorrow.

Survey respondents confirmed that it is not easy to fill skilled manufacturing roles. More than 75 percent of manufacturers report a moderate to severe shortage of skilled resources and over 80 percent of manufacturers report a moderate to severe shortage in highly skilled manufacturing resources. Skilled and highly skilled roles comprise 80 percent of the workforce for the companies we surveyed. Add to the challenge the fact that a large portion of the skilled manufacturing workforce is approaching retirement age.

These shortages have considerable business implications. Increased production costs and revenue losses that result from skills shortages in US manufacturing are costing manufacturers up to 11 percent of earnings annually.

Manufacturers can stem the skills shortage by investing in their “talent supply chain”—the overall process by which roles are sourced, developed, deployed and retained. Based on the Accenture study, we have identified how some manufacturing companies are leading the way in addressing this issue. We have also identified the most effective strategies companies are using to not only blunt the impact of the skills shortage, but to make skills development a real competitive advantage.

The severe shortage of manufacturing skills in the United States has the potential to impede the trend of steady growth in US manufacturing. Accenture research confirms that manufacturers are having difficulty filling skilled and highly skilled manufacturing roles. Companies can maintain productivity and sustain profitability by building a talent supply chain with the needed skills to fuel growth, and then developing and retaining the skilled talent over time.

Skills shortages in manufacturing: The scope of the challenge

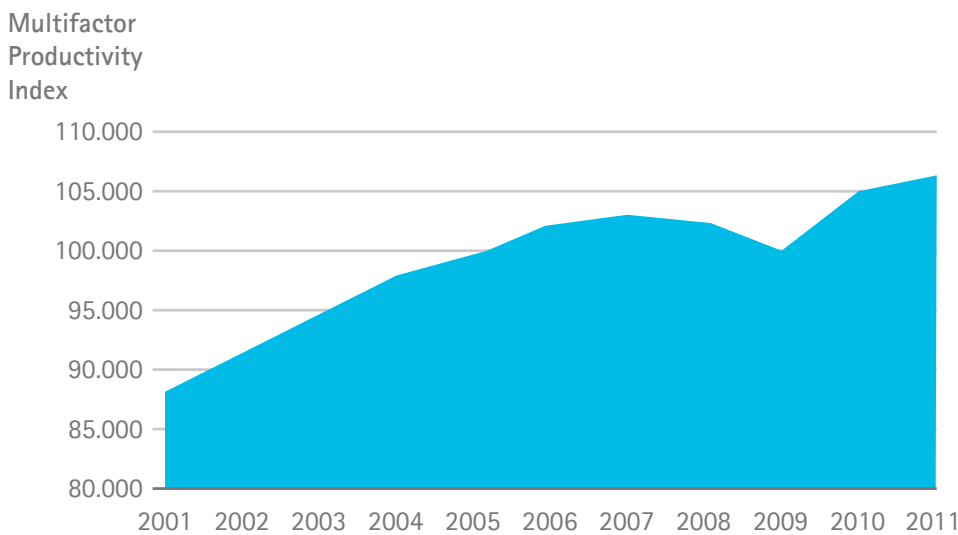
A shortage of skilled talent exists in the manufacturing industry, and this shortage is likely to become more severe in the coming years.

Manufacturing as an industry has become more efficient through automation, which has resulted in a smaller workforce overall. At the same time, productivity has steadily increased (See Figure 1). Although the workforce is smaller, a greater percentage of remaining US manufacturing roles are skilled workers who need many months and, in some cases, years of experience and training to perform their jobs efficiently and effectively.

"80 percent of the jobs in this company require a higher skill level. And the other 20 percent are probably semi-skilled. There are no unskilled jobs here anymore."

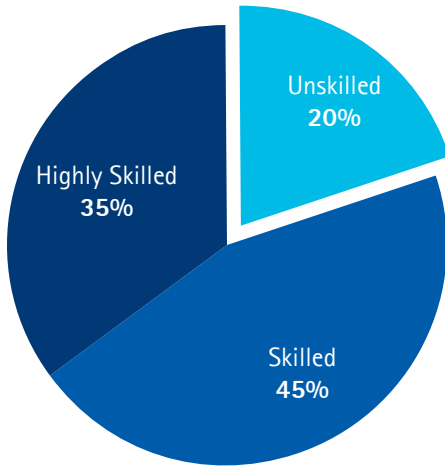
Mary Ann Cervinka
Human resources manager
Arrow Gear

Figure 1: US manufacturing has steadily increased productivity over the past several decades.



Source: U.S. Bureau of Labor Statistics—Manufacturing—Multifactor Productivity, annual index—MPU9900012

Figure 2: What percentage of your manufacturing roles require the following skill levels?



Source: Accenture 2014 Manufacturing Skills and Training Study

The Accenture survey respondents reported that nearly 80 percent of their manufacturing roles fell into the categories of **Skilled** (associate degree or equivalent 12-24 months of training and/or experience) or **Highly Skilled** (bachelor's degree or equivalent 36+ months of training and/or experience). (See Figure 2).

Help wanted

Respondents to our survey confirmed that they are having difficulty filling skilled manufacturing roles. More than 75 percent of manufacturers report a moderate to severe shortage of skilled resources and over 80 percent of manufacturers report a moderate to severe shortage in highly skilled manufacturing resources. (See Figure 3).

When we asked manufacturers about the skills shortage, many gave the example of welders. A skilled welder is a critical player in the manufacturing of many metal-based products. In addition to mastering the craft of welding itself, an entry-level welder must master basic trigonometry, geometry, metallurgy and blueprint reading.

"The problem is that we can't find enough welders who are qualified to do a particular job. We are seeing that fewer people are choosing skilled trades as a profession."

Shawn Kaufman
Riggs Industries

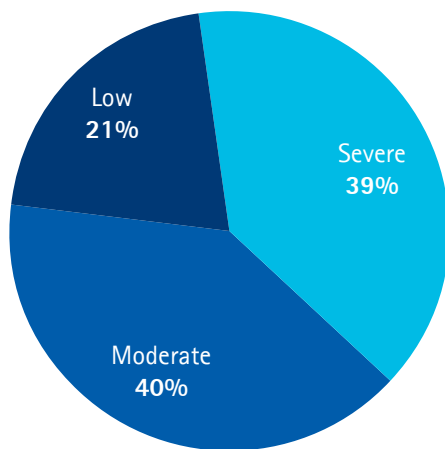
The typical preparatory coursework for an entry-level welder is around 60 credit hours, and acquiring the necessary skills to reach the master tradesman level requires years of additional experience and coursework. Skilled welders command between \$40,000-70,000 in yearly salary and are in high demand across multiple industries including manufacturing, oil and gas, and construction.

For a manufacturer that requires these specialized skills, it is not a simple matter of putting out a help wanted ad. Building and maintaining a pipeline of employees with the skills needed to keep production at top efficiency requires planning and innovative sourcing, as well as investment in developing and retaining skilled talent over time.

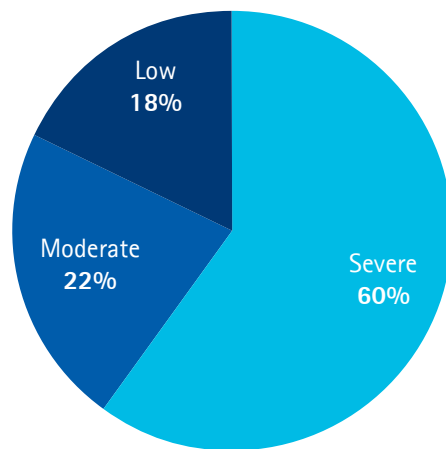
Proper planning for the future is crucial, considering the forthcoming demographic shifts. The U.S. Department of Labor reports that the average age of manufacturing labor was 44.1 years in 2011¹. This means that a significant number of the existing labor pool is nearing retirement age. As this demographic trend increases, skilled manufacturing labor will be even harder to find in the market.

Figure 3: How severe is your shortage of qualified applicants?

Skilled Resource Shortage



Highly Skilled Resource Shortage



Source: Accenture 2014 Manufacturing Skills and Training Study

Ready to grow

The Accenture 2014 Manufacturing Skills and Training Study found that 82 percent of US manufacturers surveyed plan to increase production, more than 50 percent of companies surveyed report plans to increase US-based production by at least five percent in the next five years. Nearly a quarter of our survey respondents are planning to grow US-based manufacturing roles by over 10 percent in the next five years, signaling even more demand for scarce skills (See Figure 4).

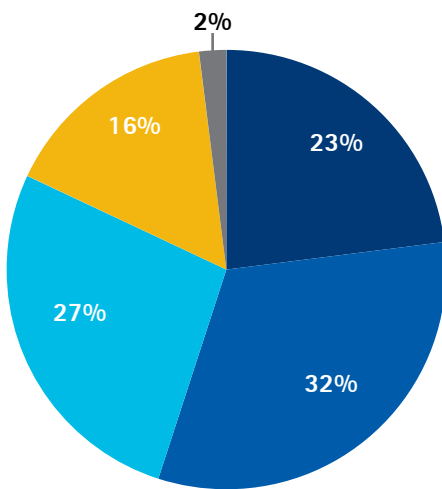
In the last several years, multinational manufacturers have made significant investment into increased US production. Lenovo opened a 115-person plant in North Carolina in 2013². Caterpillar invested \$200 million to open a new manufacturing facility in Athens, Georgia, which is anticipated to employ 1,400 people³.

General Electric invested \$432 million to establish four refrigeration design and manufacturing Centers of Excellence in Louisville, Kentucky; Bloomington, Indiana and Decatur, Alabama⁴.

US manufacturing is experiencing significant growth in both output and required labor input. Despite a significant dip in 2009 to the lowest level since 2004, gross output for the US manufacturing sector has rebounded with 7.7 percent annual growth rate between 2009 and 2011 to its highest level ever at over \$5.4 trillion⁵.

While productivity gains have gone a long way toward making US manufacturing more competitive in a global market, these productivity gains have increased the need for highly skilled manufacturing talent who have the deep skills necessary to manage an increasingly automated factory floor.

Figure 4: Plans to increase number of skilled manufacturing roles in the next five years.



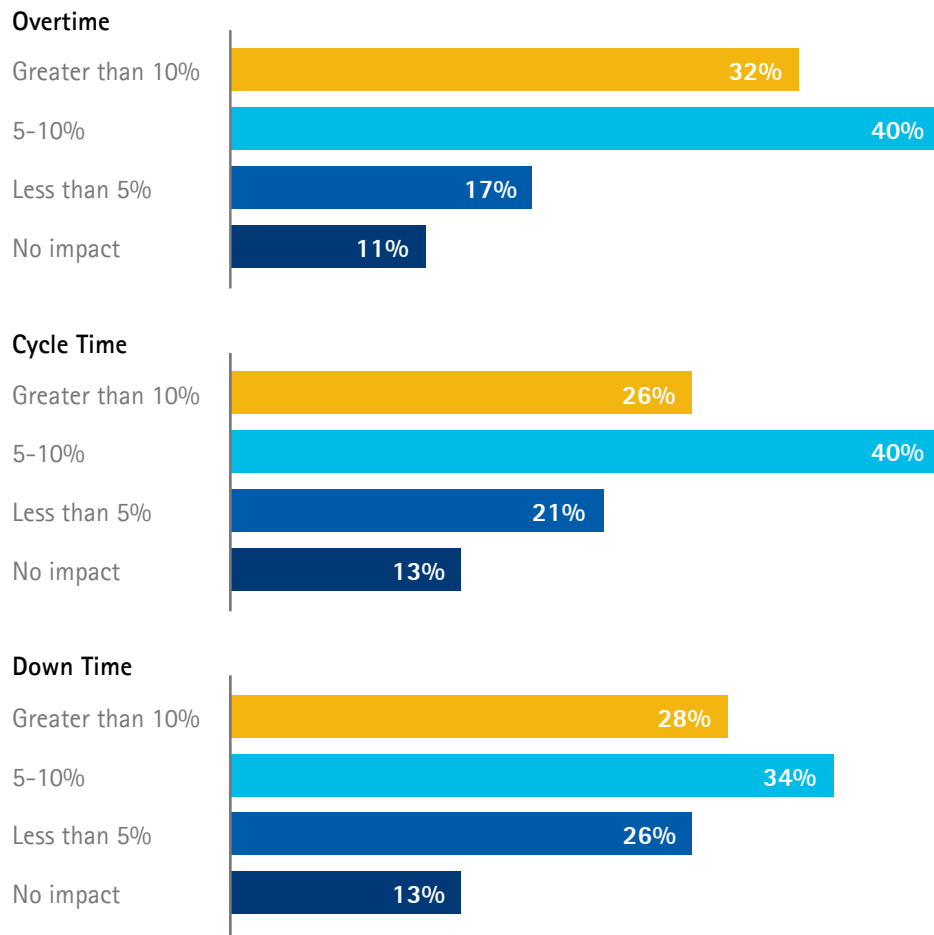
- Increase by more than 10%
- Increase by 5-10%
- Increase by 5% or less
- Stay the same
- Decrease 2%

Source: Accenture 2014 Manufacturing Skills and Training Study

A blow to the bottom line

Figure 5: Inability to fill skilled roles negatively impacts cost, quality and efficiency metrics for manufacturers.

At my company, a lack of skilled talent to fill roles increases (Category) by:



Source: Accenture 2014 Manufacturing Skills and Training Study

The manufacturing skills shortage in the United States has a direct effect on business profitability.

When a company lacks key skilled roles on a production line, it impacts productivity, efficiency and, eventually, profitability. Having skilled manufacturing roles go unfilled influences several different operational metrics:

- Quality
- Overtime cost
- Production down time
- Production cycle time
- Scrap
- Customer satisfaction—lead time, delivery and quality

Our manufacturing study was designed to quantify the bottom-line impact for companies that cannot fill skilled manufacturing roles. Using data collected from our survey respondents, the cumulative cost of the skilled manufacturing labor shortage was quantified in increased overtime cost, increased cycle time and increased downtime (See Figure 5).

The largest financial impact of the skills shortage was in increased overtime cost. In order to backfill necessary skilled roles, more than 70 percent of respondents reported at least a five percent increase in overtime cost with 32 percent reporting an increased overtime cost of 10 percent or more.

A closer look at the effects of the skills shortage

U.S. Department of Labor Current Employment Statistics (CES) data shows that average per-worker weekly hours in manufacturing have increased since 2006, while overall worker hours across industries have been decreasing since 2006.

While overtime is a viable and useful strategy for balancing peaks and valleys in customer demand, companies in our survey are being forced into using overtime to maintain base production volumes due to the shortage of workers with the right skills. This not only decreases productivity on the entire line, it leaves management unable to utilize this valuable tool for addressing peak customer demand. (Refer to Figure 5).

In addition to the impact on overtime, a lack of skilled talent damages productivity in several ways. According to the Accenture 2014 Manufacturing Skills and Training Study, 62 percent of respondents report an increase in production downtime of five percent or more, and 66 percent report an increase in cycle time of five percent or more.

What US manufacturing companies stand to lose as a result of skills shortages

To better understand how the skills shortage affects manufacturers, we looked at a fictional company based on the median respondent to our survey, which is a 2,000-employee manufacturer with \$500 million in annual revenue. Similar to many of the companies in our survey, this business plays a key role in the supply chain of several major industrial equipment manufacturers. This company, like most of the respondents in our survey, has a severe shortage in skilled and highly skilled manufacturing talent with 8-10 percent of roles going unfilled.

Respondents in our survey reported three primary areas of negative impact due to these roles going unfilled. The average company in our survey reported a 12 percent increase in overtime cost, which, for our median company, would increase overtime costs by \$1 million annually. Our median company also matches the average survey respondent in that they report a 10 percent increase in downtime and an eight percent increase in cycle time.

This impact would decrease Overall Equipment Effectiveness (OEE) by nine percent. This decrease is primarily in the metric of performance due to the increase in cycle time. Assuming our median company could sell everything it produces, this means that our median company has nine percent less effective capacity to produce product and generate approximately \$45 million additional revenue. Using a 7.9 percent average profit margin for manufacturing⁶, this translates to more than \$3.6 million in additional—but unrealized—earnings. Alternatively, for a company that is currently producing all it can sell, the increased cycle time would mean our company is spending an additional \$4 million plus in wage cost to maintain current production.

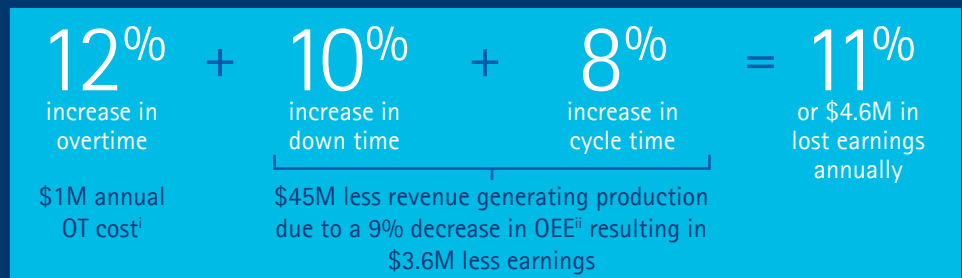
When OEE reduction impact is added to the increased overtime cost, the manufacturer in this example is potentially losing more than 11 percent of annual earnings (EBITDA) or \$4.6 million annually—that is more than \$3,000 per manufacturing, non-management role. A small manufacturer with \$50 million in revenue could potentially increase earnings by more than \$460,000 annually by addressing a similar skills issue. (See Figure 6).

Figure 6: Projected lost annual earnings for a sample manufacturer.

Impact on our median manufacturer in the study



- Midwest manufacturer
- 1,400 non-management roles at average \$20/hr—total payroll of \$56M
- \$500M annual revenue
- Severe shortage of skilled labor with 8-10% skilled roles unfilled



ⁱ 12% increase in the average 10% overtime cost

ⁱⁱ 9% decrease in OEE is the equivalent lost production of \$45M revenue from world-class levels

Meeting the skills shortage challenge

“At Caterpillar, when we have internal programs aligned with credentials and we validate that employees are developing the right competencies, we avoid those early hour issues with safety, quality and velocity because they are more work ready. We can then drive that demand into the greater pre-employment pipeline.”

Gina Vassallo
Caterpillar talent development and management

Smart training investments produce business results

Given the financial impact of the skills shortage (shown in Figure 6), it is not surprising that companies are investing more in training programs.

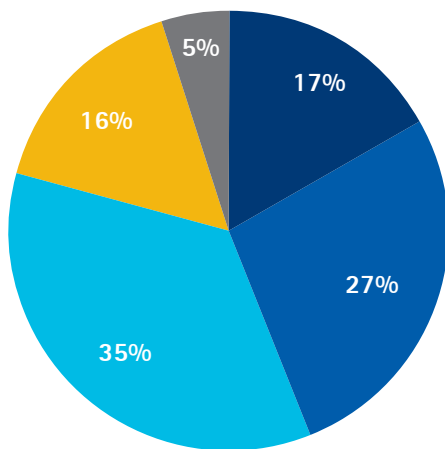
More than 80 percent of survey respondents reported some type of training program beyond informal training. Nearly 10 percent of respondents are spending more than \$5,000 annually per employee on skills training (See Figure 7), while the average respondent spent about \$1,000 annually per employee for skills training.

However, our respondents report spending a much larger amount, on average, for new hire training than is spent on existing talent. More than 55 percent of companies in our survey spent at least \$1,000 per new hire while only 42 percent of companies reported spending more than \$1,000 per employee overall.

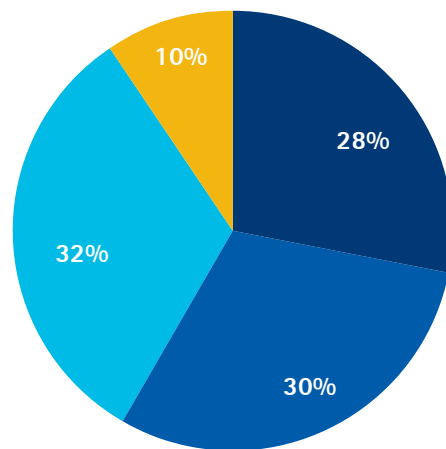
Despite a willingness to spend money on training, respondents report only modest satisfaction with their existing training programs. Our study saw no correlation between spending on training and impact on skill shortages. Successful companies spend their training dollars as part of an overall strategy to address critical skill shortages; training spend does not necessarily move the needle on operational challenges.

Figure 7: Average annual expenditure on skills training for manufacturing roles.

New Hire Skills Training Spend



Overall Skills Training Spend



- Less than \$500
- \$500-\$1,000
- \$1,000-\$5,000
- \$5,000-\$10,000
- Greater than \$10,000

- Less than \$500
- \$500-\$1,000
- \$1,000-\$5,000
- Greater than \$5,000

Source: Accenture 2014 Manufacturing Skills and Training Study

Industry leaders are innovating in learning and HR strategy to strengthen the talent supply chain

Companies that are successfully addressing the manufacturing skills shortage are spending training dollars wisely with a multi-tiered strategy to deal with the issue over short-, medium- and long-term timeframes. Survey respondents are using a variety of training methods—from informal job shadowing types of programs to formal apprenticeships with structured curricula, testing and outside training—to help build critical skills among talent.

Our ongoing research into addressing skills shortages⁷ has identified several key strategies for companies tackling the skills gap.

Offer digital learning experiences

Leading companies are embracing digital technologies to offer learning experiences anytime, anywhere. For example, organizations are offering remote skills training for manufacturing, allowing employers and employees alike to make use of self-paced learning that is available 24x7 and is delivered in a way that is best suited for the learner and learning objective. Digital learning also can be a more economical approach than traditional classroom learning.

Tooling U⁸ is an online service that offers remote skills training for engineers, machinists and press operators. The American Welding Society's (AWS) American Welding Online⁹ provides remote learning for welding skills and experienced AWS staff develops the programs.

Combine formal and informal training

Many companies are successfully partnering with local community colleges, and even high school vocational programs, to acquire formal training for existing talent and also build a pipeline of future skilled workers. Manufacturing companies are collaborating with colleges and universities to review curriculum and provide ideas for revising them. Some companies are even setting up open access training programs to ensure that more people have the skills they need in specific geographic regions.

All of the leading companies we interviewed had some form of established relationships with local community colleges or vocational technical programs. For example, the North Coast Marine Manufacturing Alliance aims to build upon the synergistic relationship between educational institutions and the regional businesses that need a critical mass of skills in specialized manufacturing, namely marine manufacturing. "The purpose of the North Coast Marine Manufacturing Alliance is to convene the ship, yacht and boat manufacturers in the region to work in partnership with the leaders in workforce development, educational institutions and economic development to promote, develop and grow the industry"¹⁰.

Northeast Wisconsin Technical College, Lakeshore Technical College and the University of Wisconsin Marinette are collaborating with the local ship and yacht building industry to attract and train employees using a specialized curriculum developed in conjunction with the local manufacturing base. This partnership provides fulfilling careers for the college consortium students and helps to build critical skills that are important to their corporate partners.

Many companies are not just using these programs as a one-way partnership to obtain potential recruits, they are sending skilled talent to spend time in these programs to teach specialized skills and generate interest in a manufacturing career.

Students will acquire industry-specific skills as part of their degree programs and once trained, the first right of employment is with the company that trained them. "We have built a really good relationship with a high school that has a welding program. In fact, the relationship is to the point where we have helped them with their curriculum, we've donated materials to them, we'll go down once or twice a year to meet with the instructors to talk about the curriculum and also to meet the students for onsite interviews. We had four or five people that we hired right after graduation," said Shawn Kaufman of Riggs Industries.

Use a certification approach to skills building

Several organizations have programs to assist manufacturers in building skills that culminate in a certified skill level. The Manufacturing Institute's Skills Certification System offers certification in 14 different manufacturing skills¹¹. The National Institute for Metalworking Skills (NIMS) offers nationally recognized certifications in key metalworking skills¹². These certifications are standardized by skill set and allow employees to build a nationally recognized standard set of skills in a given area. "It is our obligation as CEOs and business leaders to reach out and help students understand education paths to be better qualified and have better market value in this competitive global economy. If we help our students, we will be helping America," said Tony "TR" Raimondo, chairman of Behlen Mfg. Co.

Not only do employers gain confidence that their employees are able to perform at a given level of skill, employees gain confidence in their own abilities as they acquire new skills certifications. Accenture research into employee engagement and retention shows that employees place a high level of value on achievement-based recognition, and this enhances employee moral, productivity and retention for companies that offer these opportunities¹³.



Engaging early to shape a talent supply chain

Dream It. Do It.,¹⁴ a program sponsored by the members of The Manufacturing Institute, seeks to reach even further back into the skills pipeline. The program strives to influence the perception that many young people have about manufacturing careers. Working at the local, grassroots level, they educate high school students and others about career opportunities in manufacturing. The program is currently active in 27 states. Tony "TR" Raimondo of Behlen Mfg. Co. in Nebraska credits the program with helping Behlen to develop a pipeline of skills, such as welding, by encouraging students at the high school level to consider the benefits of a high-skilled manufacturing career. This is the sort of long-term thinking that is helping leading companies close the skills gap now, and for the future.

Use an apprenticeship training model

Apprenticeships combine elements of many of the previously discussed strategies. This approach has been successfully embraced in South Carolina where manufacturers see it as a way to build a critical mass of manufacturing skills to meet their company's needs.

"Quality and expertise play an important role in the design and manufacture of Delavan products. What better way to ensure that quality and build that expertise internally than through an apprenticeship program? This apprenticeship program gives us the opportunity to invest in and grow our own workforce."¹⁵

Dale Hutto

Controller and interim plant manager
Goodrich Delavan

"As we develop our people and we get them more engaged in the processes, we should expect those results to have improved. In fact, when you look at the top 30 percent of our facilities, you'll see that they have the improving scores and they have the improved results. So we see that correlation."

Gina Vassallo

Caterpillar talent development and management

Expand the candidate pool

Accenture research indicates that, given the reported difficulty of finding qualified candidates, companies should drop the notion of finding the "perfect" candidate based on a lengthy list of highly specific skills, education or experience. Instead, they should look for more generalist skills from candidates—even those outside of their industry, in other geographies or with adjacent or overlapping skill sets—that can easily be developed to perform the job.

Many of the manufacturing companies that we spoke with have a ready pool of workers who may lack the specialized skills to fill critical roles, but they have basic knowledge and motivation to build upon. "One employee six years ago started as a machinist trainee. Really smart, not a lot of formal education, but intelligent," said Mary Ann Cervinka, HR manager at Arrow Gear. "He is now pursuing formal education and is a supervisor of our highly technical area."

Employers can identify the best performers and up-skill motivated employees from their unskilled workforce pool. By providing a path to higher skilled work through training and apprenticeships, employers will offer a fulfilling career path that engages employees and builds long-term loyalty. They will also shape a long-term pipeline of skills to support the business.

Leading manufacturers measure the business impact of their talent supply chain

The manufacturing leaders that we interviewed were intensely focused on measuring business results. This includes learning from successes—and not so successful programs—and then adjusting based on the data. Looking at operational metrics has allowed many businesses to focus resources and invest in the programs that will have the most positive impact on their business.

Leading companies use statistical analysis and reporting to correlate their training and recruiting programs with key business and operational metrics, including:

- Production cycle time
- Downtime
- Inventory
- Scrap rate
- Overall equipment effectiveness (OEE)
- Order lead time
- Ability to scale for peak production
- Percentage of orders filled on time
- Lost orders due to inability to fill
- Overtime cost
- Cost of goods sold

Through data analytics, firms are able to identify and improve effective skill building or certification programs and quickly make changes to programs that are not yielding a positive return on investment.

Building your talent supply chain

The skills shortage in manufacturing is an immediate issue that requires attention—but it will not be resolved overnight.

The Accenture 2014 Manufacturing Skills and Training Study quantifies the business case for employers to take the lead in acquiring, building and retaining the skills needed to meet increasing demand. As discussed in this report, there are many tools and best practices for addressing the skills and talent issue.

To be successful, companies must take a closer look at what they have today, what they need tomorrow, and then put core processes and programs in place that address long- and short-term needs. By taking pragmatic steps to stem the shortage through a robust talent supply chain, companies can be better positioned for a future of sustainable profitability.

About the Study

Accenture and The Manufacturing Institute conducted a joint study on manufacturing skills in the US market. The study surveyed more than 300 executives from a diverse range of US manufacturing companies with average annual revenue of \$100 million. We

interviewed a subset of these industry executives, representatives of the National Institute of Metalworking Skills, as well as economists and industry specialists within the U.S. Department of Labor. The study was conducted between August 2013 and January 2014.

Notes

¹ United States Department of Labor, Current Employment Statistics (CES) data, online at <http://www.bls.gov/ces/>.

² Lenovo press release, "Lenovo to Open Computer Manufacturing Line in the United States," online at http://news.lenovo.com/article_display.cfm?article_id=1635

³ Caterpillar, "Caterpillar Celebrates The Grand Opening Of Bcp's Athens Facility," online at <http://www.caterpillar.com/en/news/caterpillarNews/h/caterpillar-celebrates-the-grand-opening-of-bcps-athens-facility.html>

⁴ GE Appliances press release, "GE to Invest \$432 Million, Create 500 Jobs, to Establish U.S. Centers of Excellence for Design and Manufacture of Refrigeration Products," online at <http://pressroom.geappliances.com/news/ge-to-invest-432-million-create-187073>

⁵ U.S. Bureau of Economic Analysis – Manufacturing Industry Data, online at <http://bea.gov/iTable/iTable.cfm?ReqID=5&step=1#reqid=5&step=4&isuri=1&402=15&403=1>

⁶ <http://www.inc.com/quarterly-financial-report/manufacturing.html>

⁷ "Accenture 2013 Skills and Employment Trends Survey: Perspectives on Training" online at <http://www.accenture.com/us-en/Pages/insight-accenture-2013-skills-employment-trends-survey-perspectives-on-training.aspx>

⁸ <http://www.toolingu.com/default.aspx>

⁹ <http://awo.aws.org/seminars/>

¹⁰ <http://northcoastmma.org/about-north-coast>

¹¹ <http://www.themanufacturinginstitute.org/Skills-Certification/Certifications/NAM-Endorsed-Certifications.aspx>

¹² <https://www.nims-skills.org/web/nims/6>

¹³ "What Executives Really Need to Know about Employee Engagement," <http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-What-Executives-Really-Need-to-Know-about-Employee-Engagement.pdf>

¹⁴ <http://www.themanufacturinginstitute.org/Image/Dream-It-Do-It/Dream-It-Do-It.aspx>

¹⁵ www.apprenticeshipcarolina.com



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About Accenture

Accenture is a global management consulting, technology services and outsourcing company, with approximately 289,000 people serving clients in more than 120 countries. Combining unparalleled experience, comprehensive capabilities across all industries and business functions, and extensive research on the world's most successful companies, Accenture collaborates with clients to help them become high-performance businesses and governments. The company generated net revenues of US\$28.6 billion for the fiscal year ended Aug. 31, 2013. Its home page is www.accenture.com.

About The Manufacturing Institute

The Manufacturing Institute is the 501(c)(3) affiliate of the National Association of Manufacturers. As a non-partisan organization, the Institute is committed to delivering leading-edge information and services to the nation's manufacturers. The Institute is the authority on the attraction, qualification and development of world-class manufacturing talent. For more information, please visit www.themanufacturinginstitute.org.

