

Closing the Skills Gap

How manufacturers are leveraging new technologies and energizing a new generation to finally close the labor gap.

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EXECUTIVE SUMMARY

The skills gap is an old story in the manufacturing world—a perennial crisis that seems to threaten the entire industry with every new technological leap or generational change. Today, however, the crisis is more critical than ever before.

We are on the cusp of a full-scale digital revolution in the manufacturing industry, with new tools and new technologies and new systems rolling in at breakneck pace, transforming every process, job, and required skillset they touch.

At the same time, we are on the cusp of an enormous wave of retirements as Baby Boomers exit the job market, taking with them decades of irreplaceable experience and expertise. Add to that the low representation of the Millennial generation in the industry, and we have a perfect storm.

If nothing changes, the combined effect of these events could widen the skills and labor gaps to catastrophic levels. Between retirements and new digital skills requirements for the industry, we already have around 500,000 unfilled manufacturing jobs

today—a figure that could balloon to 2.5 million over the next decade. If nothing changes, this will become a skills crisis that dwarfs any skills crisis we’ve ever endured before.

But things are changing.

Over the last few years, manufacturers across the industry have begun systematically attacking the skills gap head-on—re-evaluating their recruitment tactics, beefing up their training programs and harnessing technologies design to support and attract (not replace) workers.

If deployed at scale, these practices could finally close the skills gap. We already see signs of it—from the sharp jump in Gen Z interest in manufacturing to home grown training programs to the effect of technology through it all, the tide is beginning to shift.

This ebook outlines some powerful examples of these tactics and their application across the industry, which combine to create a vital new playbook for manufacturing leaders stuck in the skills gap crisis. ●



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CAN GEN Z SAVE MANUFACTURING FROM THE 'SILVER TSUNAMI'?

One-third (32%) of Gen Z has had manufacturing suggested to them as a career option, as compared to only 18% of Millennials and 13% of the general population.

BY IW STAFF



It seems that the efforts, over the past few years, of manufacturing companies showing up in classrooms and in the guidance counselors' offices touting the field as a good career choice, is paying off.

A new study, [2019 L2L Manufacturing Index](#), which examined the American public's perceptions of U.S. manufacturing, found that adults in Generation Z (those aged 18-22) are 19% more likely to have had a counselor, teacher or mentor suggest they look into manufacturing as a viable career option when compared to the general population.

One-third (32%) of Generation Z has had manufacturing suggested to them as a career option, as compared to only 18% of Millennials and 13% of the general population.

Better still, the survey also found that Generation Z is intrigued by careers in manufacturing.

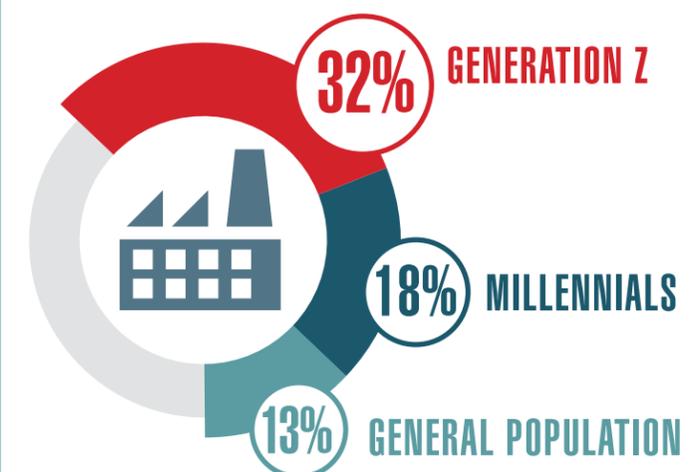
They are 7% more likely to consider working in the manufacturing industry and 12% less likely to view the manufacturing industry as being in decline, both compared against the general population.

These findings may be in relation to Generation Z having a larger exposure to the industry compared to previous generations with one-third (32%) having family members or friends working in the manufacturing industry, compared to 19% for Millennials and 15% for the general population.

"For many years, manufacturing has struggled to introduce and entice new workers to the industry," said Keith Barr, CEO of L2L, the lean manufacturing software company behind the survey.

"The industry has failed to compete with technology for their interest. Unfortunately, the industry hasn't fully explained the dynamic, technology-driven environment of the modern plant floor. With Gen Z just moving into the workforce, we need to encourage their participation in modern manufacturing. If we don't, I'm afraid the industry will be hit with the negative effects of the Silver Tsunami."

PERCENTAGE OF POPULATION THAT HAVE HAD MANUFACTURING SUGGESTED TO THEM AS A CAREER OPTION



MISCONCEPTIONS REMAIN

As Baby Boomers are beginning to retire, jobs are opening up, thus the Silver Tsunami. According to the latest government data, there are now 522,000 open manufacturing jobs in the United States (an all-time high), and a recent report from Deloitte and The Manufacturing Institute (the National Association of Manufacturer's social-impact arm) projects that 2.4 million manufacturing jobs will go unfilled over the next decade.

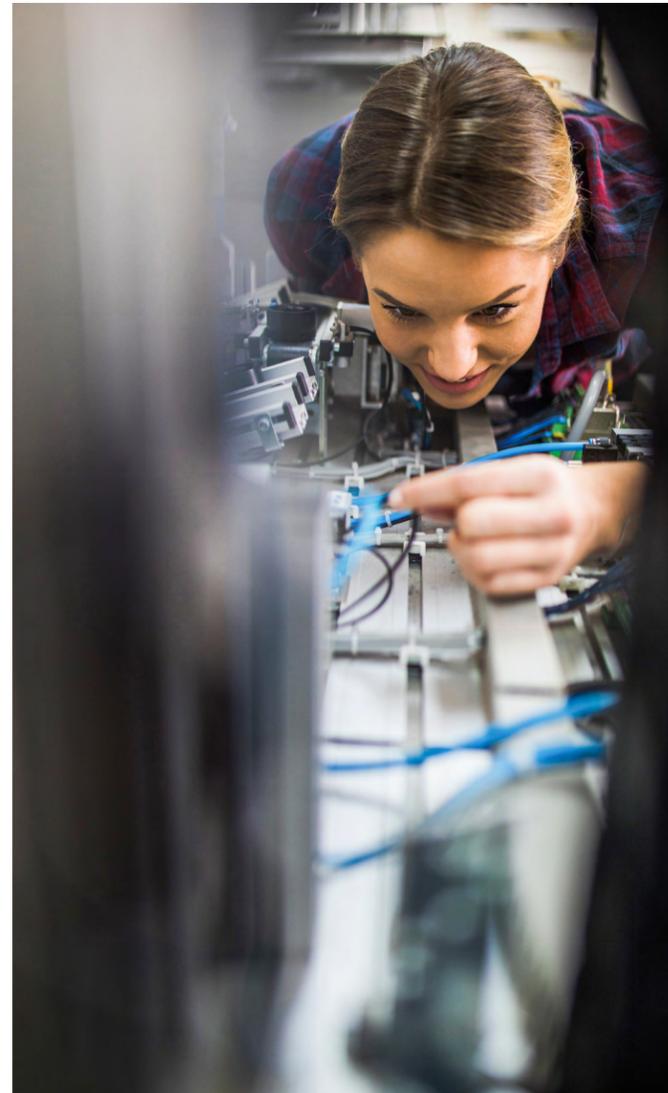
To fill these jobs more work will need to be done as misconceptions about the industry persist. For example, the study revealed that over half (53%) of the general population assumes the average salary of a mid-level manufacturing manager is under \$60,000. In reality, the average salary for a manufacturing manager in 2018 was \$118,500, according to the [2018 Salary Survey](#) report from IndustryWeek.

While Generation Z appears to have had greater overall exposure to manufacturing, misperceptions around the highly technical and modern nature of the industry still remain. A majority (56%) of Generation Z would consider working in the tech industry, while only 27% would consider working in the manufacturing industry. Additionally, they are more likely to consider manufacturing jobs boring when compared to Millennials and the general population.

However, there is a reason to believe that the industry is making positive moves towards a better-informed public. Last year's *L2L Manufacturing Index* measured that 70% of people believed that the American manufacturing industry was in decline. When the same question was asked in this year's survey, only 54% of people believed the industry is in decline, showcasing a surprisingly better understanding of the present state of the industry.

"With Gen Z we have an opportunity, as an industry, to build a new workforce, but it will be a challenge that the industry is going to have to take seriously in order to get their attention and participation," said Barr. "We know that the workforce crisis is a top concern with a majority of manufacturers. Instead of hoping new workers will appear, the industry needs to make changes that will attract the workforce. Gen Z is incredibly tech-savvy. The industry needs to consider developing and deploying plant-floor technology

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When surveyed about the likeability and availability of work, 54% of Generation Z respondents agreed that there is a shortage of skilled manufacturing workers in the U.S., and 43% agreed that manufacturing jobs are an attractive option to younger workers and the next generation of workers. A majority (59%) of Generation Z also agreed that trade schools offer promising career opportunities for high school students graduating in 2019.

Generation Z grew up in the midst of the Great Recession, watched their older peers accumulate student debt, then struggle to pay it off with low-paying jobs right out of college. They are seeking higher paid jobs in a more transparent and open learning environment, and they're increasingly open to alternative types of education and training. Barr believes manufacturing jobs can meet their needs and provide the diverse and rewarding work experience they crave. ●

that utilizes gamification and transparency to take advantage of Gen Z's unique skills. The greatest opportunity for manufacturing is to have an engaged, empowered workforce that is constantly innovating."

ROLE OF EDUCATION

Education is the key, and it is an area that manufacturing continues to struggle in. When surveyed about alternative types of education, the survey found that a vast 75% of people have never had a counselor, teacher or mentor suggest they look into attending trade or vocational school as a viable career option. The number was slightly lower with Generation Z (59%) and Millennials (67%) but still showcases an extreme disconnect in consideration of alternatives outside of traditional 4-year institutions.

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5 WAYS MANUFACTURING IS TACKLING THE LABOR SHORTAGE

BY POORNIMA APTE

The U.S. manufacturing industry is on the cusp of a digital revolution. The Internet of Things (IoT) and machine learning have the potential to bring about impressive digital transformation.

However, these advantages might miss the mark because of a talent shortage. Manufacturing also suffers from an image problem that the C-suite needs to work on.

Here is a look at the U.S. manufacturing landscape and prescriptions to overcome the labor challenges we have faced in recent years.

HOW WE GOT HERE

The talent shortage in manufacturing has been on a rolling boil for years because of a few noteworthy factors. First, blame it on the Boomers. Nearly a [whopping 10,000 retire every day](#).

A 2018 Deloitte [report](#) predicts that over the next decade, more than 2.4 million manufacturing jobs will go unfilled. Persistent skills shortage could risk \$454 billion in economic output in 2028.

This phenomenon is not simply because of sheer retirement numbers. It is also because the skills required for a job don't

match talent in existing worker pools. Five out of 10 open positions for skilled workers in the U.S. manufacturing industry remain unoccupied today. This shortage is due to the skills gap.

Another problem: The profession ranked last as a career choice in the 19-33 demographic. A digital transformation might help reverse that trend. But the industry has a new dilemma. They now have to compete for technical talent with a whole host of other industries such as finance, retail, mining, and construction.



OVER THE NEXT DECADE, MORE THAN
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So, how does manufacturing achieve its objectives? It's time for unorthodox strategies, say industry experts. Here are five creative ways manufacturing companies are attracting and recruiting talent:

1. ENCOURAGING A TEST DRIVE

According to Charlie Wilgus, General Manager, Manufacturing and Supply Chain Executive Search at the [Lucas Group](#), workers are now willing to take shorter-range job assignments. This gives them a way of testing the waters, Wilgus says.

Manufacturers are starting to embrace this idea. They understand that a contract situation also benefits them. It gives them some insight into employees before signing them on for a permanent job.

Prospective candidates are also job-hopping to test fit, says Thomas Stone, senior research analyst at [The Institute for Corporate Productivity](#). Prospects try out various jobs within several business units within a company. Each test drive usually lasts six to eight weeks.

As an added bonus, workers get a more holistic view of the company's various operations. This also allows the business to lean on the same professional in case of vacancies in other business units.

2. ADVANCING AND TRAINING INTERNAL TALENT

Promoting internal talent can be a two-fer. It serves to retain valuable employees, and the company invests in known entities. Stone says that organizations are dialing up their focus on training and development for workers who have an aptitude to move up the ladder.

Traditional tuition reimbursements for back-to-school training has long been standard operating procedure. Now, manufacturing companies are forking over the money upfront. Disbursement instead of reimbursement is becoming a mainstay, Stone says.

3. TAPPING INTO UNCONVENTIONAL TALENT POOLS

Companies are looking beyond the pool of graduating students to recruit blue-collar workers, Stone says. Boeing hires thousands of ex-convicts looking to reenter the workforce.

Manufacturing companies are also partnering with organizations that cater to veterans and minorities. Blacksmith International, an apparel manufacturing company, has started a pilot program that retrains Utah residents who have been hit hard by layoffs in the coal industry.

4. LOOKING BEYOND THE RÉSUMÉ

Manufacturing companies are looking for workers with certain requisite skills—even if they don't have a Bachelor's degree. Vocational schools are rising to this challenge. They offer training in advanced manufacturing technologies such as 3D printing. By checking on skillset rather than education alone, companies are more closely aligning specific jobs to the talent they need.

The Deloitte [study](#) found that 77% of employers are willing to prioritize a candidate's skills and potential over experience. Additionally, 65% of employers say they'll train candidates on the job if they don't have a certain skillset.

5. DIVING INTO DATA ANALYTICS

Companies are also using data analytics to help address the talent shortage. Manufacturers can analyze demographic factors across the country and find out which places will have the best talent.

Factors like graduation rates and standard of living costs make helpful indicators. According to Stone, companies can act on that intelligence proactively and recruit more aggressively in areas they feel have more desirable candidates.

The new manufacturing age will require agile processes—not just on the production floor, but in hiring as well. A little creativity is helping companies solve the talent shortage both in the short and long term. With the right talent, manufacturing companies can accelerate their journey to digital transformation. ●



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HOW TO LEVERAGE TECHNOLOGY TO ATTRACT A YOUNGER WORKFORCE

BY JARED LINDZON



In 2016, millennials officially became the most represented generation in the American workforce, [according to the Pew Research Center](#). By the end of the next decade, they will represent 75% of all American workers, [according to the Bureau of Labor Statistics](#).

This young, vital demographic comes with a range of expectations of their employers. One of those key demands is a working environment that uses technology.

“Having grown up with technology at their fingertips, millennials won’t put up with poor enterprise technology,” explained Alastair Mitchell, the co-founder and CEO of Huddle.com in a recent [op-ed](#) in *Wired Magazine*.

Outdated tech can turn millennial talent off from a job opportunity. But new technology can have the opposite effect.

Here are three ways your organization can use technology to attract younger employees:

1. OFFER ELEARNING

As the first generation to grow up with the Internet, younger workers like having constant access to information. But they don’t want that information coming all at once. Instead,

they express a strong desire to grow and advance their knowledge on their own terms. At the same time, they’re often not interested in anything that feels too much like school, according to a report by KPMG titled “[Meet the Millennials](#).”

“Companies need to prioritize learning and, more importantly, upgrade how it happens,” the report details. “Leveraging modern technology that millennials know and love, through eLearning, makes a huge difference.” Millennials are eager to learn. They just want to do it using modern, digital platforms.

2. UPDATE ADMINISTRATIVE PROCESSES

Getting frustrated by lengthy or unnecessary administrative processes isn’t just for younger workers. But millennials might be the first generation to make their employment decisions based on them.

According to Stephen Hill, the Executive Director of Product Development for talent management firm the Allegis Group, younger workers expect the same level of efficiency, convenience and usability in their work tools as they enjoy in their consumer products.

“They bring those same expectations to their jobs, so employers are increasingly examining processes to provide the same quality experience and ease-of-use for employees using technology in the workplace,” he writes in a recent [article](#) in *HR Technologist*.

Hill goes on to explain that young people have little patience for red tape. “In the end, the goal is to enable employees with streamlined and easy-to-use administrative platforms, so they spend less time completing admin work and more time doing the work that matters most,” he writes.

3. AVOID THE “IF IT’S NOT BROKE...” FALLACY

When it comes to new technology, some believe that if the old ways still work, why change? But staying ahead of technology trends can help attract younger workers.

“The phrase ‘if it’s not broke, don’t fix it’ is crippling to [younger workers’] creativity,” explains HR and Business Strategy consultant and *Forbes* contributor Heidi Lynne Kurter in a recent [post](#). “They thrive off of staying ahead of the tech curve to discover new methods of completing tasks and automating processes.”

Younger workers want to feel like they’re working for a company on the cutting edge. “The new generation is more flexible, open to change and willing to get hands-on to discover new techniques,” Kurter writes. ●

LEVERAGING MODERN TECHNOLOGY THAT MILLENNIALS KNOW AND LOVE, THROUGH E-LEARNING, MAKES A HUGE DIFFERENCE.

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LET'S NOT FORGET THE VALUE OF EXPERIENCED WORKERS

Consulting firm Mercer offers ways to optimize an experienced workforce.

IW STAFF

While it's impossible to escape advice on how to attract and retain young workers, which is necessary, often the value of older, experienced workers is overlooked.

Companies that actively leverage their older, experienced workforce will be best positioned for the future of work, according to Mercer's recently published report, ["Next Stage: Are You Age Ready?"](#).

"With labor force size, participation rate and productivity so closely tied to business and economic growth, the experienced workforce is a source of talent and competitive advantage that employers need to embrace now," said Pat Milligan, global leader of Mercer's Multinational Client Group, in a statement.

"To be 'age-ready', however, requires a thoughtful and careful analysis of this workforce segment as well as a change in mindset as to how experienced workers truly add value to organizations," Milligan added.

Mercer finds experienced workers are particularly valuable to employers in that they often:

- Lower costs because they are less likely to leave
- As supervisors, tend to retain, develop and engage more junior employees and decrease voluntary leave on the teams they manage
- Increase the productivity of those around them through knowledge sharing
- Strengthen group cohesion, collaboration and resiliency
- Enable innovation and strengthen customer connection

However, research has shown that for many employers, experienced workers are largely ignored or misperceived. According to the World Economic Forum's 2016 Future of Jobs report, only 4% of respondents said they planned on investing in experienced workers as part of their workforce strategy.

Ignoring this group is risky. By 2040 the *average* life expectancy is predicted to be 80 years, up from 56 in 1966 and 72 in 2016. As a result, many people are working longer

for a variety of reasons, including financial necessity, purpose, and social/intellectual engagement.

"For employers, managing a rapidly growing older workforce is a challenge without precedent," said Rick Guzzo, co-Founder of Mercer's Workforce Sciences Institute. "In the U.S., rates of working among older individuals have been rising and will continue to rise, with the highest growth rates among those aged 70-74 and 75-79. Given this reality, organizations that are more 'age-ready' than their competitors will likely have a significant strategic advantage."

To assist organizations in becoming 'age-ready', Mercer has developed a list of 10 ways to optimize an experienced workforce.

1. Collect and analyze your age-profile data to explore demographic and skills pinch points.
2. Develop and implement people and careers strategies that embrace the experienced workforce.
3. Understand what impact your organization's retirement plan design has on the trajectory of retirement readiness and labor flow.
4. Initiate conversations with experienced employees about how they might work differently.
5. Examine and tackle how ageism might manifest in your organization — analyzing pay, bonuses, performance, promotion and recruitment statistics through a lens focused on aging.
6. Develop a lifelong learning attitude that positions people to embrace jobs of the future.
7. Measure productivity levels across different age and position cohorts in your organization.
8. Implement an effective flexible-working strategy.
9. Develop and implement a program offering support for those who have caregiver responsibilities.
10. Create and sustain an inclusive culture that supports and enables your experienced-worker strategy. ●



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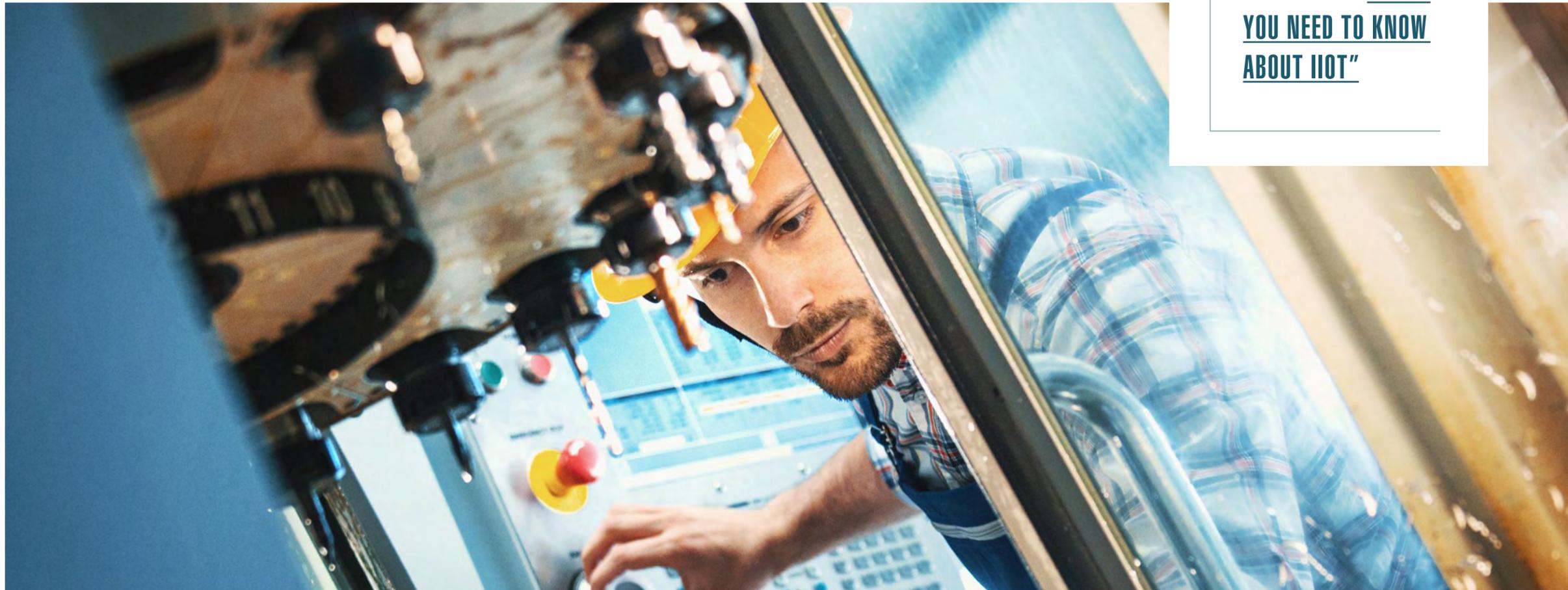
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HOW MANUFACTURING DAY IS HELPING COMBAT THE LABOR SHORTAGE

BY TOM BIDINGER

LEARN MORE ABOUT MFG DAY AND THE LABOR SHORTAGE BY VISITING WWW.MFGDAY.COM OR CHECKING OUT THE ARTICLE "[WHAT YOU NEED TO KNOW ABOUT IIOT](#)"



The manufacturing industry is facing a labor shortage. The jobs are there, but manufacturers are having trouble filling them with young, skilled talent due to some common misconceptions about the industry.

In 2012, Manufacturing Day was created to combat these misconceptions. [Manufacturing Day](#)—also known as MFG DAY—gives manufacturers the opportunity to open their doors and show what it's *really* like to work in manufacturing.

As a technology provider for the manufacturing industry, Epicor is taking an active role in reversing the labor shortage. Epicor sponsored MFGDAY 2019 and will sponsor MFGDAY

on Oct. 1, 2020. By exposing younger generations to manufacturing, we can eliminate the stigma attached to the industry and start filling those open jobs.

HOW WE GOT HERE

According to a 2018 Deloitte study, manufacturing job opportunities have been growing at a double-digit rate since mid-2017. The problem isn't that the jobs aren't there. The problem is that there aren't enough skilled employees to take them.

For decades, Baby Boomers dominated the industry. But Boomers are retiring in droves,

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and younger generations—namely Millennials—aren't filling the gaps.

Not only that, but new technologies and the onset of Industry 4.0 are also dramatically altering the manufacturing sector. As these new technologies are implemented in factories around the world, manufacturers are looking for tech-savvy workers to help run their systems.

Millennials are the obvious choice. However, they have different, specific needs when it comes to potential employment, and they're not afraid to "shop around" until they find exactly what they're looking for.

WHAT CAN BE DONE

The incoming generation of workers have never known life without computers or the Internet. Gen Z—the generation comprising recent college graduates and younger—has been using smartphones since they were children. Technology is ingrained in everything they do, so manufacturers would be wise to [leverage that technology](#) to make the industry more appealing.

Millennials and Gen Zers also like to stay on the cutting edge of technology. They want to be able to use systems like augmented reality (AR), virtual reality (VR), and [Internet of Things \(IoT\)](#) technologies because they often already use them in some form or another in their day-to-day lives. They also expect the business and manufacturing software

systems they use on the job to reflect the collaboration and analytics capabilities they enjoy in modern consumer software. This means, up-to-date and intuitive ERP and MES systems can be a major advantage in engaging this population.

The positive effect technology can have on recruiting isn't a new concept. A recent poll indicated 85% of executives believe AI gives their companies a competitive advantage. However, it's not enough for manufacturers to embrace technology. They must also champion it. Those that do so will be in a better position to attract young, skilled talent.

HOW EPICOR CAN HELP

It's estimated that the labor shortage in the manufacturing industry will leave about 2.4 million positions unfilled until 2028. This could negatively impact the economy to the tune of \$2.5 trillion.

That's why it's so important to break the cycle of misinformation when it comes to manufacturing careers. A recent survey found that just 67% of parents would encourage their child to learn more about job opportunities in manufacturing. That number needs to increase.

By working together during and after MFG DAY, manufacturers can begin to address the skilled labor shortage, connect with future generations, change the public image, and ensure the ongoing prosperity of the whole industry. ●



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LET'S GET REAL ABOUT THE SKILLS GAP AND START SOLVING IT

A lack of training and job security is at the root of manufacturing's image problem.

BY MICHAEL COLLINS



A 2018 survey published by the Manufacturing Institute says that 3.5 million manufacturing jobs will need to be filled in the next decade and 2 million of those jobs will go unfilled. Now there are people who say this skills gap is a lie. But the fact is that as skilled people retired, manufacturing companies, particularly the multi-national corporations, did not invest in the advanced training programs to replace the retiring workers.

We are 500,000 workers short today. A recent article in Industry Week said that “during the first quarter of 2019 more than 25% of manufacturers had to turn down new business opportunities due to lack of workers.”

Yes, the skills gap is real and a two-pronged problem. First, manufacturing does not have the advanced training programs needed to produce the high skilled workers they need. Second, young people, their parents and counselors do not see manufacturing as a good career.

WHAT DO SURVEYS SHOW?

A survey by the Fabricators & Manufacturers Association, International “showed a majority of teens—52%—have little or no interest in a manufacturing career. Another 21% are ambivalent. When asked why, a whopping 61% said they seek a professional career, far surpassing other issues, such as pay (17%), career growth (15%) and physical work (14%).

Other surveys from the National Association of Manufacturers and the Manufacturing Institute report that “only three in 10 parents would consider guiding their child towards a

career in manufacturing.” The same associations said, “less than five in 10 Americans believe that manufacturing jobs are interesting, rewarding, clean, safe, stable, and secure.”

A survey by Deloitte on the [public perception of the manufacturing industry](#) showed that most Americans think that the U.S. manufacturing sector is getting weaker and that many American citizens are steering their children away from careers in manufacturing in favor of other industries they view as more stable. Nearly 80% of the respondents to the survey believe manufacturing jobs are the first to be moved to other countries, according to the research.

I think this statement gets to the heart of the manufacturing image problem. It is really about the lack of job security, an idea continually reinforced by plant closures by corporations like General Motors, Hewlett Packard, Pfizer, AT&T, Kimberly Clark, Comcast, Harley Davidson, Carrier, and Tesla who all announced plant lay-offs in 2018. Mary Barra, CEO of General Motors, who is orchestrating a closure of 5 plants in North America and the loss of 14,000 workers, made it clear that GM’s decisions are about pleasing the shareholders and have little to do with workers, communities or American manufacturing. GM has already closed the Lordstown Ohio plant (eliminating 1,500 jobs) despite the fact that they received \$60 million in state and local incentives.

According to the W.E. Upjohn Institute, tax incentives for large corporations have tripled since 1990. Recent examples are \$1 billion from Nevada for the Tesla battery plant, \$4 billion from Wisconsin for the Foxconn plant, and \$46 million from North Carolina to get Honeywell to move its headquarters from New Jersey to Charlotte, North Carolina.

Multi-national corporations operate by the principles of free market capitalism and reserve the right to move production to any low-cost country in the world. At the same time they take advantage of state economic development departments by playing the “jobs for tax reduction game”. If we simply must accept closures and layoffs as the ongoing actions of multi-national companies, then you must ask yourself, why would a parent guide their kid towards a manufacturing career?

For the last 40 years the large public corporations have also been on a crusade to lower labor costs. They have used automation, union busting, two-tier pay systems, contract labor, part-time workers, and outsourcing to achieve this—and they have been very successful. Manufacturing has eliminated 6 million jobs since 2000.

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THE OPPORTUNITIES: THE CASE FOR IMPROVING THE SKILLS GAP

Demand. The fact that 3.5 million manufacturing jobs will need to be filled in the next decade shows incredible demand.

Technology environment. Manufacturing has continuously automated over the last 40 years, and is fast becoming a digital environment. What is needed now are very highly skilled technicians who can operate, repair, maintain, and troubleshoot all of this high tech equipment. Young people who already have digital skills may be the best recruits for manufacturing's evolving digital environment.

White-collar jobs. Many young people think that manufacturing is only about blue-collar jobs in the shop. But this is not true, as many types of manufacturing have as many white-collar as blue-collar jobs. There are design engineering, production control, purchasing, sales, marketing, supervisory, and general management jobs.

Journeyman jobs. A U.S. Bureau of Labor Statistics report shows that shortages of skilled workers are most serious in the machinist, fabricator, tool and die maker, electrician, and technician trades. These are the highly skilled jobs that take a lot of training but pay decent wages. How can we make manufacturing more attractive to students, parents, and counselors?

Security. To overcome the skilled worker shortage during a time of job growth, manufacturers will be forced to offer some type of job security or guarantees. This idea would fly in the face of the current "free market" philosophy, but it is the primary obstacle to recruiting the skilled people needed.

Career. To recruit the necessary people, manufacturing really needs to describe the opportunity as a career—not just another job. I think this will take a compact with new workers that offers job security, apprentice training, pay for skills attained, and long-term employment. It will require offering paid internships and apprenticeships with a guaranteed job at the end of the training. The recruits will be interested in a career that defines starting wages and the training and skills that lead to journeyman status and a manufacturing career.

Wages. America's corporations have been on a 40-year crusade to lower their labor costs, and it appears that they will continue this cost reduction effort. According to Ed Timmons, CEO of the National Association of Manufacturers, "our labor costs in the U.S. are still 20% too high."

According to the Bureau of Labor Statistics, in 2018 there were 9,115,530 non-supervisory production workers making a mean hourly wage of \$18.84 per hour or \$39,190 per year. Students are very aware of vocations that pay well, such as electrician (\$28 per hour), plumber (\$27 per hour), or nursing (\$35 per hour). It will probably take higher entry-level wages to attract the good students who have credentials in advanced math, engineering,

and science and the guarantee of a journeyman job at the end of the training. Since large manufacturers have been focused on lowering labor costs for the last 40 years, paying more to get the right people will test their resolve.

Apprentice Training. The high-skilled workers and craftsmen that are needed in manufacturing today will require some kind of apprentice training that leads to a journeyman status. President Trump's executive order has established Industry Recognized Apprentice Programs (IRAPS) for 3.8 million workers, with \$90 million in federal funding.

The Department of Labor [website for Registered Apprentices](#) shows that in 2009, there were 420,000 registered apprentices and 18,889 (6.6%) were in manufacturing. Today, there are 585,000 people registered in the federal apprentice program, and only 15,600 (3%) in manufacturing. The total number of apprentice registrants has grown by 28%, but the number of manufacturing registrants has declined.

I have been following apprentice training in manufacturing for many years, and despite the need for skilled workers, the advanced training is not improving. President Trump's National Council for the American Worker is a "who's who" list of multi-national corporations. It will be interesting to see whether these corporations are willing to pay their fair share of the apprentice training or simply depend on the government grants for funding.

I think that offering new recruits internships and advanced apprentice training that will lead to journeyman status is the best tool companies can use to attract new recruits that have STEM skills. A job that requires the skills of a journeyman, as in other industries, should pay between \$30 and \$40 per hour and should include industry certification of transferable skills.

Return on Investment. Corporations are going to have to change their ROI formulas to include the long-term training that justifies thousands of hours of training if they are committed to creating the highly skilled people they need in the digital manufacturing environment. This is not about a couple of classes at the community college or an eight-week CNC course. For instance, the training that leads to a journeyman maintenance technician who can operate, repair, maintain, and program an automated production line takes two to four years.

If multi-national corporations can see the benefit of investing in American plants and workers rather than continuing their investments in low-cost countries, then there is no reason we cannot reduce the skills gap and train the high skilled workers needed by 2028. If they can't or won't, then nothing will change, and in 2028 MAPI will issue another survey showing the skills gap has worsened. ●

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MODERN MACHINING & THE NEED FOR SPEED

Former boxer and machining revolutionary, Titan Gilroy, has an aggressive strategy to combat all the threats to American manufacturing, from outsourcing to the skills gap.

BY JOHN HITCH



Photo: Titans of CNC

The list of obstacles standing in the way of an American manufacturing comeback seems to grow every day. We have the skills gap, robots and AI that some day soon could make current manufacturing jobs obsolete, and of course, global competition. That last one is perhaps the most daunting, especially if you're a machinist. Consider that many of the parts you make, China does too, but at higher volume and for less money.

That's the situation. Now, if American manufacturers think this means we're doomed, then we are. But if we see this as a fight, and one we can win, then we might just have a puncher's chance.

But first we have to improve our odds.

If you're gearing up for a real fight, that's done by finding the best possible trainer, someone who will push you to your limits and make you work harder than you ever have. As luck would have it, the manufacturing gods have given us a Titan. Titan Gilroy, to be exact.

Gilroy is possibly the perfect (and certainly the toughest) person to lead this charge. Once a rising star in the boxing world who fell from grace and into prison, he's a man who seems to know everything there is about fighting and comebacks. And most importantly, he's a machining virtuoso, able to work a CNC machine like Hendrix did a Stratocaster.

HEAVYWEIGHT COMPETITION

Along with massive biceps and several tattoos, Gilroy carries with him incredible insights into what it takes to win. That's probably because he's had so much experience with defeat. Abandoned, homeless, bullied, imprisoned. And that was before he turned 25. He has also felt the stinging pain of laying off 40 employees and nearly losing everything. The bulky machine shop owner with a tight crew cut overcame some pretty crappy odds in his life. Now the CEO of Titans of CNC thinks America can too.

"We're losing our jobs to China, losing the ability to put our kids through college, settling for mediocre houses," says Gilroy, a father of five. "China is serious about manufacturing, because they learned from us. We built the best country in the world off our ability to make parts and keep our money here."

The trade deficit, as of 2016, was \$347 billion with China, and reportedly grew in 2017 by 7%. With Mexico, it was up by 11% in 2017, [according to CNN](#).

The one thing that separates successful and failing manufacturing companies, Gilroy says, is the same thing that will help the country: "the ability to compete on a high level."

From the schoolyard to the ring to the shop floor, all Gilroy has ever done is fight—and win. Now he just does it with his head, not his fists, bringing the industry an unrelenting expectation of a perfectly machined part, time after time.

"I want to be the best, not second best. The best," says Gilroy, who won 35 of 38 amateur boxing matches. "You run two parts at a time? I'm going to run 40 parts at a time."

At times, talking with the theatrically uber-confident Gilroy feels more like interviewing an old-school pugilist than a manufacturing pro. He was, after all, trained by boxing legend Dick Saddler, who also worked with Muhammad Ali and George Foreman, so maybe that was the most valuable lesson he retained.

"Because of that competitive nature, I make people money, and I make myself money, and am able to take care of my family," he says.

Now his mission is to give that same ability to the rest of the machining community.

SPEED ROUND

Gilroy's secret is indomitable aggression. This is what landed Gilroy in juvy in the early 1980s, on the boxing circuit's radar by the end of the decade, locked up in the early '90s, and has made him one of the most influential, dynamic figures in the industry today.

Gilroy owns and operates a successful and highly advanced machine shop north of Sacramento that has cut parts for SpaceX's and Blue Origins' engine systems. It's lined with the latest [Haas Automation](#) machines, all running at speeds several times higher than most machine shops would ever dare try. They run fast, rapidly amassing piles of shredded aluminum and steel, and slivers of more exotic aerospace materials such as Titanium and Inconel.

It's in this setting—as it was in his manufacturing-based reality show, [Titan: American Built](#)—that Gilroy is trying to change the world. His latest vehicle for that: a free training program dubbed the [Titans of CNC: Academy](#).

The idea behind this fight is simple: No matter the platform or machine, it all comes down to achieving the maximum speed and feeds.

"Manufacturing is all about creativity," Gilroy says. "Whatever the fastest way to get it done is, that's what you need to do."

That means the machine's axes, its programming, "back off" techniques, and coolant choices all come into consideration.

Getting that right allows Titans of CNC to mill Titanium at 250 inches per minute (IPM), while others run at 10 IPM. The metal is notoriously difficult to cut quickly, as the low thermal conductivity creates risk for combustion. The lightweight, heat resistant element is crucial to aerospace, the one industry American manufacturing has traditionally dominated. But it's also one where constant innovation at every level is needed to stay on top.

"When it comes to Space X, Blue Origin, and Virgin Galactic, they are struggling right now, because shops are not equipped and not prepared to actually make the components



Photo: Titans of CNC

Using a combination of Haas Automation's UMC 750SS 5-Axis Vertical Machining Center and Kennametal's HARVI III End Mill with HydroForce, Titan Gilroy can machine parts with industry leading speed and quality.

that are being demanded at the specifications and the timelines," explains Gilroy, who has made SpaceX parts for about a decade.

He says he sent Elon Musk letters for six months to get the chance. Landing the commercial space company helped Titans of CNC (then called Titan Engineering) stay viable after the Great Recession nearly wiped him out.

He does it all with American-made Haas machines, from five different models of CNC lathes to ten types of CNC mills. The job shop currently uses three [UMC-750SS 5-Axis Vertical Machining Centers](#).

"We haven't truly accepted how awesome these machines are," says Gilroy, who is sponsored by Haas. "Machining is an art. If you understand the machine and it has good repeatability, you can actually make almost anything on a good CNC machine. Haas makes a good CNC machine."

The UMC-750 stands out to him as a platform on which he can put all his artistry, creativity, and programming skills to good use.

"This thing is all about making all sides of the parts all at the same time," Gilroy says. "Whatever you can fit in that envelope."

In a five-axis machine, instead of stopping a job to reset the work holding for each side, you can attack all but the side held down to keep the part in place. On the UMC-750, the spindle moves along X, Y, Z axes, and the table holding the part tilts along the B-axis, while the C-axis rotates it. Programming time is also reduced because "you only have one zero to worry about."

He has said that if he's using one of the Haas Super Speed mills that have an upper limit of 833 IPM, he is going to go at 833 IPM. And that's why he believes he has a competitive edge.

He says other machinists, who used to run at 30 or 60 IPM and have increased to 150 IPM, shouldn't settle for these incremental gains when cutting cycle time generates more money.

THE FIGHT PURSE

To Gilroy and his customers, every minute saved is a dollar earned, and 833 IPM versus 150 IPM equals a huge swing in revenue. Fighters wield intimidation and swagger to land hits before throwing a punch, so it is possible the Titan brand has perfected marketing more than it has machining. After all, he does have an oft-used catch phrase: Boom.

So we contacted Haas Automation and spoke to John Nelson, Haas' senior product specialist who has been with the company for 17 years.

The way he describes the Oxnard-based company—the largest machine tool builder in North America—it has a lot in common with every other American manufacturer: "We're

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trying to provide a fantastic, quality machine that can compete on price with cheaper imports,” Nelson says.

As such, Haas has tried to evolve its functionality to meet modern demands. The industry, which now more than ever needs to get faster, has some reluctance to evolve with the equipment.

“The interesting thing is that the machining has changed a lot over the last 20 years, and sometimes the machinists and operators don’t change with the times,” Nelson says. “Tooling geometries, CAM programming systems, tool path strategies, higher speed spindles: All of these things are designed to work together to remove material more quickly. But we run into machinists who want to do it the same way they did 30 years ago.”

The industry size itself hasn’t changed much since 1988, when Haas prototyped its first VMC, the VF-1, which is still sold today. The BLS listed 397,000 machinists at the time, and 391,000 in 2016. Not bad considering manufacturing had more than 19 million jobs at the time, and has dropped 35% to 12.5. That’s more than 1% a year; machining has dropped 1.5% total.

Complacency often shadows security, so it’s not shocking that machinists not facing imminent extinction would scoff at the “X-Games sponsored by Mountain Dew” equivalent of machining, as it has been called. What good is speed if you sacrifice safety or wreck the part?

Haas has embraced Gilroy and his machining philosophy, not only by providing financial support for his reality show, but also by promoting similar machining methods.

“We’re traveling in a parallel direction to what Titan is preaching and trying to get people to understand,” Nelson says.

Haas, which operates the massive Haas Technical Education Center Network, is planning to release 200 training videos this year to further that goal.

Nelson himself has made a five-part video series called [“Don’t Fear Five Axis,”](#) something Gilroy also preaches. Autodesk, also a big sponsor of Titans of CNC to promote its Fusion 360 CAD/CAM software has its own [“Don’t Fear 5 Axis”](#) video (on a Haas UMC 750) as well.

As knowledgeable as the experts in these videos are, Gilroy’s dark past and how he overcame it (which we cover in-depth at [NewEquipment.com](#)) speaks directly to the disenfranchised who can also rise through the industry’s ranks.

LESSON LEARNED

As a transplant to the island of Maui, a middle-school aged Gilroy learned to box to defend himself. He says machine shops are in a similar situation, “fighting for scraps from outsourcing.”



The Titan Building Blocks increase in complexity and give students the skills and confidence to succeed in a machine shop.

The scraps the once-homeless youth used were to build go-karts or make art projects. His social path, though, put him “on the wrong road,” ultimately leading to a bar fight he says he was trying to break up, two severely injured brawlers he hit too hard, and a 16-year prison sentence.

After getting paroled after three years to pursue a boxing career in Las Vegas, a neighbor in his apartment complex threatened his wife. That literally forced Gilroy’s hand yet again, which he bashed into the attacker’s cranium. This time the police ruled the fight self-defense, but deciding violence wasn’t his chosen path, Gilroy packed up his family and moved to California. He found work at a machine shop, where he got to see the raw speed and power of its tools.

“Watching the cutter plow through metal, I was fascinated,” Gilroy recalls. The shop owner taught him how to work the CNC machine, and the grateful Gilroy absorbed every lesson. He made head programmer in six months.

“I didn’t have people judging me,” Gilroy says. “I was judged based on the parts that I would complete — their quality and efficiency.”

He says his acumen for math and art gave him the confidence to not just repeat processes, but improve them. “I instantly started pushing things past peak, max level,” he says. “I played with levels, pushed them faster and faster and the bit wouldn’t break.”

He was cutting cycle times, making his boss money and in a few years became head foreman of the shop.

Ten years later, in 2005, he opened his own shop and within three years the business was earning \$1 million a month and he had 55 employees. They were running 20 Haas machines and pushing them to their limits, making parts three to five times faster than customers’ previous shops.

This time Gilroy was the one to take a hard hit. The economy crashed. In 2009, the business lost 80% of its work and Gilroy laid off 72% of his staff. The reality of outsourcing, and

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how it nearly took everything he worked so hard for, everything he had to overcome, also gave him a new purpose.

"I'm 100% dedicated to making a difference and see this trade lift up and see people compete and see all that work come back," Gilroy says.

That's the reason for the show and the online training: to mold new machinists in his style.

TITAN EX MACHINA

As it turns out, Gilroy isn't alone in his loathing of slow machining rates.

Jon Schaefer, a machinist in Phoenix, knew modern CNC machines were being underutilized.

"It's frustrating when you have to sit and wait for it to go through everything, and you know in your gut it could go faster," he says.

He found Titans of CNC's training library and decided to test the method out for himself.

"After seeing it, I said 'I knew it!'" Schaefer recalls. "I jumped on board right away."

Schaefer pushed cycle times and went from doing eight parts a day to 48.

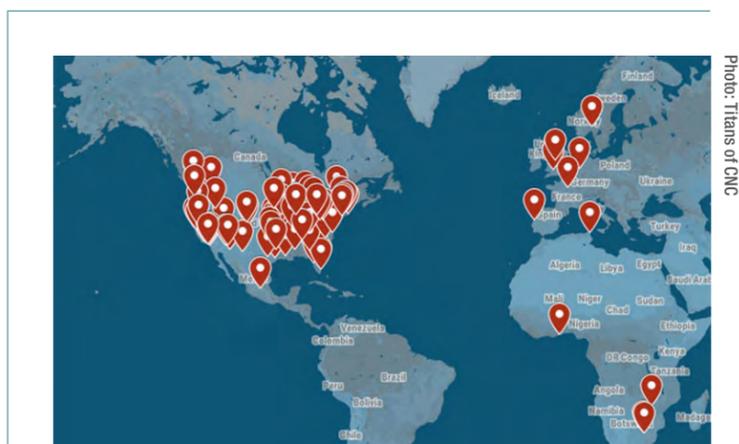
The programmer also scared his operator, a friend of 20 years, by entering starting values five times faster than usual and cutting at a shocking pace. But the values were verified to work, and his friend is now also a believer.

Schaefer wanted to evangelize to even more people, and contacted Gilroy about how to connect the online Titans of CNC Academy with actual shops, to give users practical experience.

Because he also has his own small machine shop, Schaefer offered to become the first Academy "small group." At least once a week, Schaefer allows machinists of all levels of experience to come by his shop and work on the different 10 Titan building blocks—training modules that increase in complexity. They pay for materials and need their own laptop to run Fusion 360, and Schaefer lets them use the machine and workholdings.

The Academy itself has 28,000 students and 1,600 teachers around the globe, with dozens of small groups from coast to coast, as well as others dotting Europe and Africa, in under a year.

"There is a huge skills gap within our industry, and there's not one entity who has developed content to attract and retain machinists," says Kymberly McCarty, national



Map of Titans of CNC: Academy Small Groups

Photo: Titans of CNC

key account manager for [Kennametal](#), Titan's major sponsor for the academy. "Titan is the one who raised his hand and developed the academy in order to educate all generations and increase skill levels."

While Gilroy says the strength of Kennametal's [HARVI III End Mill](#) is crucial to cutting aerospace parts, Kennametal says it's his strength of character that allows the program to flourish.

"He's able to grab and keep people's attention, because of his reputation and level of passion," McCarty says. "He's a big man with a big personality, but he has an even bigger heart and wants to see everyone succeed."

Again speed is the secret weapon. Gilroy, who rarely really hit the books, knows the power of practical learning. He advocates getting students to first use CNC machines days into learning, not months.

"These kids get it and understand computers and when [a machine] can crash," says Gilroy, who has had a 7-year-old run one of his lessons. "It's child's play to them; they're just killing it."

In Worcester, Mass., vocational teacher Brian Cummings is running many of the training modules a third of the time in his school. He estimates to have about \$1 million in machining equipment.

"When I first started teaching, it was 75% manual, you work way into CNC machining, and you couldn't touch the machines until senior year," Cummings says.

This way, the students get three more years of experience, creating more qualified, more hireable graduates.

And he hopes more schools catch on.

"I think he's found a way to be competitive and profitable in the US," Cummings says. "The products in China, luckily for us, have been a flop as far as quality and cost of mistakes and unskilled labor."

For Gilroy, it's all about providing new challenges. Instead of new opponents to knock out, it's new machines and materials to learn and new jobs to tackle. That's what will make American manufacturing strong, and its workers engaged and productive.

"If you try to keep people down and keep them as button pushers, you're going to lose them," Gilroy says.

For the industry, the risk of not emphasizing on faster production of parts and faster training of skilled labor could also put it down the wrong path.

"If schools don't step up quickly and adapt to a system similar to mine, they're going to be left in the past and all the companies around that school are going to have problems with a skills gap and have issues with competing." ●

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CREATING A NATIONAL WORKFORCE OF TRAINED WELDERS

Lincoln Electric has partnered with Tooling U-SME to expand its welding education program in order to close the national skills gap in welding.

BY ADRIENNE M. SELKO



Photo: Lincoln Electric Holdings, Inc.

Years ago, when lean became popular the theory was that if all of those in the manufacturing industry were trained to this high level of continuous improvement, through the Toyota Production System, the entire sector would feel the benefit.

Most in manufacturing today would agree that this training has come to bear fruit.

This same strategy can be applied to training for specific skills as well.

For years Lincoln Electric Holdings, Inc. has been recognized as the gold standard for training those in the welding sector. They have trained 250,000 welders in the past 100 years. And their quest of excellence moved forward in 2018 when they opened a \$30 million, 130,000 square foot new [Welding Technology and Training Center](#) (Center) in Cleveland, Ohio.

While the company trains for internal use, this new facility is to further its mission to train an entire industry. At last year's opening CEO Christopher Mapes described the company's mission. "Our new Center is a strategic investment to help our customers and educational partners grow using leading solutions. Our educational offering and leadership in automation solutions provide meaningful solutions to address the skills gap and capacity constraints facing customers in our industry."

The capacity strain he is referring to is the fact that the average age of a welding operator is 57. And many of them are about to retire. This will leave a huge gap. In fact, the American Welding Society predicts that there will be a shortage of 400,000 operators by 2020.

Training as many people as quickly as possible is critical.

"The industry now requires more highly-skilled workers than it did in the past as welding has become much more technical and sophisticated," explained Jason Scales, business manager, education, Lincoln Electric.

To ensure that welders have the skills they need to perform their jobs, the new Center is focusing on training welding educators, engineers and industrial professionals who are advancing welding in schools and industry globally. The curriculum includes virtual reality and technology-assisted training tools, industry-leading welding and cutting solutions and robotic cells.

This will build upon the company's U/LINC program that was developed by 35 of the industry's top welding instructors. It contains more than 18,000 pages of curriculum resources connecting welding theory, practice and knowledge in one place. Subscribers to U/LINC can easily search, download and print out lesson plans, class assignments, presentations, group-based activities and more with in-depth directions, tips and teaching strategies that leverage the company's welding training experience.

To ensure that this program has the furthest possible reach, Lincoln Electric announced in May 2019 that is partnering with [Tooling U-SME](#), to administer its U/LINC platform.

Tooling U-SME is well established in the training field as it works with more than half of the Fortune 500 manufacturers, 600 educational institutions and thousands of companies.

As part of the agreement, new and current U/LINC subscribers will receive additional support services and reporting capabilities and curriculum materials will also be integrated with the industry's most popular learning management systems, such as Blackboard, Moodle and others.

"This new partnership builds on more than a decade of collaborating that began with online welding training classes and has now expanded to include a comprehensive set of tools, including lab activities, demo videos, assessments, instructor guides, PowerPoint

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presentations, and reference documents,” said Chad Schron, the senior director for ToolingU-SME and Co-founder of Tooling U. Chad grew up in manufacturing. He started his career working in his grandfather’s machine shop, Jergens, Inc., and attended his first IMTS show before he graduated from high school. It was while working at Jergens Schron came up with the idea for an online training school to address the issue of the skills shortage.

“The skills shortage is a major issue and is impacting the quality of the work being done in manufacturing,” says Schron. “We are out there in the field every day and are hearing about companies not having talent that is trained in new technology and we see how this is adversely affecting the work. Even safety can become an issue.”

While Lincoln Electric and Tooling U feel that the new Center can go a long way toward providing the training, they are still working bringing in the number of workers that they will need in the future.

Shales is finding that many people have expanded their view of the field and are entering it for a variety of reasons. “While the perception is often that manufacturing isn’t a cool place, I’m seeing students who are in their late 20s and have received a college degree but couldn’t find a job that provided them a livable wage. Or those that found out that didn’t really like sitting behind a desk. So, they come to manufacturing and welding, get the skills necessary, find a job quickly and enjoy the field.”

Schroon said that new entrants into the field are reporting a high level of satisfaction. One reason might be is due to the many opportunities the field provides.

“Looking at the millennial population that likes variety and room for advancement, at our company we have a lot of different operations and encourage employees to move around the company and increase their skills,” said Scales.

Understanding how to work well with Millennials is a top priority for Tooling U-SME and they recently issued a [report](#) about the subject.

They offered seven tips for working with this age group:

DON'T GENERALIZE

Like all generations from Boomers to the newest Generation K (as in the Hunger Game’s Katniss Everdeen), this broad swathe of workers is made of up individuals with different life experiences.

COMMUNICATE YOUR CORPORATE MISSION

Millennials expect companies to demonstrate a strong sense of purpose and want to be part of that. Be sure to communicate your mission and show how each individual job ties to it. Allow them to see how their talents and skills fit into the big picture.

SHOW THEM THEIR FUTURE

Millennials want to see their (near) future. Provide room for growth within your company so they do not feel they need to grow somewhere else. Institute clear steps that young employees can take to develop skills they might need for future positions within your organization

PROVIDE CONTINUAL LEARNING OPPORTUNITIES

Millennials have a strong desire to learn and acknowledge they have things to learn. Pair millennial employees with your own organization mentors or those outside of the company.

GO DIGITAL

Much hiring and training can now be done digitally through tablets and smartphones. Online courses allow workers the flexibility to complete training at any time of the day or night.

ALLOW THEM TO SHARE THEIR IDEAS

Only 28% of millennials feel that their current organization is making full use of their skills to provide them the opportunity to show what they can do. Arrange for dynamic brainstorming sessions allowing all employees to contribute ideas.

PROVIDE REGULAR AND IMMEDIATE FEEDBACK

Millennials grew up with constant feedback from their parents, teachers and coaches. They expect it from you, their leader. Just five minutes of clear, direct feedback on a regular basis, will keep them motivated and engaged.

Beyond millennials, Lincoln is looking to the future workforce. “By 2025 there will be a 25% reduction in students attending college, university and trade schools,” says Scales. His company is seeking out additional solutions to stay viable.

Staying relevant has always been the mission of Lincoln Electric and education has always been the key to doing that. Through the Center, and other methods that are yet to be created, the company and its partners, such as Tooling U-SME, are creating that future class of well-trained welders that will ensure a continued bright future for manufacturing. ●

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—Carey Smith, Chief Executive Officer | Big Ass Solutions



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