HOW WORKFORCE UPSKILLING WILL IGNITE A NEW ERA FOR MANUFACTURING

Redshift by AUTODESK

Cover: As manufacturers around the globe adopt advanced robotics, employees will need upskilling to operate, maintain, and update the machines. Courtesy of the Autodesk Technology Center in San Francisco.

HOW WORKFORCE UPSKILLING WILL IGNITE A NEW ERA FOR MANUFACTURING

Introduction

The talent shortage in the manufacturing industry has CEOs around the world concerned and rightly so: Digital transformation is changing the nature of work at an accelerated pace. Workers need to adapt more quickly than in the past and continue to do so throughout their careers. Traditional workforce upskilling methods are evolving as well, driven by new educational delivery systems, intelligent technologies, and the impact of the COVID-19 pandemic.

The advent of online technologies such as assistive learning allows course designers to incorporate education directly into user experiences. Educational institutions, including a revitalized community-college system, are also stepping up, offering both on-site and online continuing education to help fill skills gaps.

Emerging technologies can also help designers and engineers make better decisions, create more efficient workflows, and learn new skills. For example, using generative design in concert with additive manufacturing can yield truly optimal outcomes without the constraints of traditional manufacturing. Artificial intelligence (AI) and machine learning can help building owners understand when equipment might need maintenance due to intelligent system integrations. So while people need different skills to work with advanced technologies, it's also becoming clear that the potential for humans and technology to complement each other is increasing. New roles and opportunities are emerging with exciting new prospects.

In these pages, learn how various companies and educators are navigating a rapidly changing manufacturing industry. Hear from a professor and leading digital-manufacturing authority about strategies for upskilling and reskilling the workforce. Discover how futurists and experts are helping manufacturing professionals rethink, recruit, and prepare for digitization. And see how leading Asian manufacturing companies are making the transition from a lower-skilled to a higher-skilled labor workforce.

Although this is a time that many view with trepidation, it's also a unique opportunity to reinvent careers and companies. The manufacturing industry has historically been a leader in optimization; the next challenge is to think past optimization to transformation.

SCOTT BORDUIN
Chief Technology Officer
Autodesk

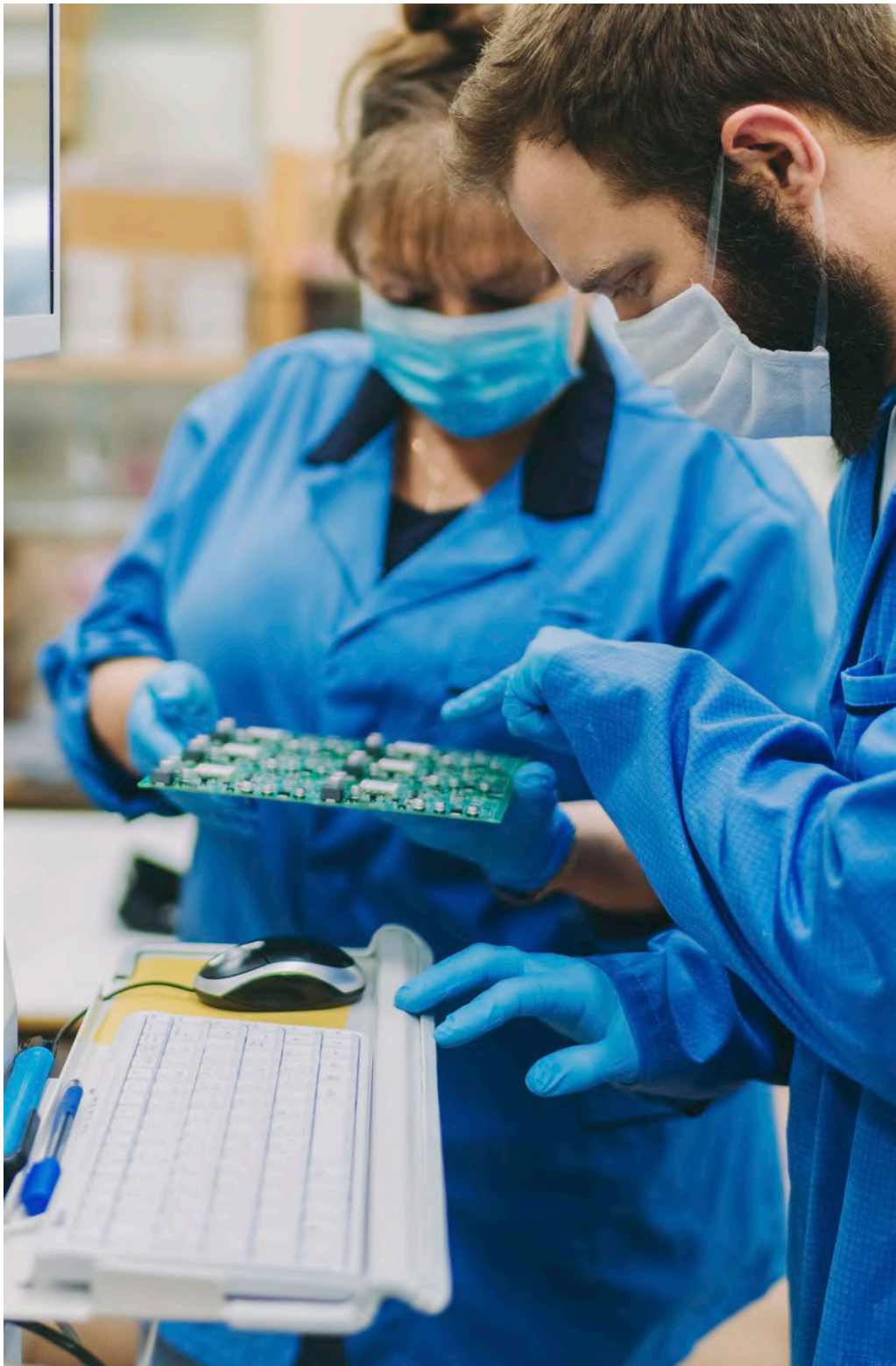
Closing the skills gap is crucial to growth and competitiveness post–COVID-19. Here, an MIT professor speaks about upskilling workers by combining digital and hands-on learning.

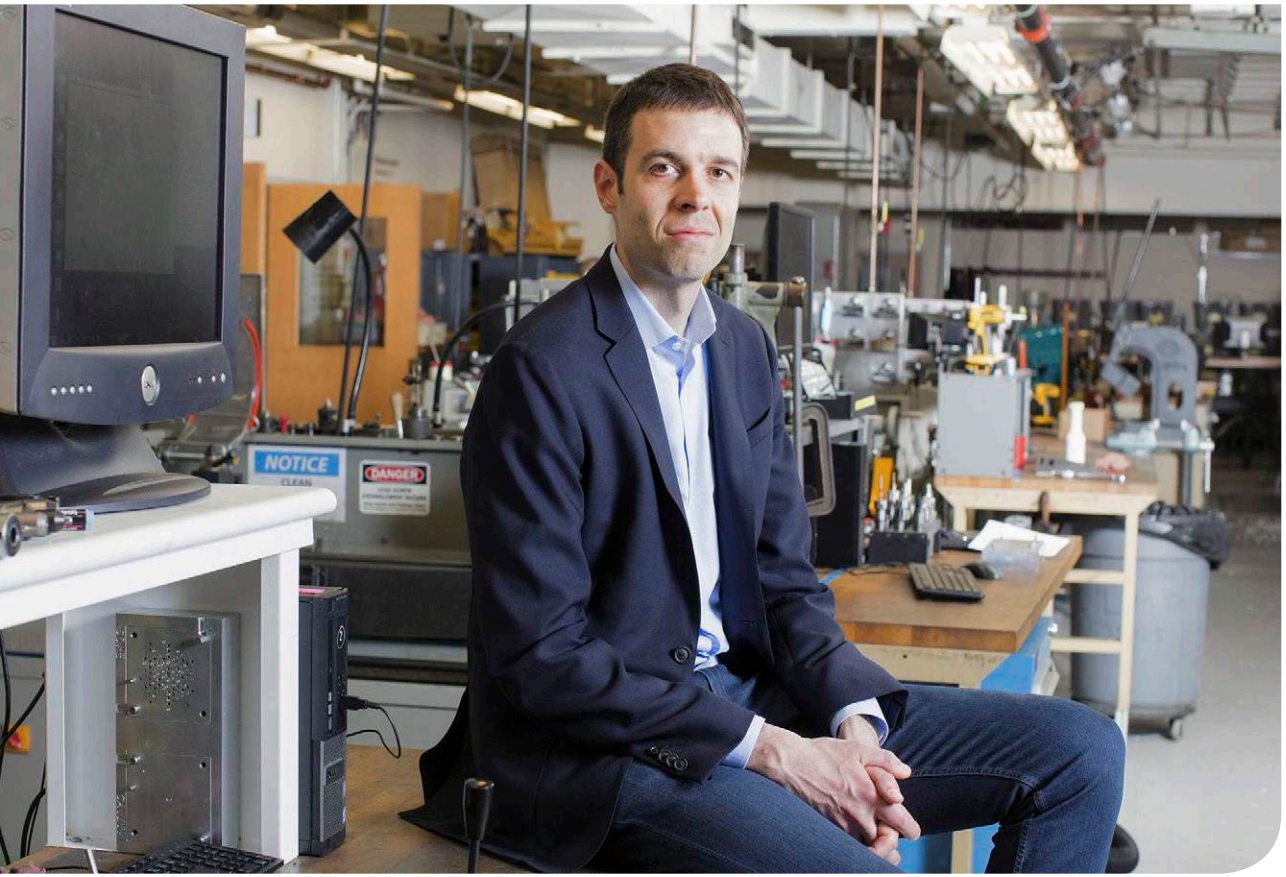
HOW CAN LEADERS CONFRONT THE SKILLS GAP IN MANUFACTURING AFTER COVID-19?

BY PETER DORFMAN

In a 2018 Deloitte/Manufacturing Institute report, 89% of manufacturing CEOs cited a critical shortage of talent as their top concern. The study estimated that 4.6 million manufacturing jobs would need to be filled in the next decade—and 2.4 million jobs might go unfilled due to a lack of trained workers.

US manufacturing has taken a beating during the COVID-19 pandemic. According to the Bureau of Labor Statistics, 486,000 job openings were available in manufacturing in June 2019. That number dropped to 306,000 by May 2020 but had recovered to 336,000 (a 10% rebound) by June 2020. So, while overall demand is down, assuming that the pandemic's impact on the US economy is not permanent, the skills gap in manufacturing will persist.





Dr. A. John Hart, associate professor of mechanical engineering and director of the Laboratory for Manufacturing and Productivity at MIT, says that more diverse educational approaches and accessible offerings can help empower workers to be more competitive. Courtesy of M. Scott Brauer and MIT.

Ever since the Great Recession of 2007–2009 subsided, manufacturing executives have tried—and not quite succeeded—to staff up to handle resurgent demand. The gap is widely blamed on the shortage of STEM skills as manufacturing became increasingly technology-driven. Some of the most needed skills are in AI, machine learning, software development, and cloud development. But the gap is not entirely digital. Conventional manufacturing skills (machining, assembly, quality management, process engineering, and the like) are in short supply, as well. Some of the problem is demographic.

More manufacturing workers are retiring than are coming on board to replace them. Still, not everyone is convinced that the skills gap in manufacturing is real. Some argue that there are plenty of skilled workers, but the gap arises from manufacturers' unwillingness to pay them attractive salaries. Others have suggested that manufacturers are deepening the problem by constantly ratcheting up the training and experience requirements for new hires.

For Dr. A. John Hart, a Massachusetts Institute of Technology (MIT) professor, the crux of the matter isn't outsized expectations for new manufacturing employees; it's the rate of change needed for skills throughout the course of a career. "We need to evolve a market in which the desire and ability to learn the new technologies is valued among employers—where workers recognize when the demand for their current skills is waning, and they have the opportunity to acquire new skills and confidently market themselves," he says.

A Divergence of Skills

Hart says there is a need for more diverse institutional approaches and accessible offerings so that workers can understand the future of their careers—and can empower themselves to be competitive in a changing job market and in a technology-driven industry.

In addition to his work as a professor of mechanical engineering, Hart is director of the Laboratory for Manufacturing and Productivity and the Center for Additive and Digital Advanced Production Technologies at MIT. He also created an online course to get professionals up to speed with industrial 3D printing.

Hart is all too familiar with the traditional ways of training manufacturing talent. "There is a divergence between the skills of

today's manufacturing workers and the skills required to operate, implement, and execute many of the cutting-edge manufacturing technologies—robotics, automation, 3D printing—and to harness the insights enabled by data science applied to manufacturing," he says. "There is an increasing need for a practical curriculum that can fill the gap between vocational training, a two-year degree, and a four-year technical degree."

New modes of training, credentialing, and learning that surpass the traditional degree are also needed, Hart says. Emphasis should be on continued learning, upskilling, and reskilling. This often requires support from the government in establishing training programs. These kinds of upskilling/reskilling programs also require support from manufacturers, "valuing the skills of its workers beyond their day-to-day jobs," Hart says.

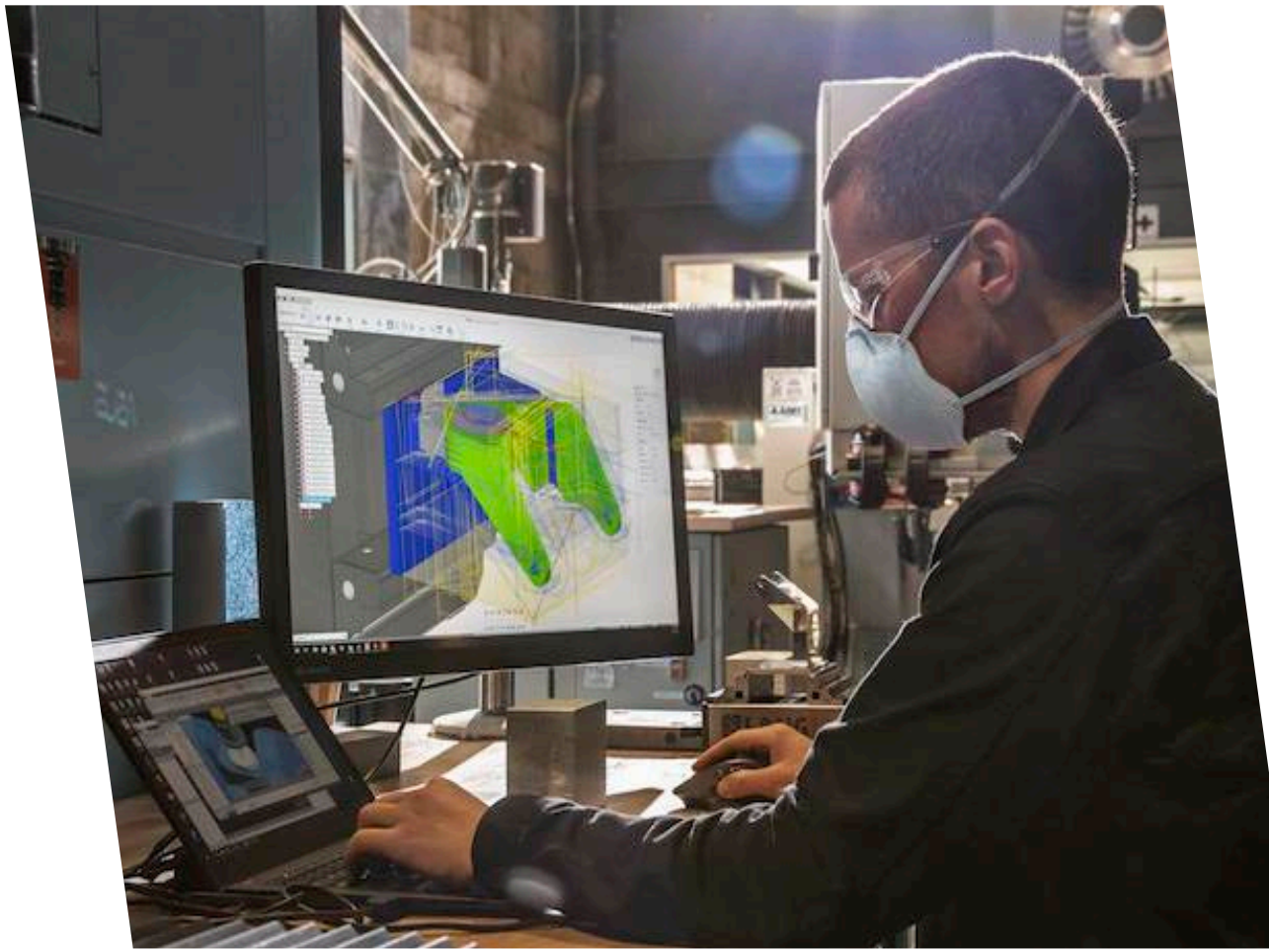
Certainly, many of the necessary new skills for manufacturing are digital skills. But Hart says the fact that engineers are consumers of machine-learning services doesn't mean they also have to be data scientists. "They do have to understand what questions you can ask and what answers are credible and important," he says.

Data science is a core competency in many companies, where, in some cases, they hire data scientists from other industries and team them with subject-matter experts to create tools for factory-floor analytics, rapid materials characterization, and similar tasks. But Hart says what's important is the ability to collaborate with experts from other disciplines—not necessarily to master every relevant skill.

"We, as a world, are discovering so much about what's effective and what's ineffective in digital learning from all our students needing to be remote during the pandemic."

—Dr. A. John Hart,
MIT professor and leading digital-manufacturing authority

With the necessity of social distancing due to COVID-19, educators are learning the extent to which remote learning can substitute for hands-on experience with modern manufacturing tools.



Continuing Education

Hart's 12-week advanced manufacturing course, Additive Manufacturing for Innovative Design and Production, is geared toward professionals. "It teaches the fundamentals and applications of 3D printing, tailored for engineers, managers, executives, and shop-floor people," he says.

"There are a lot of practicing professionals—from engineers right out of college to senior executives—who want to know about 3D printing and how to use it in their organizations. About 5,000 people have taken the course. Some of them recently took on new roles, and they want to push 3D printing in their organizations."

Hart also teaches Fundamentals of Manufacturing Processes, a massively open online course (MOOC). The class is a broader introduction to manufacturing processes, an online rendition of the undergraduate manufacturing processes class he teaches at MIT. Over the past several years, thousands of people around the world have taken this more basic, entry-level course, with more than 400 so far earning an MITx certificate.

While online courses can teach the fundamentals of various technologies, educators must also find ways to provide remote students with hands-on experience.

Yet, "a lot of these topics are intrinsically hands-on: programming a robot, conducting a mechanical test, and so on," he says. "You can take a great online course and ask questions, but without the hands-on experience, your skills are likely to fall short. We, as a world, are discovering so much about what's effective and what's ineffective in digital learning from all our students needing to be remote during the pandemic. It's not just about how you connect on video and chat. You have to be prepared to ship stuff to the students and engage them with cutting-edge software tools so they can have a powerful learning experience without needing to be on campus, in the shop."

To enrich the online learning experience, one technique Hart has used is to ask the students to identify how manufacturing touches their surroundings. "We ask the students to look around their house: Find an object made by injection molding; find a part made by casting, a sheet-metal part," Hart says. "If they can take it apart, take pictures of the assembly, calculate the forces needed, the result can be a more world-aware learning experience."

These are continuing-education courses. Completion doesn't result in a degree from MIT, but it does come with a branded certificate. "The MIT name on the certificate helps," Hart says. "I'm proud of it and want to live up to the reputation."

Hart sees a role for many kinds of institutions in solving the upskilling problem. “I hope in the future there is more collaboration between educational institutions of different sizes and in different places,” he says. “The community-college system has a great part to play in addressing manufacturing skills gaps and growing the workforce of the future.”

The Global View

The skills gap in manufacturing is not unique to the United States, and Hart takes a global view. “Someone in Germany or China or Brazil might express the problem differently,” he says. “In China, for instance, I’ve been told that there is a shortage of talent for programming high-end computerized milling machines that make really complex parts in the aircraft industry, for example—making parts that are lightweight and have complex geometries.”

It’s essential to see the global picture, Hart says, as additive manufacturing pushes industries toward digital manufacturing. He adds that manufacturing is cost-effective to outsource overseas. “But these are not just low-wage markets,” he says. “Many countries have built the ecosystem, the supply chains, the talent, and the flexibility of the talent, as well as the machine shops to be able to scale up quickly and establish firsthand expertise.”

MIT has summer bootcamps on topics such as 3D printing—typically one-week courses held in person on campus. The university was unable to hold them in 2020, but Hart hopes to resume the schedule next summer. They’re short but intensive and have advantages—especially for networking.

“As MIT’s motto says, ‘the mind and hand’—we merge the practical, hands-on experience with the theory and analysis,” Hart says. “The best engineers and innovators in manufacturing know how to grasp the key technical principles to solve important problems and create technologies and businesses that will sustainably advance our world.”

From disruption-ready supply chains to personalized products and intelligent automation, here are the manufacturing trends that will define 2021 and beyond.

The need for workers with advanced manufacturing skills, such as CNC programming, is increasing.

How can manufacturing build a collaborative human-machine workforce? By bridging the human-machine gap.

6 WAYS TO START UPSKILLING FOR THE FUTURE OF MANUFACTURING

BY MARK DE WOLF

Are robots coming for your job? In manufacturing, the answer isn't a simple yes or no. After all, different studies tell different stories.

A 2013 analysis by Oxford University said automation could replace half the world's jobs. A later forecast from the Organisation for Economic Cooperation and Development (OECD) concluded that tech's impact would be notable but less severe. What's indisputable is that digital transformation is changing the nature of work.

In manufacturing, for instance, software isn't so much devouring employment as it is transforming it. While routine administrative and assembly-line tasks are being handed over to machines, trends such as automation, convergence, and sustainability are creating brand-new jobs that didn't exist before. New roles need new skills, and upskilling for the future sometimes includes a mix of aptitudes that haven't been combined in the past.

Instead of being replaced by robots, people in these jobs have to be—or become—tech savvy enough to work beside them. That poses big questions: How can the sector build a collaborative human-machine workforce? What skills will be must-haves on the digital factory floor? What education and training will make employees comfortable using advanced technologies?

The key is to bridge the human-machine gap. As digital transformation redefines manufacturing jobs, leaders must normalize the idea of upskilling workers for environments that blend advanced technology with uniquely human aptitudes.

Here are six suggestions from futurists and experts to help manufacturing professionals start rethinking, recruiting, and upskilling for the challenges of digitization.

1. Keep Skill Sets Human

Digital's rise in the workplace has had an unexpected consequence: more demand for skills only Homo sapiens can provide. By replacing the repetitive and manual tasks that mark many traditional jobs, digital is actually making space for soft skills that are uniquely human.

In fact, a survey by the World Economic Forum found that the top job requirements for the next 10 years rest heavily on essential human attributes such as creativity, critical thinking, and emotional intelligence.

To prepare for the future, manufacturers need to begin recruiting for and upskilling in talent that can exhibit these attributes in tandem with the technical skills required to work alongside growing automation.

2. Be Open to Online Communication

Even as automation, AI, and robotics expand all around them, more manufacturing professionals are using digital solutions to handle their current responsibilities more efficiently. Collaboration platforms such as work-based social media and instant messaging are already making jobs more digital. These platforms should encourage upskilling for the future: They're already providing the additional communication and interaction needed to sustain productivity.

"Embracing this shift to working online opens up an opportunity for us to find new skills and expertise from anywhere in the world," says Christopher Greenough, chief commercial officer of Shrewsbury, England–based SDE Technology. "We're in the Midlands, but why can't we employ engineers from Scotland or Wales or the South Coast—or why not in the US time zone or the Japanese time zone? You could arguably create 24/7, around-the-clock working practices. I think that in itself could be pretty transformational."

3. Remember to Be Patient: Upgrades Require Trust

A study conducted by the US Manufacturing Institute found that manufacturing businesses planned to spend $26 billion in 2020 on upskilling alone. But convincing staff to leave behind tried-and-tested processes in order to embrace new tools requires more than just budget.

"When you embrace change, you have to know that not everyone is going to like this," says William Bridgeman, chairman of Norfolk, England–based Warren Services. "Anyone can spend money on machines, but people are the core asset. Getting them on board can be the hardest nut to crack. You've got to show them the benefits. Automation and digitization help speed up processes, and that creates more capacity. More capacity gives you more resources to grow, and that's in everyone's interest.

"We try to regularly communicate this by emphasizing that we want to free ourselves from the mundane, whether that's loading parts into a machine or loading data onto a system," Bridgeman continues. "We also make it clear to people that while their role may become redundant, their job isn't. In other words, maybe the robot will steal your current job, but it will also give you a better one."

As digital transformation redefines manufacturing jobs, leaders must normalize the idea of upskilling workers for environments that blend advanced technology with uniquely human aptitudes.

4. Don't Confuse Transformation With Revolution

To bring current staff on board with upskilling plans, it's vital to not only show people the direction they'll be going but also involve them directly in the process of getting there.

"What you don't want to do is attempt to throw everything away and put something new in place very quickly," Greenough says. "You need to take small steps and make sure you're investing in your people all the way through that process.

"Starting with a clear and achievable objective that underpins the change you want can be very effective," Greenough continues. "We have an objective to completely do away with paper on the shop floor and make everything digital through one integrated system. We're approaching it by mapping current processes first, seeing exactly where the paper is and what could be easily replaced with digital. That involves people in a hands-on way and lets them see the benefits of changing tack while also allowing them to manage the timelines involved in getting there."

5. Let New Employees Be Digital Catalysts

Understanding how technology might change manufacturing processes on the current shop floor can help everyone prepare for a future where work is more sophisticated, growth-oriented, and personally rewarding. New joiners can become digital catalysts, working together with current talent to bring a fresh set of eyes to the process.

"One of the easiest ways to identify areas for digitization and process improvement is to let a smart young person in the business take a few days and have a dig about," Bridgeman says. "Ask us, 'Why are you doing this, and why are you doing that?' Young people are comfortable with technology in ways older generations aren't. They see things with fresh eyes and ask the questions that maybe we've forgotten to ask."

6. Leverage the New Drive for Apprenticeship

Manufacturers should also look again at how they build their pipeline of new talent. Partnerships with universities and colleges can be frustrating if they aren't geared toward skills-based training and commercial outcomes. This is where partnerships linked to apprenticeship programs can really deliver.

"I think the apprenticeship role is the best way to get a loan-free degree," Greenough says. "With the UK government's apprenticeship levy and all the discussion about the sector's central role in restarting the economy after COVID-19, manufacturing is gaining traction with young people as a career choice. It's the perfect time to start talking with companies about apprenticeship and partnerships they can support."

Automation: threat or opportunity?

Tune in to *The Art of the Impossible* podcast for a deep dive into digital transformation with executives from Warren Services and SDE Technology.

As new technologies continue to change manufacturing, future jobs will look different. See how this is playing out in Asia, where upskilling the workforce is a collaborative effort.

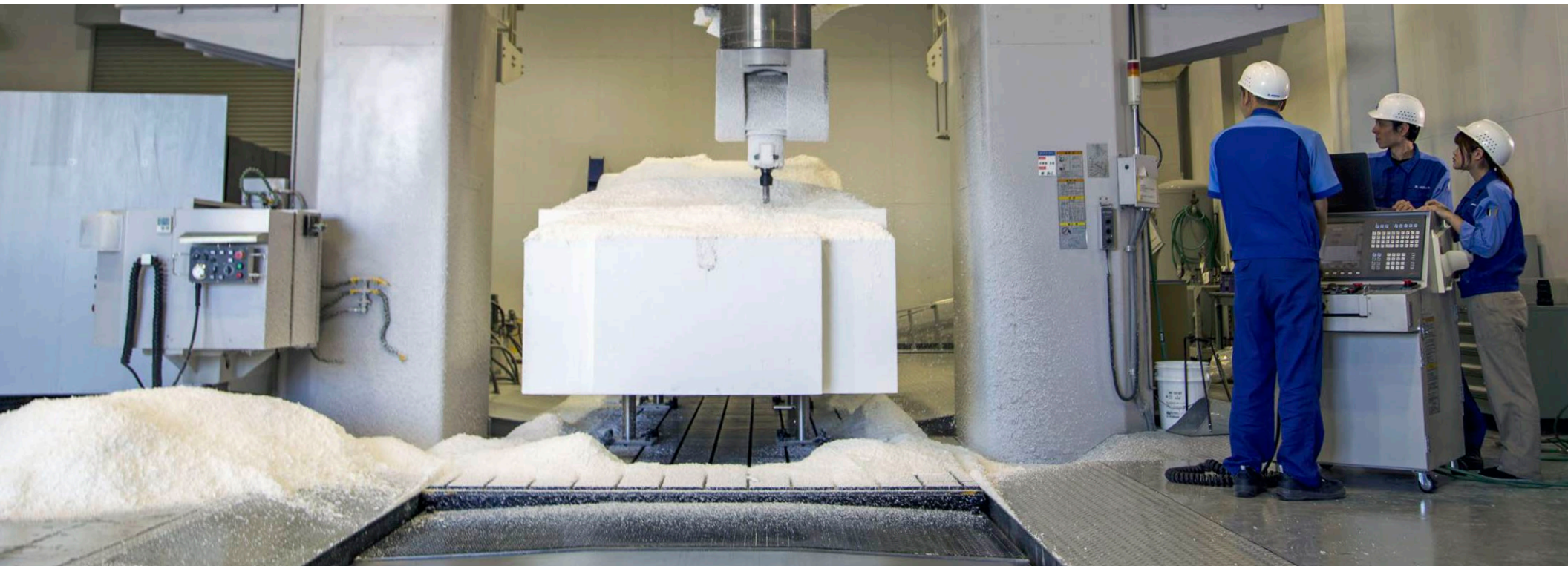
ASIAN MANUFACTURERS GO ALL-IN ON UPSKILLING EMPLOYEES

BY RINA DIANE CABALLAR

Many new technologies—additive manufacturing, AI, automation, the Internet of Things (IoT), and robotics—are transforming the future of manufacturing in Asia.

AI and robots can automate tasks such as quality assurance, defect detection, assembly-line optimization, and other routine or repetitive tasks. Robotic process-automation technology, for example, allows organizations to automate back-end business processes. While this shift affects many industry employees, it doesn't mean that their jobs will disappear. Rather, the industry will adapt by upskilling employees.

Workers for the Nichinan Group in Japan used a CNC mill to create a full-size foam prototype of a car chassis. Operations of this type will require many manufacturing employees to receive upskilling training.



As manufacturers in Asia and around the world adopt advanced robotics, employees will need upskilling to operate, maintain, and update the machines.

"What this means for the jobs of the future is that workers whose tasks are largely repetitive are at risk of their jobs being automated or significantly reconfigured," says Katherine Loh, an independent international-development consultant with expertise in Asia and the role of Industry 4.0 technologies in the future of work and private-sector development. "At the same time, these technologies will still require workers to understand, operate, maintain, and update them, so they will have to upskill and constantly seek training opportunities to stay on top of these trends."

Most businesses in the Asia-Pacific region consider upskilling as a driver of success; 84% say they prioritize skilling and reskilling workers. However, 64% of business leaders haven't yet implemented plans to help employees gain the necessary skills. Although upskilling is linked to company success, businesses seem unprepared to follow through.

Workers in Asia-Pacific also regard upskilling as vital; 86% of employees view career development to be essential to their future. Yet 69% of employees are concerned their organization does not provide the training opportunities they need to remain employable.

"The model of employee learning and training is evolving to reflect the accelerating replacement rate of skills," Loh says. "Now and in the future, workers will likely be expected to take a lifelong or continuous-learning approach to gaining new skills throughout their careers."

Strategies for Upskilling Employees

Upskilling is crucial to keep up with the changing world. But this endeavor must not fall only on the hands of workers. Companies also must invest in upskilling and reskilling their workforce to avoid disruption as innovation accelerates.

"Manufacturers across all sectors are integrating automation, AI, additive manufacturing, digitalization, and other technologies into their business processes to improve product quality, raise worker productivity, strengthen their supply chains, and ultimately remain competitive," Loh says. "Employers will need a workforce

trained to operate and understand these technologies. It will be incumbent upon them—in partnership with governments, labor unions, educational and training institutions, and others—to do the work of investing in workers."

This investment may come from internal training sessions or digital learning programs, such as Autodesk's free online courses and generative-design certification or MIT's Fundamentals of Manufacturing Processes course and online certification for Additive Manufacturing for Innovative Design and Production.

Another strategy is to engage small businesses specializing in technologies such as 3D printing or cobots (collaborative robots) to train employees. "Manufacturing is essential to the economic health of Asia, and as the region adopts more technology, the demand for skills becomes more volatile," says John Karr, senior director of The Asia Foundation's technology programs team. "We need to build systems—like taking advantage of existing knowledge from entrepreneurs—that quickly address these skill gaps, shifting from routinized training to adaptive and responsive training."

Some of these strategies are already in place across Asia. Here are a few organizations embracing upskilling and reskilling to equip their current workforce with the skills needed for future manufacturing in the region.

Training Young Engineers in Japan

Japan is accelerating training for young engineers through organizations such as Kojima Industries Corporation, a car-parts manufacturing company and one of Toyota's partner companies, and Technohama, a Kojima affiliate company specializing in injection and press molding and material measurement. Technohama's basic training program focuses on flow analysis and mold fabrication; the company also trains young engineers through information sharing and technology-exchange meetings across the larger Kojima group. As a result, Technohama has raised its skill level in flow analysis and seeks to expand its reach to other companies.

Upskilling is crucial to keep up with the changing world. But this endeavor must not fall only on the hands of workers. Companies also must invest in upskilling and reskilling their workforce to avoid disruption as innovation accelerates.

Diverse manufacturing sectors—including food, energy, and pharmaceutical production (pictured)—are all moving toward more automated assembly lines, which will require upskilling employees.

“The monthly group studies at subcommittee meetings within the Kojima group have been helpful in training engineers,” says Atsushi Matsumoto, Kojima director and executive officer for production control at Technohama. “In these subcommittee meetings, younger engineers are actively learning simulations and significantly contributing to mold and product designs for actual products.”

These meetings also give engineers an opportunity to interact with the software and hardware vendors and distributors the company enlists to help with training. “It’s difficult to keep up with the speed of technology advancement if you try to do everything in-house,” Matsumoto says. “So it’s important to collaborate with other manufacturers, vendors, and start-up companies.”

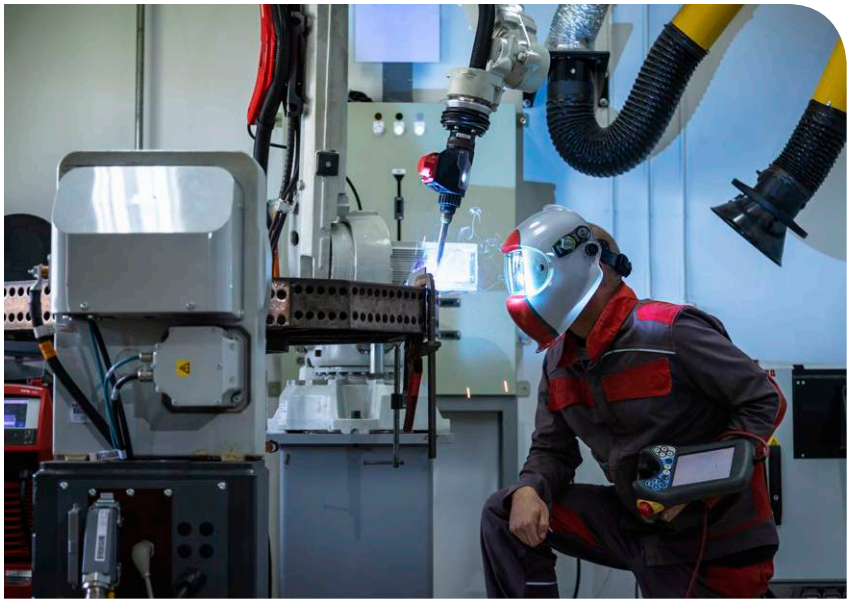
For Asian manufacturers, investing in training opportunities for workers is as important as investing in new processes, equipment, and technologies. “Employers should proactively anticipate the changes on the horizon,” Loh says. “They should create a work environment and company culture that enables employee growth and allows workers to self-direct their education by giving them access to the right content in the right format, whether that’s digital-learning platforms, app-based learning, or learning on the job.”

A Joint Effort in China

China’s technical and vocational institutions play a major role in transitioning workers to the higher skill levels needed for modern manufacturing. Guizhou Equipment Manufacturing Vocational College, for example, has added new courses: Digital Design Technology, Digital Process Design, and Digital Manufacturing Technology for the increased dependence on digital applications; Multi-Axis Machining Technology for working with advanced machine tools; and Industrial Robot Programming, Industrial Robot Installation and Debugging, and Intelligent Production Line Installation and Debugging to help students adapt to automated processes.

Guizhou also offers retraining and skills-improvement training for different types of workers in varying career stages, including laid-off

The continued rise of additive manufacturing and robotics contributes greatly to the need for upskilling employees. Here, a man in the Kanagawa prefecture of Japan cleans up a 3D print of a small automotive part (left) and a man in a Thai factory controls a welding robot (right).



and unemployed persons, veterans, and migrants. “This type of training is in response to the country’s call to build a lifelong learning system for citizens and provide convenient and high-quality training for everyone,” says Lin Yang, associate professor and deputy director of the college’s mechanical engineering department.

China’s technical and vocational colleges are syncing up with industry needs. “China has established vocational colleges and schools for different fields in every province and city to provide talent for enterprises,” Yang says. “The knowledge and skills students learn in school are determined by enterprise needs.”

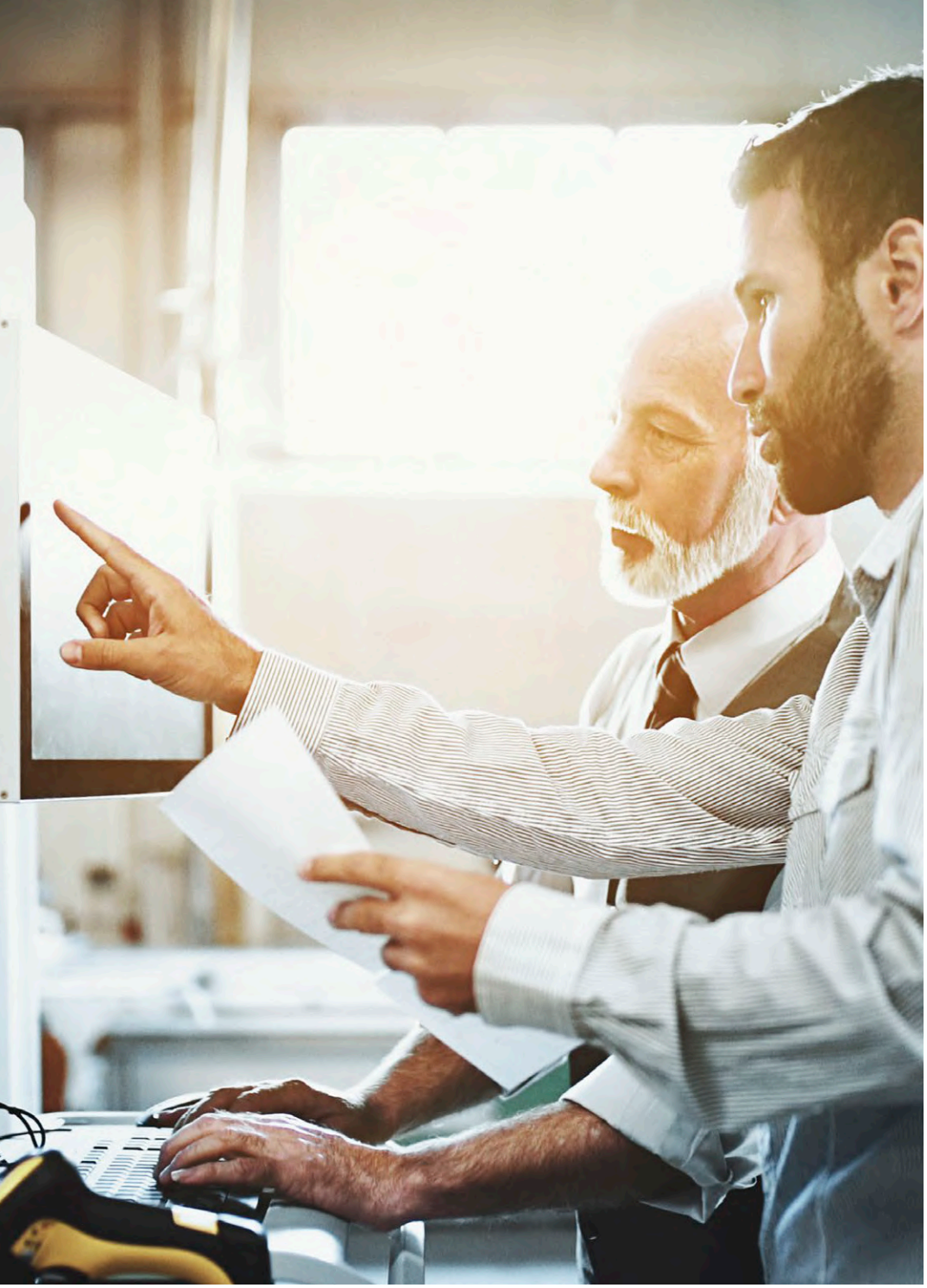
In Guangdong Province, for instance, the Guangdong Light Industry Technicians College formed industry partnerships for internships as well as soft skills and technical skills training. Guangzhou Industry and Trade Technicians College established a dual training system: The college and its partner companies work together to develop teaching and training plans. Yang’s college has done the same, forging relationships with Guizhou Aerospace Linquan Electric Co. Ltd. and Geely Automobile to co-construct majors and short-term training programs and mutually employ teachers and staff.

“Growing the education system in a way that produces more thought leaders, knowledge workers, and innovators has a lot to do with higher education,” Karr says. “But it also has a lot to do with making sure people in the Asian region are always able to upgrade their skills. And the central component to that is the education and training process.”

Collaboration Is Key

Upskilling must be viewed as a shared endeavor among sectors. In Singapore, for instance, the government’s SkillsFuture initiative provides skills development resources for students and workers at different stages of their careers. By working with education and training providers, employers, unions, and industry associations, the government helps citizens acquire the skills and knowledge needed to stay competitive.

“Business leaders should be willing to engage in dialog with policy makers to ensure they are informed of their training needs,” Loh says. “For example, leaders in the private sector can provide policy makers with access to novel and real-time sources of labor-market data on changing skills needs, which would allow policy makers to engage in sound planning and public investment. Both public- and private-sector leaders can work together with educators and training providers to ensure that training content reflects market needs and training formats are accessible to all kinds of learners. Collaboration is key. No one player holds all the levers to navigating to success.”



Reverse mentoring helps older generations benefit from the technical knowledge of younger workers.

Workplace problem-solving varies widely and is often divided by generation. In reverse mentoring, the learning goes both ways and makes the best skills and technologies available to all.

IS REVERSE MENTORING THE KEY TO UPSKILLING THE FUTURE MANUFACTURING WORKFORCE?

BY ROSA TRIEU

The rise of disruptive innovation proves that complacency is dangerous and that even the most established organizations can't ride on their early successes forever.

Conscious of this reality, Hosokawa Micron Ltd., a manufacturing company formed in 1989, has been upskilling its workforce through reverse mentoring, where older employees learn about the latest and greatest technology from new recruits.

Likewise, applying the concept of neuroplasticity, you *can* teach an old dog new tricks; research shows that a life of continual learning changes the very nature of the brain.

The UK-based company started hiring employees as young as 16 who initially didn't even know what engineering was. The decision turned out to be mutually beneficial to younger and older generations alike.

"The older guys saw that when young people work through processes or problems, they use very different methods to solve the problem," says Iain Crosley, Hosokawa managing director. "Whereas older people will talk to other people with experience to find the answer, the younger ones will try to find a logical solution by trawling the Internet, doing all sorts of searches, toying with gizmos, or using technology to solve it. They're more technology-driven than application-driven."

Reverse mentoring has helped Hosokawa Micron refresh its image and attract young employees. Courtesy of Hosokawa Micron Ltd.

Hosokawa wanted to maintain productivity by eliminating any undermotivation, lack of purpose, job dissatisfaction, and disengagement from problem solving within its primary workforce (average age over 40). Seeking opportunities to energize its employees with a view of the future, management hoped the reverse-mentoring route would reverberate positive effects throughout the company—but there were no guarantees.

Although it seemed counterintuitive, the benefits of reverse mentoring have been known for some time. It was popularized in the '90s by former GE CEO Jack Welch, who asked 500 top managers in the company to reach out to young employees who could teach them how to use the Internet. During Welch's time at GE, the company's valuation was up by 4,000%, so the practice seemed worth trying.

Through the reverse-mentoring program, Hosokawa matches older employees (up to 65 years old) to mentor younger employees on how to navigate the work environment and deal with people while the young mentors teach their older colleagues how to use technology to overcome their obstacles.

Breaking Through Perceived Barriers

According to Crosley, younger mentors did not view the older employees' obstacles as problems at all—though the younger cohort did expect to find the answers right away from the Internet. Although millennials are often chided for their short attention spans and multitasking tendencies, those are considered valuable skills at Hosokawa. In contrast, it's a common challenge in the industry to convince employees to embrace new technology.

"With manufacturing design, their comments are, 'Why don't you do more design in Autodesk Inventor and add more detail?'" Crosley says. "'Why don't you take some of what you've always done this way and change it?' The older people work around the challenge by physically moving machinery, but these guys will go on their iPad, draw, and work in a totally different way."

Aside from the younger and older generations being able to learn valuable intangible lessons, reverse mentoring has even improved the company's overall image. Thanks to the program, Hosokawa has been able to attract younger employees because of the reputation that it's not just another company with old standards. In addition, there's been higher engagement from the older employees.

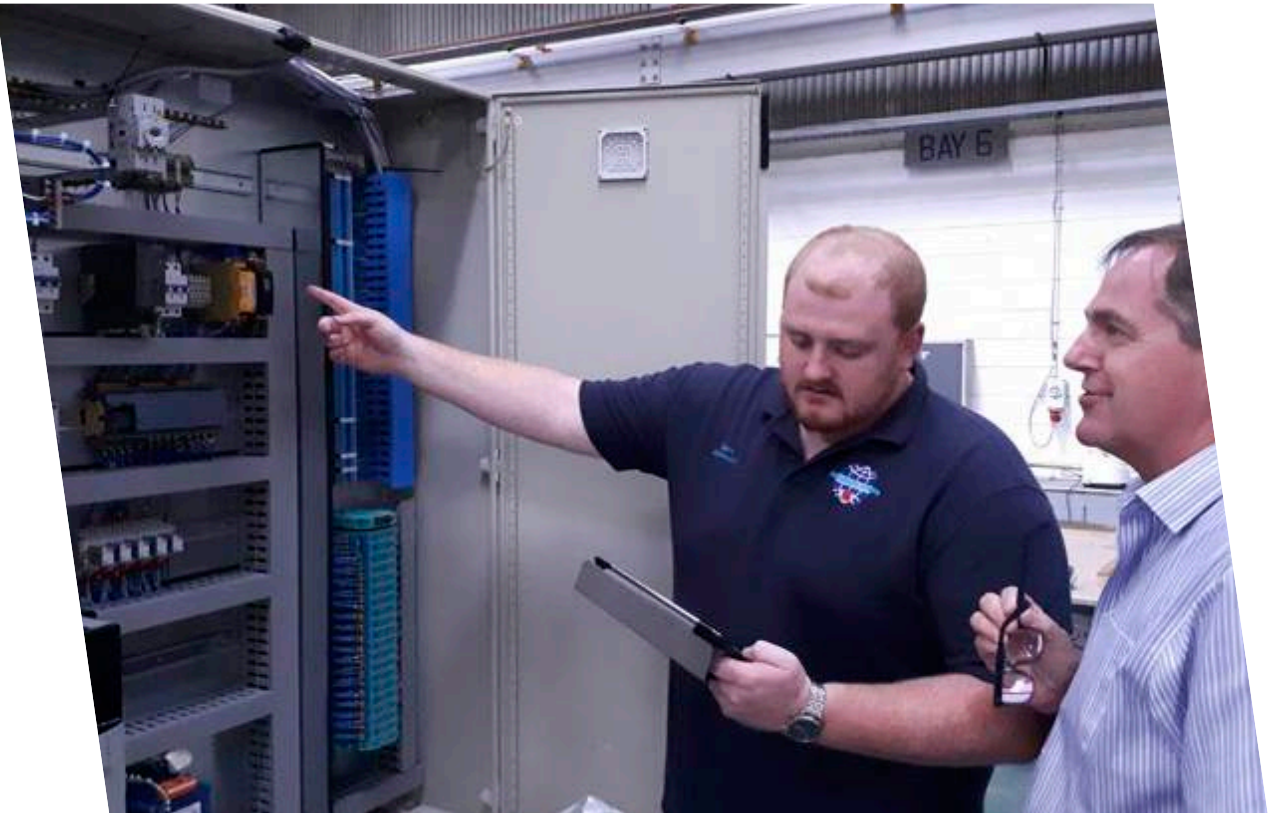
"We've found that the new working environment is changing people—they're actually now trying to get involved in areas they're not directly involved in," Crosley says. "So the perceived barriers are gone. It's good motivation to people, really."

Grist for the Reverse-Mentoring Mill

Illustrating Hosokawa's reverse-mentoring strategy, Crosley pointed to the project of building a new mill from existing 2D drawings. The task demanded a collaborative solution to build the best machine on time and within budget.

"It also delivered a real insight to how an established engineer with over 30 years' experience and a 20-year-old apprentice in the engineering department would tackle the project—turning the task into a highly effective reverse-mentoring assignment and demonstrating a win-win result," Crosley says.

The older engineer drew on his massive experience and expertise and proposed making a rough check of the drawings before using rule-of-thumb guidance to spec parts and build a prototype mill. The prototype would need time in the workshop fitting parts together and fine-tuning.



Aside from teaching the younger and older generations valuable intangible lessons, reverse mentoring has improved Hosokawa's image, helping it attract younger employees due to its reputation as a forward-thinking company.

The younger generation at Hosokawa is more likely to turn to technological conveniences like tablets and the Internet to solve problems. Courtesy of Hosokawa Micron Ltd.

Conversely, the younger engineer preferred an automated design technology route: converting 2D drawings to a 3D model. Using clash detection, they could check the compatibility of the mill's parts prior to producing a rendered model for ergonomic assessment. That way, he argued, no prototype mill would be required.

Both engineers agreed that using new methods and techniques to overcome the 2D design problem lead to fewer costs; potentially shorter production time; and a more accurate, validated mill design.

"In the end, both engineers had a better appreciation of each other's skills and methodology and agreed that working around the design challenges delivered a heightened level of engagement and increased motivation from both engineers," Crosley says.

Mutually beneficial: With reverse mentoring, both younger and older generations can gain new skills and experiences.

How Other Manufacturers Can Follow Suit

According to Crosley, the manufacturing landscape is changing, and the workforce will need to prepare for these looming shifts in the next five to 10 years to keep up. Automation threatens to take away heavy-lifting tasks and highly repetitive tasks, though a human still needs to build these machines extremely accurately.

"A lot of these young people have lots of ideas of how this could be done better in terms of the techniques in the build and laser alignments and so on," Crosley says.

Whereas engineers previously needed one skill set—computing skills—they now need to be more disciplined and blend multiple skills to do their jobs. The good news is they can use modern technology to get more out of their jobs and be more efficient.

Crosley says that as innovations in automation, virtual reality, and AI advance and continue to integrate into manufacturing, the younger generation brings the understanding of those technologies while the older generation grooms the young people into effective employees.

TAKEAWAYS

Digital transformation is changing the ways people work. Manufacturers who focus on reskilling, upskilling, and personalized education can help their employees not only adapt to today's technological changes but also develop a mindset that embraces continual learning.

Move over, traditional learning methods.

New educational delivery systems and intelligent technologies are driving a new wave of learning. What's missing: a practical curriculum that can fill the gap between vocational training and traditional degrees.

It still pays to be human.

Robots *are* automating repetitive tasks—but they're also making space for uniquely human skills such as creativity, critical thinking, and emotional intelligence. Manufacturers must begin recruiting people who exhibit these attributes as well as technical skills.

It's a group effort.

Upskilling is not just an employee's responsibility. Companies—in partnership with governments, labor unions, and educational and training institutions—must invest in their workforces to avoid disruption as innovation accelerates.

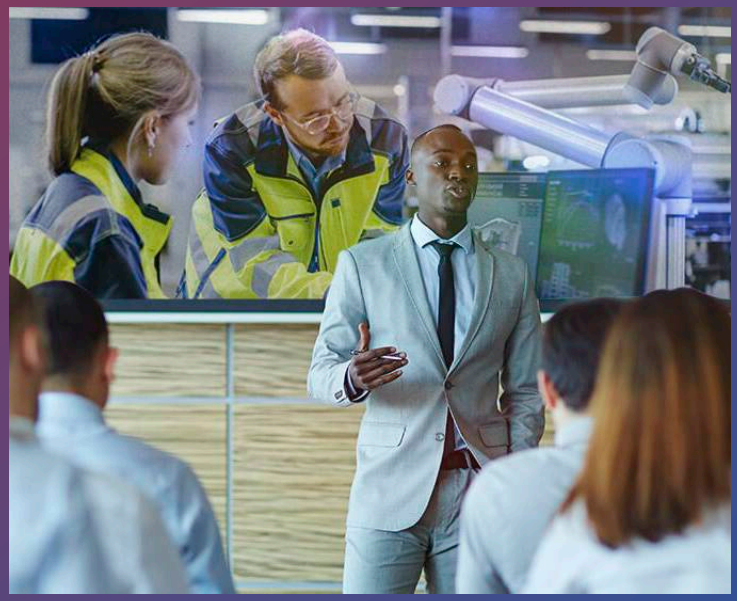
Learning goes both ways.

With reverse mentoring, younger and older generations can acquire new skills as well as learn valuable intangible lessons.

Are you ready for the workforce of the future? Learn why upskilling employees now will help them adapt to today's technological challenges and embrace tomorrow's changes.

To Prepare for the Workforce of the Future, Start Upskilling Employees Today

WATCH NOW



The Reskilling Revolution Is Coming: How Manufacturers Can Survive Industry 4.0

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