Lightcast

Are You Prepared for a Vanishing Manufacturing Workforce?

RETHINKING HOW WORK GETS DONE IN THE NEW LABOR MARKET REALITY

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The manufacturing industry is the fourth largest contributor to the US GDP at 10% of $29.72 trillion and is a leader in productivity and innovation, contributing $2.64 to the economy for every dollar spent and 53% of all private-sector research and development.

Yet it faces a widening workforce gap that threatens long-term sustainability.

A combination of retiring Baby Boomers, training bottlenecks, and both a declining population and interest among younger workers are leaving manufacturing jobs unfilled by the thousands each month. Further, increasing global competition, uncertainty in the future of immigration, and the rising demand for technologically advanced manufacturing capabilities increase operational risk, leaving organizations asking, "How will work get done? Will we be able to staff, and how much will that cost?"

At its core, there are only four ways to address labor shortages:

- **Build** and train a domestic workforce.
- **Rely** on foreign-born workers to fill gaps.
- **Globalize,** moving operations to where the labor is.
- **Replace** or augment human labor through AI or automation.

While each of these strategies come with their own constraints, navigating both the limitations and possibilities of each can help CEOs, COOs, CFOs, and CHROs work in concert to respond to business challenges with workforce planning built for the new realities of the labor market.

Manufacturing Workforce Risk Outlook

Lightcast studied 15 industries across the Fortune 1000 to assess workforce challenges through the lens of the four ways work gets done.

While both durable and consumer goods manufacturing can tap into each option, they all present significant challenges. Across a decades-long decline in young workers entering manufacturing jobs, an over-reliance on immigration facing increased restrictions, the rising costs of doing business abroad, and rapid skills shifts among automated and AI technologies, getting work done in manufacturing will continue to require a strategic balance among workforce planning options.

Learn how these challenges will uniquely impact your organization. Get my score.

Risk Factors

4.00
INDUSTRY RISK SCORE

2.56
MARKET RISK SCORE

2.06
OCCUPATION RISK SCORE

1.82
AI SKILLS GAP SCORE

Local Workforce Development:

The Long Road Ahead

Developing the domestic labor pool builds resilience, supports local economies, and fosters long-term retention.

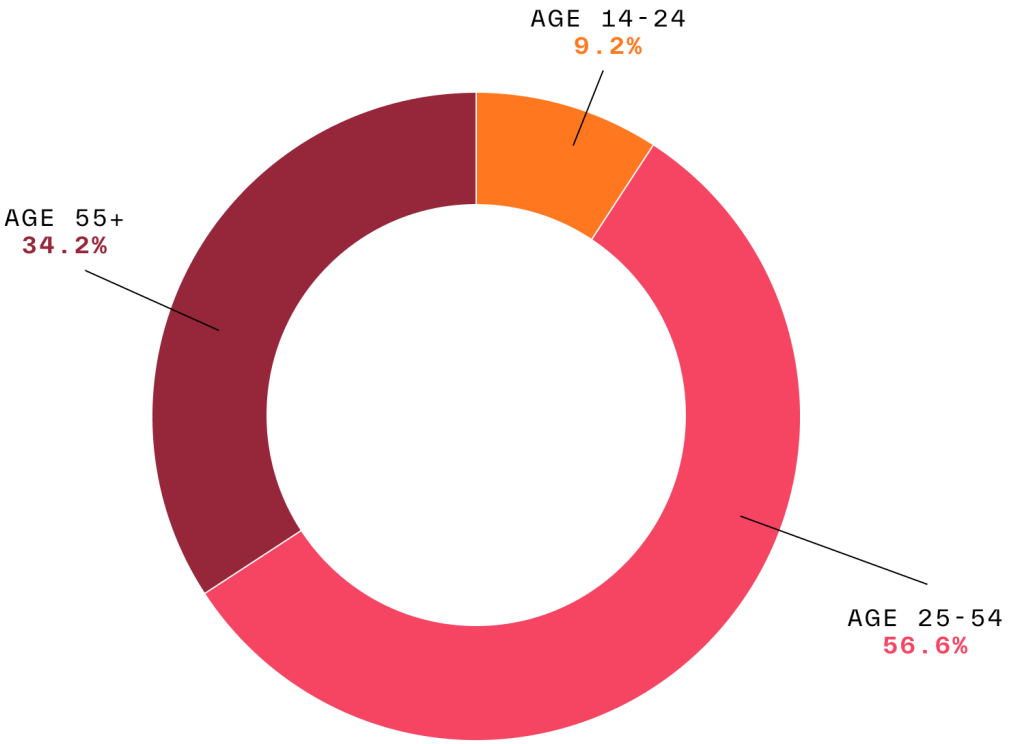
However, the pipeline for manufacturing workers is constrained, and failing to build the local workforce has lasting effects: in a 2021 joint Deloitte and Manufacturing Institute report, nearly 83% of manufacturers responded that attracting and retaining a quality workforce is their top challenge, with 45% saying they had to turn down business opportunities due to workforce shortages. To regain control, business leaders need to understand how the conditions of this shortage formed.

Demographic Decline

The share of prime-age working adults (25-54) in the US has stagnated, with manufacturing facing an elevated risk of workers retiring from the industry. Of the current 13.2 million US manufacturing embedded talent, 3.7 million, or just over a third, are approaching retirement. Additionally, the fertility rate in the US has been in decline since 2007, is currently sitting at 1.62 (below the replacement rate of 2.1), and according to the UN, will merely increase to 1.64 by 2054. With retirements far outpacing youth entrances to the workforce, the following issues become more compounded.

Manufacturing Age Breakdown

SOURCE: LIGHTCAST TALENT ANALYST, INDUSTRY SNAPSHOT



The Perception Problem

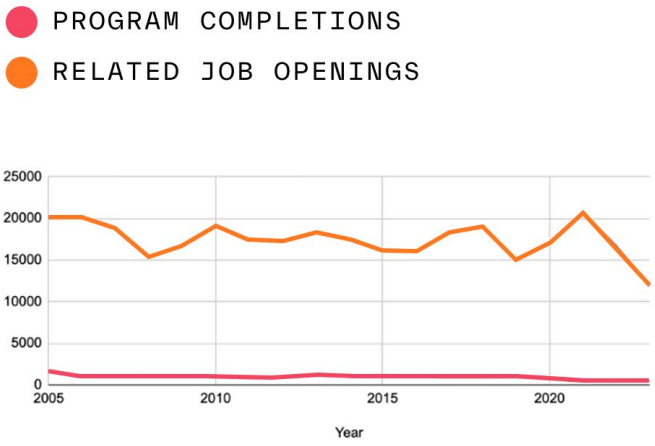
The Deloitte Manufacturing Perception Study found that limited public awareness of opportunities in manufacturing do not reflect the realities of compensation, benefits, and career mobility. For those surveyed who are familiar with the industry, 66% agree that the average entry-level US manufacturing job tends to pay more than other industries, compared to 34% of respondents unfamiliar with manufacturing. Additionally, of those familiar with manufacturing, 58% think it offers limited career prospects—however, when asked if they would choose a manufacturing job with customized training and a clearer pathway for career progression, eight out of ten said yes.

Educational Gaps

While investments in Career and Technical Education (CTE) have increased across secondary and postsecondary schools, program completions still have a long way to go to keep up with job demand, a trend that has been decades in the making. Looking at the past 18 years of completions across five machinist programs compared to annual job openings for occupations that map directly to these programs, Lightcast finds that these completions are vastly dwarfed by job openings. This trend carries across vocational and technical programs, pointing to a severely constricted talent pipeline that must be addressed, especially in high manufacturing GRP states like California and Texas.

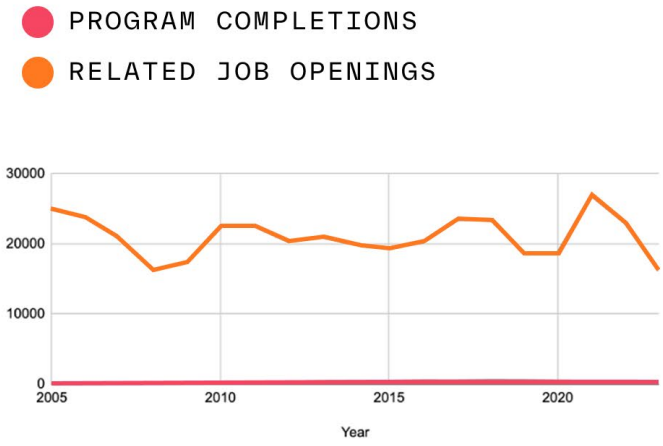
Machinist Program Completions and Related Job Openings, California, 2005-2023

SOURCE: LIGHTCAST TALENT ANALYST, PROGRAM SNAPSHOT



Machinist Program Completions and Related Job Openings, Texas, 2005-2023

SOURCE: LIGHTCAST TALENT ANALYST, PROGRAM SNAPSHOT



Skills Mismatch

Modern manufacturing increasingly requires advanced digital, mechanical, and troubleshooting skills. While training programs are struggling to produce enough skilled workers to keep up with job demand, many of them also haven't kept pace with the demands of smart manufacturing. The top educational program producing workers with CNC, robotics automation, CAD, or CAM skills is mechanical engineering, yet only 25.23% of program completions contain any of these skills. The demand for digital skills is growing faster in physical industries than in the tech sector and economy as a whole—job postings requesting digital skills, like data collection, Python (programming language) and AutoCAD, grew 86% in physical industries between 2017 and 2023, compared to 45% in all industries and 29% in the tech industry.

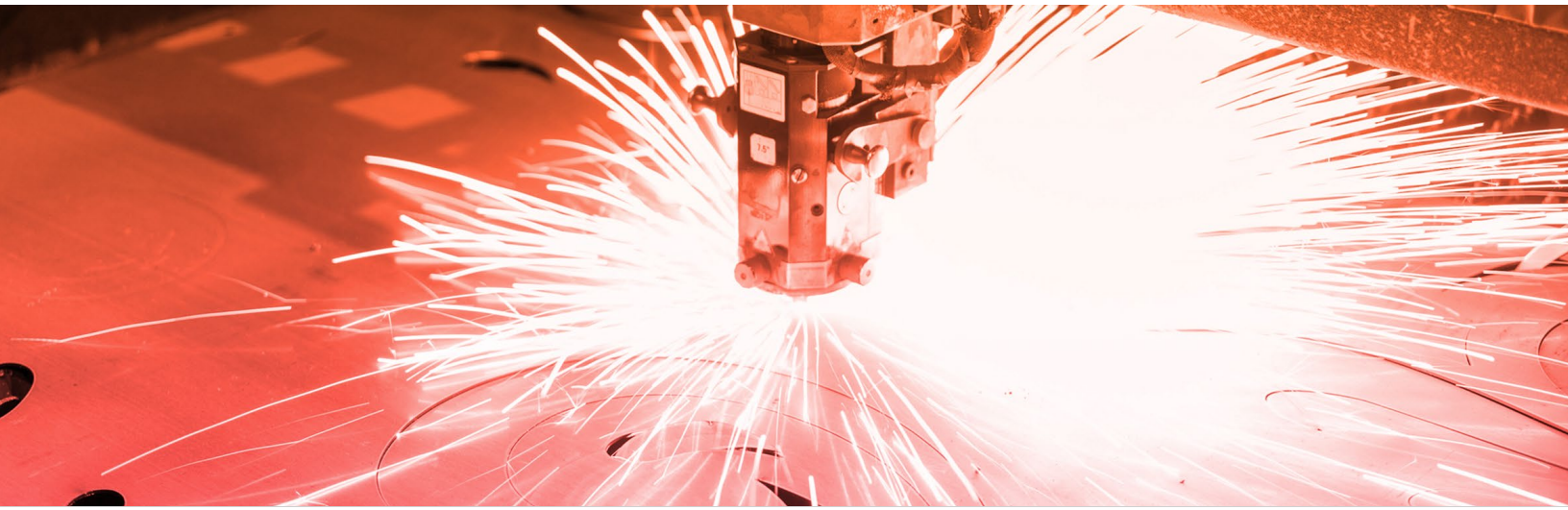
Investing in Local Talent

Despite these challenges, investing in local talent offers a high return on investment through retention, innovation, and ultimately, stability. While it's a long-term strategy and may not solve immediate vacancies, it's essential for a sustainable talent supply.

Structured programs, like apprenticeships and work-based learning, can bridge skills gaps and attract early talent through earn-as-you-learn incentives. Toyota, for example, has implemented an automotive technician training program in conjunction with community colleges, vocational schools, and dealerships to grow new skilled talent. This provides Toyota with the opportunity to help shape education curricula, ensuring alignment with evolving job requirements, as well as close talent gaps faster and retain its workforce.

Additionally, a collaboration among the Detroit Regional Chamber, its MichAuto program, and community colleges is revitalizing Detroit's rich history in automotive manufacturing by focusing on skills-based hiring, targeted skills development, and innovative educational pathways. Using data-driven insights to determine a custom definition of Advanced Mobility and analysis of regional talent gaps, the collaborative was able to find new talent from adjacent industries and create skills development opportunities for workers of all educational levels—increasing talent availability and widening career paths for the local workforce.

Employers will also need to focus on their ability to appeal to the next gen workforce. In a 2019 op-ed featured by IndustryWeek, a high school student—who would now be in or approaching the prime-age workforce the manufacturing industry needs—offered her advice on how to combat the perception problem: "In order to better engage youth, manufacturers have to focus on aspects of manufacturing jobs that involve creativity and innovative ideas, and have to highlight how their company is creating change in the community. Instead of advertising manufacturing jobs with the



selling points of high pay and job demand, center on how these careers offer a dynamic, meaningful, and purposeful line of work." At the turn of the decade, Siemens launched its "Industry 4.0" campaign, positioning its employer brand in the "I am Industry" video as one of societal importance, a digital future, collaboration, and human potential. Aligning with the expectations of Gen Z—a population that has surpassed Baby Boomers in the workforce—is a powerful tool in acquiring younger workers across all levels of education.

Finally, organizations should focus on reskilling and upskilling their current workforce. If one of the challenges in manufacturing is the perception of limited career growth, now is the time to demonstrate to your current employees that this isn't the case. Invest in them by mapping their current skills against the external market to identify career paths, close skills gaps, and ensure that employees' careers are evolving with new technologies. For example, closing the skills gaps from machinist to computer numerically controlled tool programmers not only provides a path toward advancement and increased salary for the employee, but also ushers in opportunities for the organization to implement automation technologies—a value add for both employer and employee.

MACHINIST

Median Salary: $57,216

Employers Competing: 6,255

MOST IMPORTANT TRANSITIONAL SKILLS

CNC Programming

Mastercam (CAD/CAM software)

Computer-Aided Manufacturing

Computer-Aided Design

CNC TOOL PROGRAMMERS

Salary Increase: +$12,485

Employers Competing: 5,833

Source: Lightcast Talent Analyst, Career Pathways

Immigration:

Historically Reliable but a Risky Future

Immigration has played a vital role in bolstering the US manufacturing workforce for decades.

From skilled technicians to general laborers, foreign-born workers have helped manufacturers scale operations and meet demand. As of 2023, the US manufacturing sector employs 3.2 million foreign-born workers, 20% of its workforce. However, immigration is now more constrained and politically volatile, making reliance on the foreign-born workforce a difficult strategy for organizations to build long-term workforce planning strategies.

Restrictive Policies

The US immigration system has become increasingly difficult to navigate for employers and job seekers alike. Employers sponsoring foreign-born workers must work with a half-dozen government agencies and the standard procedural time now exceeds three years. Additionally, H-1B visas can cost employers between $3,900 to $18,150 for an initial petition and up to $31,800 for an initial plus extension application. The process leaves employers with virtually no room for error, either. Given legal risks and application costs—as well as the historical 66,000 cap on H-2B visas (restrictive temporary non-farm work) plus the Dec. 2, 2024 expansion to 64,716 for FY 2025 only, and 85,000 cap on H-1B visas (65,000 for those holding a bachelor's degree and 20,000 for those with advanced degrees)—employers may find themselves exceeding risk and cost tolerance for workers they may not even be able to secure, or even need.

Lack of Pathways for Mid-Skilled Labor

H-1B visas are limited to high-skilled occupations, with the top approved (66%) in computer-related jobs. These occupations do not align with the needs of the manufacturing industry, which are oriented toward vocational jobs. Even when manufacturers can obtain H-1B workers, they are not in the roles that are most critically needed to sustain operations.

Rank	Top 10 Manufacturing Occupations Needed	Top 10 H1-B Occupations Approved
1	Miscellaneous Assemblers and Fabricators	Computer-Related
2	First-Line Supervisors of Production and Operating Workers	Architecture, Engineering, and Surveying
3	Laborers and Freight, Stock, and Material Movers, Hand	Administrative Specializations
4	Inspectors, Testers, Sorters, Samplers, and Weighers	Education
5	Packaging and Filling Machine Operators and Tenders	Medicine and Health
6	Welders, Cutters, Solderers, and Brazers	Life Sciences
7	General and Operations Managers	Mathematics and Physical Sciences
8	Machinists	Managers and Officials
9	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	Miscellaneous Professional, Technical, and Managerial
10	Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	Art

Source: Lightcast Talent Analyst, Staffing Patterns

Source: Boundless: Immigrant Workers in the United States

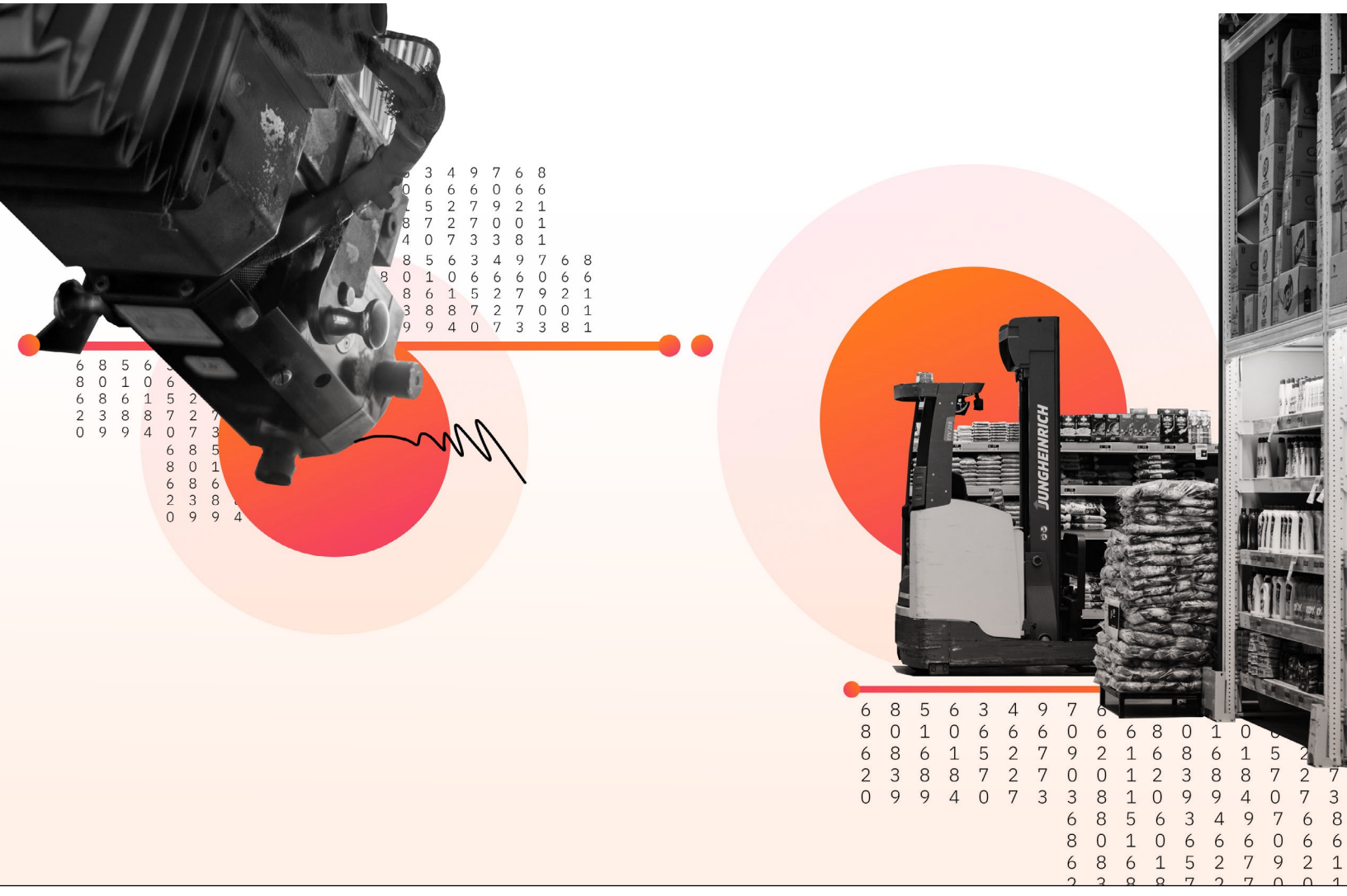
Additionally, H-2B visas are heavily restricted to temporary needs only: a one-time occurrence, seasonal need, peak load need, or intermittent need. This workforce can help food manufacturing organizations, but are not as beneficial to other manufacturing subsectors. A more viable employer-sponsored visa program is the EB-3 category for skilled, professional, and other workers in roles that are not temporary; however, the backlog is longer, applicants must have a permanent, full-time job offer, and must demonstrate they will be performing work for which qualified workers are not available in the US.

Immigration Workforce Planning Strategy

There is no one-size-fits-all solution—employer-sponsored programs to pursue foreign-born talent require a calculated, role-specific strategy that aligns with legal capability, budget constraints, and time-to-fill urgency, and may not be the right path to fill the roles most critically needed. While there are still millions of foreign-born workers that do not require employer sponsorship, organizations must continue to stay informed of policy shifts that impact talent supply.

When organizations are evaluating market strategy, exploring state-level initiatives can provide insight into foreign-born availability and stability. For example, Michigan's "welcoming strategies" are designed to strengthen the international immigrant talent pipeline and transition into the workforce as a means to balance its declining native-born workforce. This program is specifically targeted at skilled trades—a valuable program for the state's 15,920 manufacturing businesses.

Though immigration remains a viable lever, it is still fragile—it can be part of the solution, but it won't solve the shortage alone.



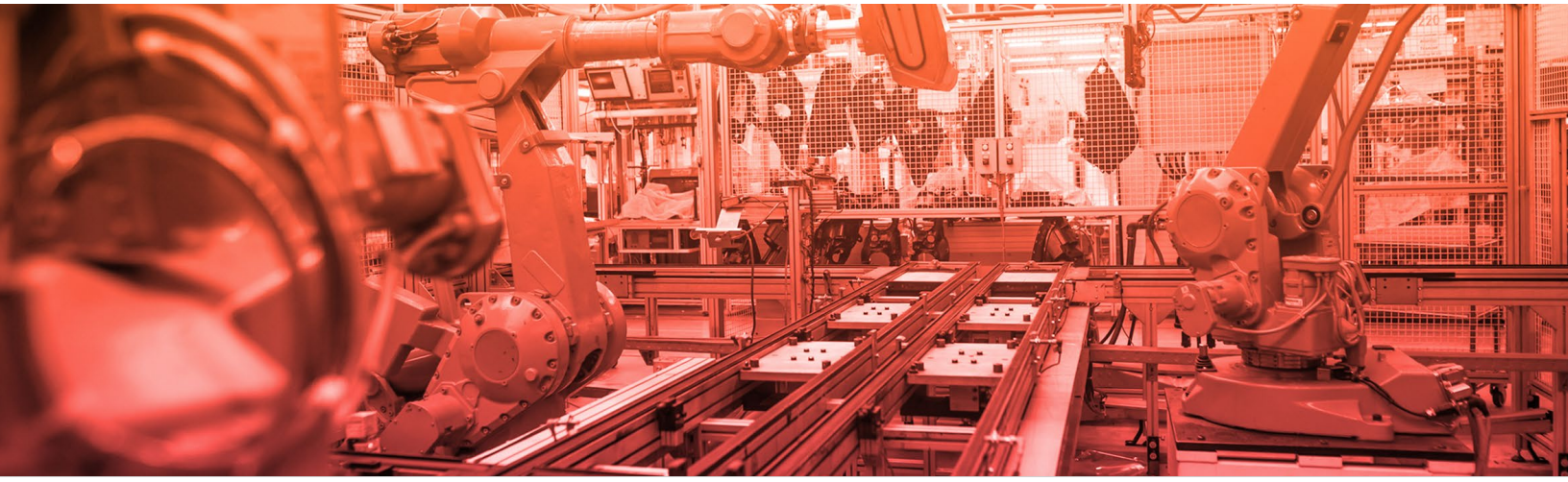
Globalization:

Here? There? Where?

For decades, globalization has been the go-to solution for labor shortages. Moving manufacturing operations overseas, particularly to countries with lower labor costs, allowed companies to scale quickly and affordably. As a result, global supply chains have become more complex, costs are harder to predict, and regulatory compliance is more difficult to navigate. Globalization will remain a necessity for many organizations, but presents increasing uncertainty.

Shifting Costs of Doing Business

In a KPMG and Manufacturing Institute report, Malaysia, China, and Mexico rank as the top three nations with the lowest primary costs of doing business—indexed by hourly compensation, real estate, and utilities costs, as well as corporate tax rates and interest rates—with the US ranking fourteenth. However, these are not the only costs that must be considered. When incorporating secondary costs—bucketed into quality of labor, ease of doing business, infrastructure, and risks and protections (e.g., political risk or corruption)—the top three nations are Canada, Taiwan, and South Korea, with the US ranking fifth. When looking solely at these secondary costs, the US ranks first. Market strategy has become increasingly more complex; what once used to be the cheapest way to produce goods may not be in the long term.

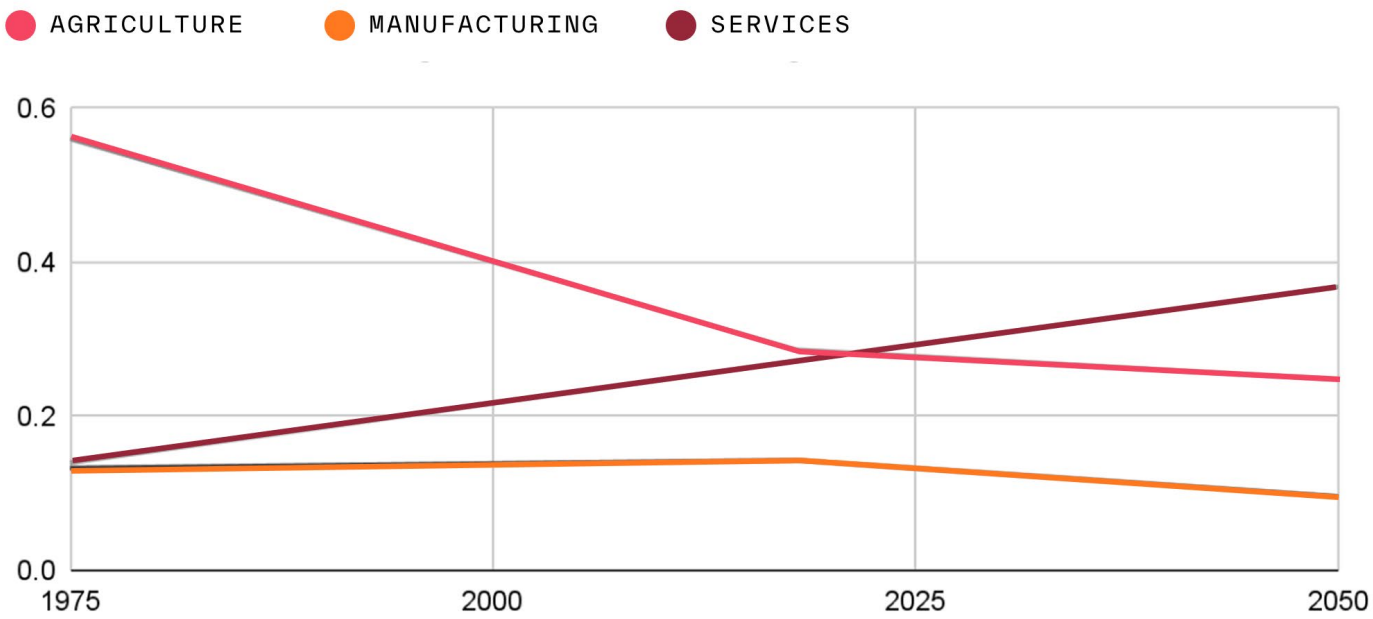


The Global Manufacturing Workforce Has Peaked

Offshoring decisions cannot be made on the assumption that manufacturing labor is widely abundant, even in nations with the lowest hourly compensation rates. Research has shown that as countries develop economically, they shift their industries from low-wage agricultural jobs to more specialized roles in manufacturing. Manufacturing jobs have historically peaked when GDP per capita reaches $40,000, and then declined as a country becomes wealthier, transitioning into an upward trend of service-oriented jobs. However, in a report by the Center for Global Development, models show an important twist: global deindustrialization. Manufacturing jobs are expected to decline in high-income countries, remain flat at about 7.7% of jobs in low-income countries, and drop significantly in middle-income countries from approximately 18% to 10%. Global manufacturing jobs have essentially already peaked. This cannot be attributed to offshoring—these trends are across global workforces. Instead, the cause is productivity: nations are beginning to deindustrialize at lower income levels than before due to higher productivity opportunities in services.

Global Share of Employment by Primary, Secondary, and Tertiary Sectors

SOURCE: CENTER FOR GLOBAL DEVELOPMENT: IS MANUFACTURING DESTINY?



Supply Chain Disruption

The 2024 McKinsey Global Supply Chain Leader Survey uncovered that, though nine in ten executive respondents say they have encountered supply chain issues in 2024, only a quarter say they have a formal process in place to address them at the board level. Supply chain disruptions occur for many reasons—natural disasters, geopolitical events, raw material shortages, currency fluctuations, regulatory shifts, and labor and transportation issues. Diversifying suppliers is critical, but can only be safely achieved through risk assessments across these categories of disruption at the executive level.

Navigating Globalization

Labor cost savings and availability are no longer the default decision criteria for offshoring production. Holistic cost-of-doing-business decisions are increasingly driving organizations, especially in automotive, electronics, textile, and consumer goods manufacturing, toward nearshoring to withstand global shocks and dramatic changes in tariffs. Reshaping talent strategies as a means of supply chain resilience enables organizations' ability to diversify suppliers, nearshore or reshore production, increase transparency and digitization of supply chains, and build flexibility into production capacity.

First, as onshoring and nearshoring across North and Central America will incur higher labor costs, organizations will need to place more emphasis on automation and digitization to increase output value. According to a Deloitte survey, 76% of manufacturers are adopting digital tools to enhance transparency into their supply chain. This rapid technological change means employers must upskill and reskill their workforce while also attracting tech-oriented talent. For this reason, manufacturers are building multiple regional hubs instead of one large offshore plant to distribute hiring across geographics, allowing flexibility into how they source, train, and retain workers.

Additionally, organizations can directly assess talent risks alongside supply chain risks, especially in critical roles like logistics, welding, maintenance, and controls engineering. When organizations expand the view of their workforce beyond their walls to evaluate the health of their broader talent landscape, it not only bolsters internal workforce planning, but also provides insights to where production or fulfillment could slow. Resilient supply chains depend on resilient workforces. As manufacturers localize production and adopt new technologies, they must align their talent strategies accordingly by investing in skills and building stronger regional networks.

AI and Automation:

Retooling a Future-Ready Workforce

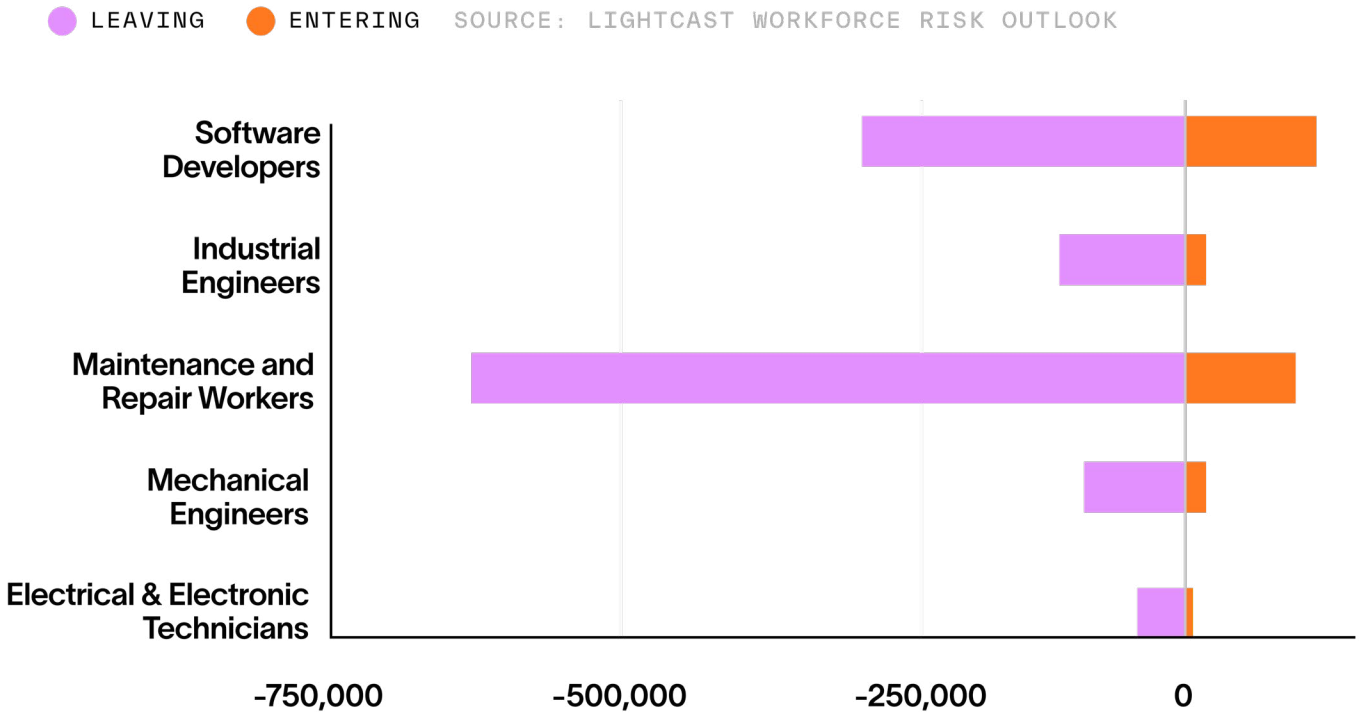
AI, robotics, and automation, though promising in alleviating some workforce shortages and maintaining productivity, are not a plug-and-play solution.

While some manufacturing subsectors, such as life sciences, automotive, and electronics, have long adopted these technologies, it hasn't been without workers and their specialized skills. Modernizing manufacturing has a strong business case, but presents its own set of barriers, especially in acquiring and sustaining the talent necessary to build, implement, and maintain these technologies.

Workforce Readiness

Automation doesn't eliminate the need for people—it changes the skills workers need. Manufacturers need technicians, programmers, data analysts, and engineers to design, maintain, and oversee automated systems. However, the Lightcast Workforce Risk Outlook uncovered that the prime-age talent pool (ages 25-54) is seeing far more exits than entrances for the occupations necessary in manufacturing automation.

Exits vs. Entrances of Prime-Age Workers In Occupations Needed for Manufacturing Automation



Skill / Projected 2-Year Growth
Automation +30.5%
Lean Manufacturing +28.1%
Process Improvement +27.0%
Data Analysis +25.8%
Scalability +25.2%

When looking at the skills needed (a set of 130 normalized skills) for automation in the manufacturing industry, Lightcast can project which will grow the most and what organizations should either recruit or upskill, especially in critical roles that will implement and manage automation technologies.

Source: Lightcast Talent Analyst, Job Posting Analytics

Investment Costs and Implementation Timelines

The upfront costs of automation—equipment, integration, maintenance, and training—are steep, particularly for small and midsized manufacturers. These costs include equipment, software, infrastructure, tools, and talent, which create a complex ecosystem that can be challenging to vet ROI. Additionally, unlike hiring, which can (in theory) fill a gap in approximately a month, full implementation of automated systems often spans years. Additionally, many production tasks still require dexterity, judgment, or variability that machines can still struggle with; while automation can assist in many other tasks, these are tasks that will not benefit from automation and are also those in greatest shortage.

Evaluating Automation Strategies

At its core, automation is about augmenting human capabilities, not fully replacing them. It's most effective when used to support workers and free capacity for higher-skilled tasks. If US manufacturing wages are going to cost more than offshoring, then manufacturers need to evaluate these costs through the lens of productivity. For example, robotics can take over repetitive, injury-prone tasks to reduce fatigue and turnover, but someone is going to have to evaluate performance and ensure both its operating systems and material equipment are well maintained. Also, with every new robot installed, the importance of skilled robotic maintenance mechanics increases, and the US is in very short supply of these people.

Skills-based transformation should be the top priority for organizations wanting to implement automation, robotics, and AI. As these technologies change the landscape, employers will need to stay ahead of skills changes and address gaps as an operational strategy. While production workers are in shortage, upskilling the organization's current employees on process improvement, project management best practices, and data analysis can make them more effective at their jobs. Reskilling workers from the tech sector into manufacturing also provides an opportunity to fill talent gaps and modernize operations—according to the 2024 Eclipse Employment Impact Report, there were 1.5 million more job postings demanding digital skills in the physical industry than the tech industry. However, tech workers will also need to acquire the domain skills (those that are relevant to a particular field or industry) of manufacturing, highlighting a valuable opportunity for apprenticeships, cross-skilling, and blending roles.

AI and automation should be part of the workforce strategy, but not the entire plan. Organizations must weigh their workforce readiness, project timelines, and return on investment against their labor needs. Technology can amplify human capacity, but cannot yet fully replace end-to-end operations.

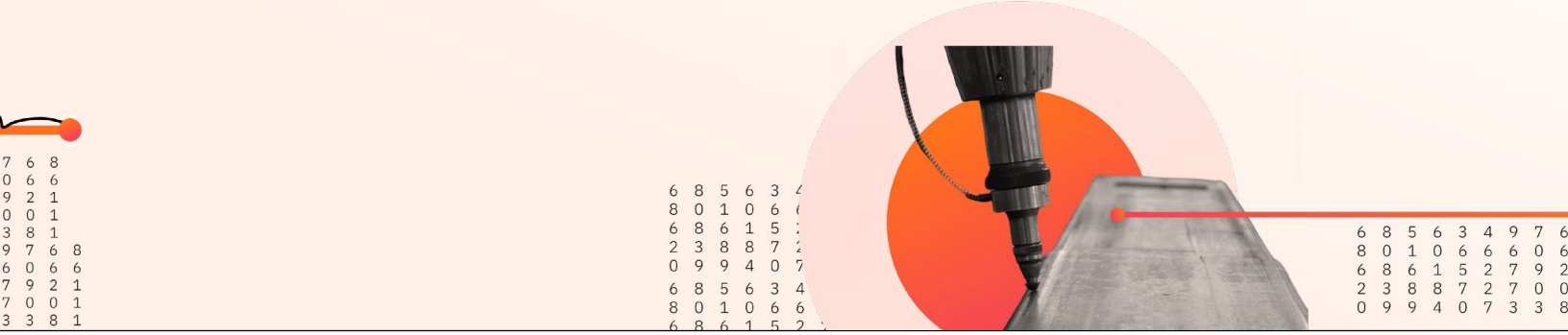
So What Should Organizations Do Now?

Manufacturers face a new era where labor constraints are not cyclical—they are structural on a global scale.

Each of the four levers for getting work done offer potential, but none provide an all-encompassing solution. Securing operational continuity requires a focus on workforce planning, as no part of a manufacturing organization operates completely autonomously, nor does any organization operate outside of the interconnected global system. Leaders in HR, technology, operations, finance, and compliance must work together to proactively guard against operational disruption—which means a team focused on workforce planning.

Conduct Workforce Risk Assessments

Understand which roles are on the frontlines of operational continuity and the roles most at risk of going unfilled. More importantly, determine the causes—if retirements are concentrated in one team or occupation, understand that this institutional knowledge will need to be shared with other workers and talent acquisition must proactively fill and upskill roles before workers leave. When there is a strong business case for automation, workers will either need to be acquired, upskilled, or reskilled to adopt and maintain both software and equipment.



Focus on Skills

Organizations must think in terms of skills rather than traditional jobs. What capabilities are needed? Does the organization already have a workforce, or a potential labor pool within its market, that can be trained locally, hired externally, or automated? When tasks can be automated, what else can these workers do to add value? Skills-based hiring is a vital path toward building a future-ready workforce, unlocking opportunities to find talent in other industries, become more flexible with educational requirements, and reach talent outside of the traditional box.

Build Talent Ecosystems, Not Just Pipelines

Organizations need to collaborate with community colleges, workforce associations, training providers, and economic development organizations to build local ecosystems that support talent development over time. Engaging with high schools is particularly important; in a 2024 Gallup poll, 68% of students hear a lot about college, but only 23% say they've heard a lot about apprenticeships, certificates, and vocational programs and only 19% say they hear about jobs that don't require college. As Gen Z and Gen Alpha approach working age, partnering with public school districts is a key strategy to engage students in careers that don't require a college degree.

Commit to Workforce Planning as a Business Strategy

Labor cannot be treated as a downstream issue. Organizations must elevate workforce planning to the C-suite level by integrating it into capital planning, site selection, and long-term investment decisions. The cost of doing business can change in a number of situations, some hard to predict or rapidly changing, so modeling market strategy, technology, and geopolitical scenarios within the context of the labor market—supply, demand, cost, and skills—can guide the opportunities and constraints of operational strategy.

Strategy	Strengths	Constraints
Local Workforce Development	Sustainable, more controllable management, creates long-term value	Aging workforce, slow training pipelines, requires a sustained, long-term strategy
Immigration	Offers more immediate relief from workforce shortages	Policy restrictions, uncertainty
Globalization	Historical cost efficiency, ability to rely on operations that are more mature in production processes	Complex cost of doing business analysis, global workforce shortages, supply chain risks
AI/Automation	Scalability and productivity	High costs, skills gaps, longer timeline to implement

The manufacturing industry is at a crossroads. Labor shortages are not temporary, nor are they only confined to the US—they are the new operating environment, globally. By embracing a multi-pronged, future-ready approach to workforce planning, organizations can mitigate risk, improve competitiveness, and ensure that the work gets done—not just today, but in the years ahead.

Experience the Lightcast Workforce Risk Outlook for a deeper analysis and understanding around the unique risk scores across 15 industries and the Fortune 1000.

LIGHTCAST.IO/WHY-LIGHTCAST/RISK-OUTLOOK