OCTOBER 2019

Perfect Match

How Can Workers Find Jobs That Fit Them Best?

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CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

A Report of the
CSIS SCHOLL CHAIR IN INTERNATIONAL BUSINESS

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Acknowledgments

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1 | Introduction

Since the Great Recession, manufacturing employment and output have been growing, and much like their peers in other industries, manufacturers have new vacancies. Manufacturing unemployment has come down from 13 percent in January 2010 to 3 percent in June 2019, and job openings are today outpacing hiring in several industries, including manufacturing, health care, IT services, professional and business services, finance and insurance, and government.[1] A key driver of the need to hire is the considerable churn in labor markets: voluntary separations have soared, suggesting that workers are actively going for new opportunities, leaving their former employers with vacancies. Baby boomer retirements contribute to manufacturers' hiring needs. In addition, manufacturers are looking for new workers with the technical skills required for modern twenty-first century advanced manufacturing.

These dynamics have contributed to concerns that American manufacturers will face significant challenges to hire adequately skilled workers in the coming years. For example, Deloitte and the Manufacturing Institute estimate that there will be an additional 4.6 million manufacturing jobs to be filled over the next decade and that some 2.4 million of those future openings are expected to be challenging to fill because of what they claim is a skills gap—a shortage of workers with the right skills to do jobs in the manufacturing sector.[2]

Arguments about skills shortages in American manufacturing have claimed center stage in policy discussions in recent years. There have been good proposals on how to train young people for future manufacturing jobs, such as in a recent CSIS policy report.[3] Yet as other work attests, the skills shortage argument is only one of many potential explanations for why there are more vacancies than hires in manufacturing or why it may take time for manufacturers to fill vacancies.[4] Indeed, a closer look at many of the arguments that

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1. For manufacturing unemployment, see "Unemployment Rate: Manufacturing Industry, Private Wage and Salary Workers," FRED, Federal Reserve Bank of St. Louis, August 21, 2019, https://fred.stlouisfed.org/series/LNU04032232.

2. Deloitte and the Manufacturing Institute, *2018 Deloitte and The Manufacturing Institute skills gap and future of work study* (New York: 2018), http://www.themanufacturinginstitute.org/~/media/E323C4D8F75A470E8C96D7A-07F0A14FB/DI_2018_Deloitte_MFI_skills_gap_FoW_study.pdf.

3. Charles Carson et al., *Training the Next Revolution in American Manufacturing* (Washington, DC: CSIS, July 2019), https://csis-prod.s3.amazonaws.com/s3fs-public/publication/190722_Carson%20et%20al_Manufacturing_WEB_v4.pdf.

4. Patricia Buckley and Rumki Majumdar, "A growing skills mismatch? Not necessarily," Deloitte, April 15, 2015, https://www2.deloitte.com/insights/us/en/economy/behind-the-numbers/us-skills-mismatch.html. See also, Edwin Koc, "Is There Really a Skills Gap?" National Associate of Colleges and Employers Center for Career Devel-

attribute hiring challenges to a skills shortages offers little data on skills that are actually available in the American labor market or any particularly rigorous evidence that would trace hiring challenges to a lack of skilled workers. In fact, industry-wide data suggest that manufacturers have no more difficulty recruiting than firms in other industries such as finance or health care, and as the Organization for Economic Cooperation and Development (OECD) argues, the U.S. manufacturing industry does not have a skills shortage but rather a skills surplus, with the supply of skilled workers exceeding demand.[5]

Another potential explanation for why manufacturers might take a long time to hire is a labor market mismatch, whereby the talent with the right skills does exist in the economy, but employers struggle to tap it due to various frictions that prevent the supply in the labor market from meeting demand. A mismatch can also manifest as a situation where hired workers are either under- or overqualified or under- or overskilled for the work they do. For example, the OECD finds that 32 percent of workers in the U.S. labor market are mismatched, or over- and underqualified for the jobs they do, and 16 percent are over- or underskilled for the jobs they do.[6] This finding is echoed in several academic studies and is rather similar to patterns in many other OECD nations.[7]

Granted, data on skills shortages and labor market mismatch problems are rife with definitional and methodological challenges, and thus the magnitude and relevance of these problems remain debated.[8] Data also need to be interpreted with care. For example, a long vacancy does not necessarily imply that a manufacturer is "struggling" to hire. But to the extent that the skills shortage and labor market mismatch problems exist, they both matter. Economists have for years shown that both skills shortages and labor market mismatches can arrest firms' productivity and undermine economic growth.[9] For example, a setting where an employee is overqualified for their job and thus mismatched may be beneficial for the firm but bad both for the employee (who likely gets less pay and unsatisfying work) and productivity growth of the economy (as the employee could likely be used more productively in another firm or position).

opment and Talent Acquisition, February 1, 2018, https://www.naceweb.org/talent-acquisition/trends-and-predictions/is-there-really-a-skills-gap/.

5. "Skills for Jobs; United States Country Note," OECD, September 2018, https://www.oecdskillsforjobsdatabase.org/data/country_notes/United%20States%20country%20note.pdf.

6. Idib.

7. For a review, see: Peter Cappelli, "Skill Gaps, Skill Shortages, and Skill Mismatches," *Industrial and Labor Relations Review* 68, no. 2 (March 2015): 251-290, https://www.researchgate.net/publication/279290714_Skill_Gaps_Skill_Shortages_and_Skill_Mismatches. Also see "Skill for Jobs Database," OECD, https://www.oecdskillsforjobsdatabase.org/ - FR/ and Lila Shapiro, "'Skills Mismatch' Causing High Unemployment? Not Quite," Huffington Post, June 14, 2012, https://www.huffpost.com/entry/skills-mismatch-unemployment_n_1292273.

8. For recent efforts to parse the concepts, see: Seamus McGuinness et al., *How Useful is the Concept of Skills Mismatch?* (Geneva: International Labour Organization, April 2017), https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_552798.pdf. In this study, "Skill gaps" describe the situation where the employer believes that workers do not possess the adequate competencies to perform their current role, while a skill shortage is a situation where employers are unable to fill key vacant posts due to a lack of suitably qualified candidates. A mismatch or skills mismatch can be vertical (overeducation, undereducation, overskilling, and underskilling) or horizontal (where the employee is hired outside one's area of study).

9. See for example: Müge Adalet McGowan and Dan Andrews, "Labour Market Mismatch and Labour Productivity: Evidence from PIAAC Data," OECD, Economics Department Working Papers, no. 1209, April 28, 2015, https://www.oecd.org/eco/growth/Labour-Market-Mismatch-and-Labour-Productivity-Evidence-from-PIAAC-Data.pdf; Müge Adalet, McGowan, and Dan Andrews, "Skill Mismatch and Public Policy in OECD Countries," OECD, Economics Department Working Papers, no. 1210, April 28, 2015, https://www.oecd.org/eco/growth/Skill-mismatch-and-public-policy-in-OECD-countries.pdf; and Daniel Boothby et al., "Technology adoption, training and productivity performance," *Research Policy* 39, no. 5 (June 2010): 650-661, https://www.sciencedirect.com/science/article/abs/pii/S0048733310000594.

The purpose of this report is to focus on such mismatch problems in manufacturing labor markets. This report lays out several frictions that keep qualified and available American workers from becoming hired by American manufacturers and puts forth ideas for both manufacturers and the public sector to make the marriages between qualified workers and best-fit jobs happen and work. As such, this report is *not* focused on measuring or analyzing skills shortages or proposing new ways to build a workforce skilled for twenty-first century manufacturing jobs. Thus, "mismatches" in this report do not refer to "skills mismatches" where workers do not have skills employers want, as they do in some studies; rather, mismatches in this report mean settings where available workers are not being easily and optimally sorted into best-fit jobs.

The exploration of the drivers of labor market frictions is not new—there is ample academic literature, especially on structural and cyclical factors that can cause labor market mismatches, for example, how stringent rental agreements can prevent workers from moving or how recessions can make employers more selective and demanding.[10] But the focus here on recruitment dynamics and frictions—like informational asymmetries and behavioral dynamics between workers and employers that keep talent from being quickly and optimally sorted into jobs—is more novel and less explored by economists, likely because of data challenges. Yet talk to any job seeker or HR department and you will quickly discover multiple frictions and gaps in the hiring process that appear to lead to suboptimal outcomes. Indeed, several analysts who do not find the skills shortage story in U.S. manufacturing compelling have called for studies that would explore precisely the kinds of frictions this report examines to account for the hiring challenges reported by manufacturers.[11] This report is intended to respond to those calls.

This report is not the first to identify the puzzle that manufacturers bemoan severe skills shortages when empirical studies do not find them. Nor is this report the first to point out that there are remarkable empirical gaps in our understanding why, as Wharton's Peter Cappelli put it, "good people cannot get jobs."[12] This report takes both sides seriously—(1) manufacturers who struggle to find workers with appropriate skills and (2) academics who see few skills shortages but do uncover frictions that keep demand and supply in labor markets from meeting optimally—and shows how these seemingly contradictory views can be reconciled. Importantly, this report does not claim that frictions caused by informational gaps are necessarily the leading cause of manufacturers' reported hiring challenges, but it does believe they are a contributor, just like skills shortages and mismatches caused by structural problems. More importantly, they are critically overlooked in policy discussions on how to help employers access the right talent.

This report also calls for more granular occupational and sectoral analyses for discussions on the future of jobs in manufacturing. Generalizations about manufacturing jobs—for

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10. Isaac Baley and Ana Figueiredo, "Mismatch Cycles," October 11, 2017, https://pdfs.semanticscholar.org/c000/b1df51d7b5782fc4ce5744024899ff49ea41.pdf.

11. See, for example: Gary Burtless, "Unemployment and the 'Skills Mismatch' Story: Overblown and Un-persuasive," The Brookings Institution, July 29, 2014, https://www.brookings.edu/opinions/unemploy-ment-and-the-skills-mismatch-story-overblown-and-unpersuasive/; Peter Cappelli, *Why Good People Can't Get Jobs: The Skills Gap and What Companies Can Do About It* (Philadelphia, PA: Digital Press, May 2012); and Andrew Weaver and Paul Osterman, "Skills Demands and Mismatch in U.S. Manufacturing," *ILR Review* 70, no. 2 (March 2017): 275–307, http://web.mit.edu/osterman/www/SkillDemandsAndMismatch.pdf.

12. Peter Cappelli, *Why Good People Can't Get Jobs: The Skills Gap and What Companies Can Do About It.*

example, that there is a skills shortage in the industry—are not useful, either to help manufacturers bring talent in the door or for policymakers seeking to craft public policies. After all, manufacturing is made up of multiple sectors and occupations, from statisticians and biomechanical engineers to machinists, clerical workers, and bench carpenters, as well as several sectors, from food production to vehicles to computers and electronics. Each of these occupations and sectors has its own dynamics, needs, and frictions. Future data and discussions about jobs and hiring challenges in manufacturing need to be more specific to occupation and sector to enable nuanced debate and impactful and targeted policy prescriptions.

Chapter 2 explores occupational dynamics in the U.S. manufacturing sector and discusses the types of occupations that are expanding and shrinking over the next decade, as well as how hard they are to fill today. The chapter 3 analyzes various potential frictions in firms' recruitment processes. Chapter 4 assesses the effectiveness of different recruiting methods and technologies to attract talent to the manufacturing industry and explores how public policy can help manufacturers access the right talent faster. Chapter 5 concludes.

2 | How Hard Is it to Hire in Manufacturing?

Manufacturing consists of several sectors with widely different growth trajectories and occupational profiles. The largest sectors are: food and beverage and tobacco products; fabricated metal products; machinery; computer and electronic products; motor vehicles; chemicals; plastics and rubber; and other transportation equipment. These sectors make up 70 percent of manufacturing jobs. From 2010-2017, post-Great Recession job growth has been particularly potent, over 2 percent per year, in motor vehicles, wood products, mineral products, plastics and rubber, and food and beverage in (Figure 1).

Manufacturing labor markets have considerable churn. In durable goods manufacturing, openings outpaced hires by 2011 and have shot up particularly after 2016; in non-durable manufacturing, openings started outpacing hires in 2013 (Figures 2a and 2b). Importantly, most of the openings are not new jobs that have never existed before. Instead, they are the result of voluntary quits, retirements, transfers of workers to other locations with the same firms, or layoffs and firings. Voluntary separations have also grown in the past three years, partly reflecting gray wave retirements and partly job-hopping, as workers seek better paying jobs and new opportunities opening in the economic boom. All in all, according to the Bureau of Labor Statistics (BLS), there were 435,000 job openings in the manufacturing industry in December 2018, while 351,000 new hires were made in the same month.[13] Openings outpace hires in most other industries, including finance and insurance, government, and health care (Figure 3).

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13. "About the Manufacturing Sector," U.S. Bureau of Labor Statistics, https://www.bls.gov/iag/tgs/iag31-33. htm#workforce.

Figure 1: Number of Manufacturing Jobs in 2017 and Growth in Manufacturing Jobs in 2010-2017
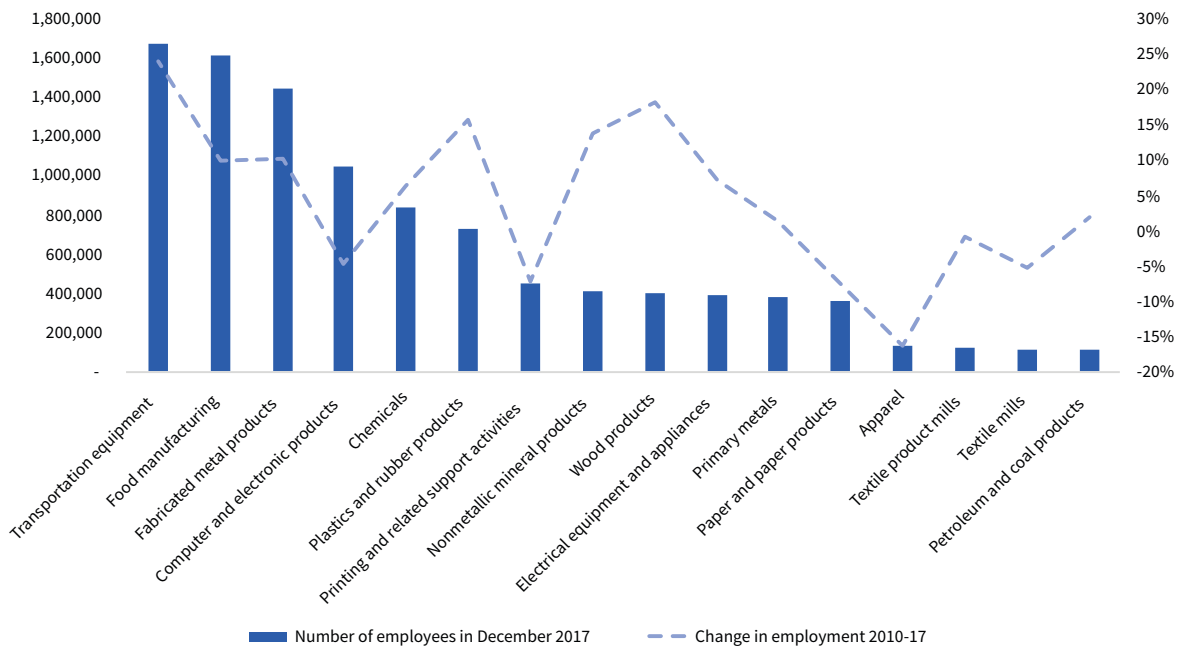
Source: "Employment, Hours, and Earnings from the Current Employment Statistics survey (National)," Bureau of Labor Statistics, https://data.bls.gov/PDQWeb/ce.

Figure 2: Labor Market Dynamics in Durable and Non-durable Manufacturing, Monthly Averages in 2009-2019 (seasonally adjusted)
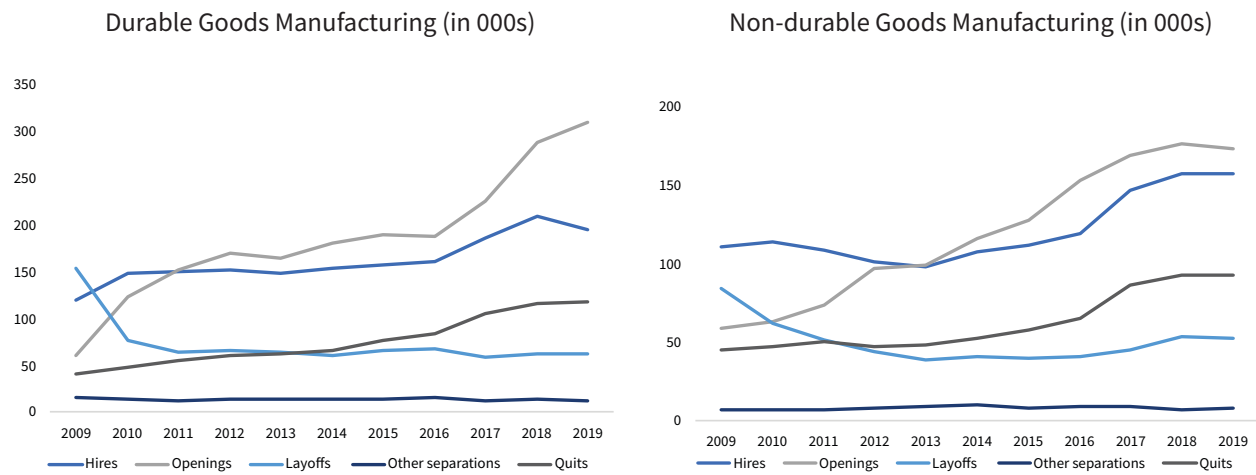
Source: "Job Openings and Labor Turnover Survey," Bureau of Labor Statistics, https://data.bls.gov/cgi-bin/dsrv?jt.

Figure 3: Openings and Hires in U.S. Industries in June 2019
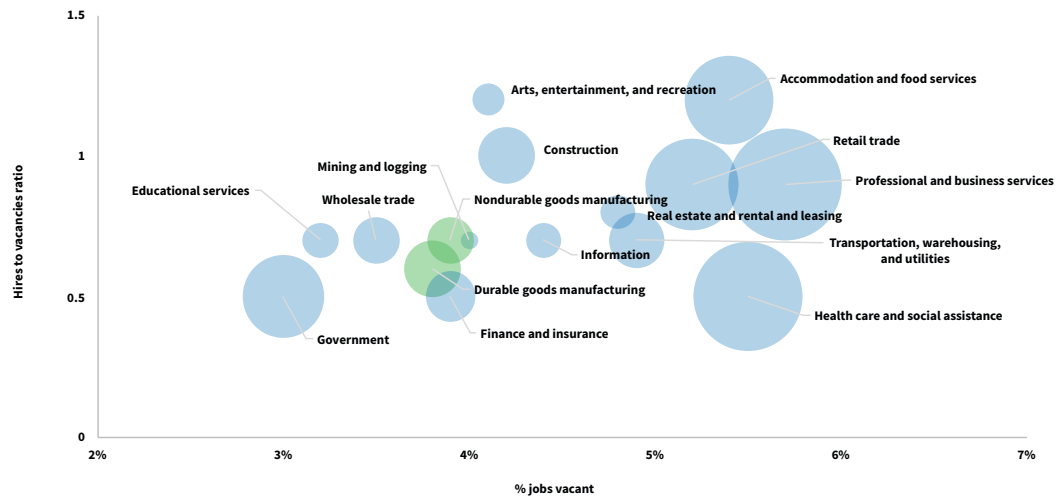
Note: Size of bubbles represents number of opening; hires-per-openings ration of <1 means more jobs unfilled than filled.

Source: Table A. Job openings, hires, and total separations by industry, seasonally adjusted, Bureau of Labor Statistics, https://www.bls.gov/news.release/jolts.a.htm.

Manufacturers employ workers in a very diverse mix of occupations. The main occupational categories making up about 30 percent of all jobs in the industry include: first-line supervisors of production and operating workers; inspectors, testers, sorters, samplers, and weighers; machinists; packaging and filling machine operators and tenders; maintenance and repair workers; industrial truck and tractor operators; industrial production managers; sales representatives; and mechanical engineers. Jobs in many of these large categories are poised to decrease, often by 10 percent or more from 2016-2026 (Figure 4).[14]

Meanwhile, the number of manufacturing jobs is poised to grow by one percent or more in the more skill-intensive categories, such as aircraft mechanics and service technicians, mechanical engineers, biomedical engineers, financial managers, operations research analysts, market research analysts and marketing specialists, and cabinetmakers and bench carpenters.[15] A large category employing some 322,000 manufacturing workers, the machinists category will grow by 0.8 percent in 2016-2026. Such medium-skilled jobs require increasingly extended computer skills that enable core production workers to program a computer numerical control (CNC) machine and work with specialized software.[16] Granted, the makeup of jobs varies by manufacturing sector. For example, the aircraft manufacturing sector will add engineers, while the food and beverage and tobacco sectors will mainly add installation and repair staff (see appendix).[17]

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14. "Occupational Outlook Handbook: Assemblers and Fabricators," U.S. Bureau of Labor Statistics, https://www.bls.gov/ooh/production/assemblers-and-fabricators.htm#tab-6.
15. This transformation is already occurring as manufacturing is undergoing "servification," whereby the share of services value-add in manufactured products is growing and manufacturers are also themselves producing more services and hiring services workers. According to Deloitte, the top skills for manufacturing workers needed going forward are technology and computer skills, digital skills, programming skills for robots and automation, and critical thinking skills. Deloitte and the Manufacturing Institute, *2018 Deloitte and The Manufacturing Institute skills gap and future of work study*.
16. Ibid.
17. "Employment Projections," U.S. Bureau of Labor Statistics, https://data.bls.gov/projections/occupationProj.

Figure 4: Growth in Manufacturing Jobs in 2016-2026

Mathematicians

Statisticians

● High-Skill   ● Low-Skill   ● Medium-Skill

Operations research analysts

Market research analysts and marketing specialists

Paralegals and legal assistants

Machinists

Agricultural engineers
Chemical engineers

Roustabouts, oil and gas

First-line supervisors of helpers, laborers, and material movers, hand

Financial managers

Cabinetmakers and bench carpenters

First-line supervisors of production and operating workers

Chefs and head cooks
Transportation inspectors

Aircraft mechanics and service technicians

Mechanical engineers

Instructional coordinators
Biomedical engineers
Carpenters

First-line supervisors of mechanics, installers, and repairers

Management analysts

Logisticians
Purchasing managers

Business operations specialists, all other

Industrial truck and tractor operators

Packaging and filling machine operators and tenders

First-line supervisors of transportation and material-moving machine and vehicle operators

Materials engineers
Chemical technicians

General and operations managers

Computer and information systems managers
Extraction workers, all other

Semiconductor processors

Customer service representatives

Sales representatives, wholesale and manufacturing, except technical and scientific products

Extruding, forming, pressing, and compacting machine setters, operators,...

Sales representatives, services, all other

Production, planning, and expediting clerks

Advertising sales agents

Computer hardware engineers

Shipping, receiving, and traffic clerks
Maintenance and repair workers, general

Credit authorizers, checkers, and clerks

Bookkeeping, accounting, and auditing clerks
Office clerks, general

Payroll and timekeeping clerks

Receptionists and information clerks
Print binding and finishing workers

Industrial production managers

Chief executives

Laundry and dry-cleaning workers

Secretaries and administrative assistants, except legal, medical, and executive

Inspectors, testers, sorters, samplers, and weighers

Engine and other machine assemblers

First-line supervisors of office and administrative support workers

Prepress technicians and workers

% of Total Industry Employment

Executive secretaries and executive administrative assistants

Note: Size of bubbles represents the size of employment in the occupation. Color of the bubble represents the occupation's skill-intensity.

Source: "Employment Projections, National Employment Matrix, 31-330 Manufacturing," Bureau of Labor Statistics, https://data.bls.gov/projections/nationalMatrix?queryParams=31-330&ioType=i.

The changing occupational makeup of the manufacturing industry suggests that manufacturing workers will have skills in demand across industries. For example, while engineering is a fast-growing occupation in the manufacturing industry, only 34 percent of American engineers actually work in manufacturing; 66 percent of engineers work in other industries, such as in informational technology or professional services. In another fast-growing occupation, only 54 percent of industrial machinery installation workers work in the manufacturing industry, while 46 percent work in other industries, such as in machinery repair, electric power generation, natural gas distribution, pipeline transportation, and machinery wholesale industries. In contrast, of first-line supervisors and team assemblers, both declining occupations in the manufacturing industry, 72 percent and 97 percent of workers, respectively, work in manufacturing. Altogether, in the occupations that show growth in manufacturing in 2016-2026 (weighted by the size of the labor force in those occupations), 34.7 percent of workers are in manufacturing; but 45 percent of workers from declining occupations are in manufacturing. This suggests that while the manufacturing worker of the past tended to be in occupations specific to the manufacturing industry, the manufacturing worker of the future will more likely be in occupations in demand across industries. This in turn means that manufacturers may have to work harder to attract and retain talent.

## Is it really hard to find workers for manufacturing?

How difficult is it then for manufacturers to find and hire the workers they need? A useful proxy for potential hiring challenges facing manufacturers is the length of vacancies: it can be expected that positions that are hard to fill also take a long time to fill. In a nonrandom sample produced by an online survey of 400 manufacturing executives in the Deloitte and Manufacturing Institute study mentioned earlier, more than 80 percent of manufacturers report they struggle to find people to fill their skilled production jobs and indicate that it takes as long as 13 weeks to hire skilled production workers, 17 weeks to hire engineers and scientists, and 12.5 weeks for all other workforce areas.[18] Yet other data suggest that manufacturers may not be that hard-pressed to find and hire workers:

- In a random sample of 900 U.S. manufacturers, Weaver and Osterman (2017) find that only 5 percent or fewer of American manufacturers have vacancies in core positions, only 16-25 percent have long-term vacancies in non-core roles, and manufacturers in general fill vacancies quickly—the median company hires a core worker in four weeks and the average establishment in six weeks.[19] A smaller indicative survey the author conducted with 200 U.S. manufacturers on May 5-30, 2019 echoes this finding: two-thirds of respondents report that the hard-to-fill jobs typically take 3-5 weeks to fill, and a quarter of respondents report needing 5-7 weeks to fill positions, with small firms reporting faster hiring in general (Figure 5). Only six percent reported vacancies of longer than seven weeks. In our survey, firms reported the most difficulty identifying candidates for the more high-skilled roles (Figure 6), while in interviews manufacturers tended to single out the medium- and high-skilled categories as hardest to fill.

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18. Deloitte and the Manufacturing Institute, *2018 Deloitte and The Manufacturing Institute skills gap and future of work study*.
19. Weaver and Osterman, "Skills Demands and Mismatch in U.S. Manufacturing."

Figure 5: Time to Hire a Candidate in Hard-to-fill Positions, 200 Manufacturing Firms

- Less than 3 weeks
- 3-5 weeks
- 5-7 weeks
- More than 7 weeks
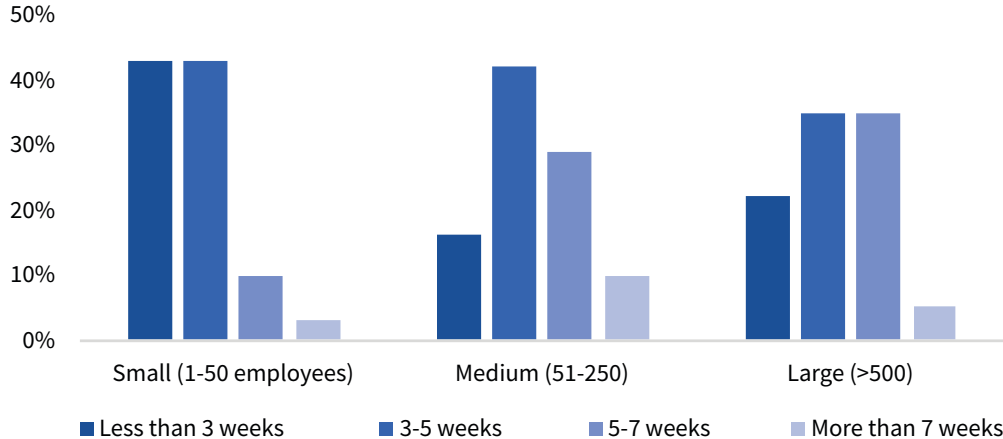
Source: Online survey by author of 200 U.S. manufacturers on May 5-30, 2019.

Figure 6: Ease of Hiring for Different Types of Skill Levels, 200 Manufacturing Firms

Small (1-50 employees) Medium (51-250) Large (>500)
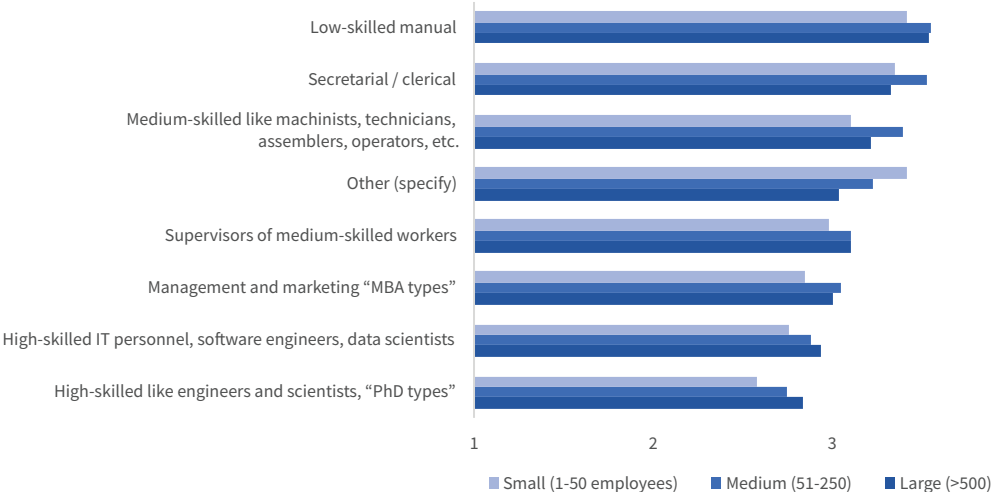
Note: 1 = very difficult to find candidates; 5 = very easy to find candidates.

Source: Online survey by author of 200 U.S. manufacturers on May 5-30, 2019.

- Another indicator of hiring challenges is the Beveridge curve. The curve plots unemployment rates to job openings rates; high openings rates amid high unemployment and ample supply of workers indicates hiring managers have difficulty accessing the appropriate talent. The Beveridge curve's recent moves do not indicate hiring in manufacturing is getting harder. In the latest data from May 2019, the Beveridge curve is at a rather unprecedented point: 4.6 percent job openings rate and 3.6 unemployment rate, a slight inward shift in the curve from April 2018 (4.6 percent and 3.9 percent, respectively). In other words, it seems hiring and employment are both high, and the ability to find workers has improved slightly from 2018.[20]

20. The graph captures the impact of advertising, hiring standards, compensation packages, and other employ-

- Still another indicator of the hiring challenges, the DHI Hiring Indicators measure of average vacancies did rise to 32 working days in 2016 and 31 working days, or roughly 6 weeks, in the first half of 2017 from 21 days in 2004-2006. But the trend is similar across industries, and vacancies in non-manufacturing sectors take longer to fill, for example, in financial services (46 days), health services (49 days), information, (32 days), and government (41 days).

In short, various data on the hiring challenges faced by manufacturers deliver contradictory results, and evidence largely suggests that manufacturers are not particularly struggling to hire, certainly no more than many other leading industries. In addition, extended vacancies in certain occupations in U.S. manufacturing do not always have to result from hiring challenges. For example, employers may worry about economic prospects or some policy change and postpone hiring, as occurred in the Great Recession. Or, some of them may experience a curse of riches: the number of qualified candidates applying for a position may be high, lengthening the hiring process. Still another possibility is that some employers are highly discerning in filling certain types of jobs, which lengthens vacancies. Weaver and Osterman find that the more technical and firm-specific the skills, the harder the job seems to be to fill.[21] They hypothesize that certain occupations in manufacturing have become so niche and specialized that companies are looking for workers with hyper-specific skills and are willing to take a long time to identify the standout who will help the company differentiate itself from its peers.

Reconciling Diagnostics about Skills Shortages Versus Labor Market Mismatches

To the extent that hiring challenges do exist in manufacturing, their causes can be several, not just skills shortages. In fact, a 2018 OECD study finds that manufacturing in the United States, along with mining, transportation and storage, energy supply, and wholesale industries, has a skills surplus rather than a shortage, with supply of workers exceeding demand, while real estate and accommodation and food services are facing the most intense occupational shortages.[22] Another explanation for hiring challenges in manufacturing, to the extent they exist, is a labor market mismatch, where talent with skills and qualifications does exist but is not optimally sorted into jobs requiring those skills and qualifications. In the OECD study, 32 percent of workers in the United States are mismatched, or over- and underqualified for the jobs they do, numbers echoed across OECD nations and in several academic studies.[23]

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er actions that influence the pace of job filling. Buckley Rumki Majumdar, "A growing skills mismatch? Not necessarily." The graph suggests hiring challenges arise when there is increasing unemployment but the same level of job openings, meaning that though employers open jobs, more workers become unemployed. This setting would then call for speculation about a skill shortage or some sort of mismatch. But today, this is not occurring, at least not in the economy as a whole. For example, in November 2004 the job opening rate was 2.5 percent and unemployment 5.4 percent, but in August 2009 unemployment was 9 percent, at the same opening rate of 2.5 percent. That is, something was making employers less likely to hire in August 2009 or workers less likely to seek employment. This does not mean that suddenly Americans lost useful skills within five years and that the outward shift was due to a sudden skills shortage; it may simply mean that employers were hesitant to hire given uncertain economic conditions. Indeed, the recruitment intensity that measures how eagerly employers seek to hire for jobs they post hit rock bottom in August 2009.

21. Weaver and Osterman, "Skills Demands and Mismatch in U.S. Manufacturing."
22. "Skills for Jobs; United States Country Note," OECD.
23. Idib.

There are at least five ways to reconcile the seemingly contradictory arguments of those that perceive skills shortages and struggle to hire and researchers that do not see major struggles to hire (but may see some mismatches):

- Manufacturers often hire workers in a specific place where the work is to be done and may face a location-specific skills shortage. Yet this does not mean there is a national skill shortage: there likely are workers in the United States able to do the job, but they never apply because they do not see the job posting, do not want to incur relocation costs, do not want to move, or want a different employer and better pay, among other reasons. In such a situation, the manufacturer never sees the talent in the American labor market, even if it does exist, and perceives a skills shortage. Conversely, a researcher may see a labor market mismatch.

- Shortages of specific types of workers such as machinists may wash out in broader, industry-wide analyses such that what a manufacturer sees as a severe skills shortage in an occupation does not show up in aggregate data examined by economists, who often examine an immense range of sectors and occupational categories in the U.S. manufacturing sector.

- Manufacturers settle for workers with passable skills (so that hiring is quite swift) yet complain about skills shortages. This phenomenon would then show up in data as a labor market mismatch rather than skills shortage: talent was hired, but it was mismatched.

- Part of the reason why manufacturers see a skills shortage where studies do not can be intertemporal; some of the former studies heralding a skills gap focus on the future, while the latter studies look at the recent past and present. And thus again, both may be right.

- As called for by several scholars, part of the answer may be taking a different analytical approach by analyzing manufacturers' recruitment and hiring practices and the frictions that may keep talent with the right skills from applying to vacancies in manufacturing. Again, the manufacturer would perceive skill shortages (as no one applied), while a researcher may see mismatches. The next section examines these frictions.

3 | Why Might Supply and Demand Fail to Meet in Manufacturing Labor Market?

Imagine a labor market without friction—one of perfect and complete information and full mobility. In such a market, all employees would immediately know about all vacancies when they become available and about the job's features and compensation, the employers offering them, and the competition the worker would face if applying. All employers would have perfect visibility into supply in the labor market and know where and who the best-fit workers are and what their past performance and qualities are. Any worker could immediately resign and move to a new job, even if it were in a different sector and geography, and every employer could fill every vacancy immediately. There would be no search costs, , no lags in hiring, and probably few mismatched workers.

This, of course, is not the labor market that exists today. Instead, employers in the United States spend a great deal of time and money to find, interview, and hire workers, and workers spend time to look for, apply, and interview for jobs—on average a total of 43 days, ranging from 36 in hospitality to 71 in C-level jobs.[24] The matching game, and informational asymmetries between workers and employers that undergird it, have helped create a $154 billion industry of recruiters, with U.S. companies on average spending $4,129 to fill a job, and much more to fill a management position.[25] And judging by OECD data, the matches that are made are not perfect: a third of American workers are under- or overqualified for the jobs they get up to do every day.

Causes of Mismatches between Labor Demand and Supply

A plausible reason why manufacturers perceive hiring challenges and long lags in filling vacancies in certain jobs and spend significant resources to recruit is that the supply of talent for those jobs is hampered from knowing about, applying, or taking those jobs. What could then cause mismatches that stop demand and supply from meeting and the right talent from being allocated to the right jobs? There are at least three sets of explanations.

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24. Martha C. White, "Here's How Long It Really Takes to Get a Job," *Money*, October 22, 2015, http://money.com/money/4053899/how-long-it-takes-to-get-hired/.
25. Peter Cappelli, "Your Approach to Hiring Is All Wrong," *Harvard Business Review*, May-June 2019, https://elb.hbr.org/2019/05/recruiting#your-approach-to-hiring-is-all-wrong.

HIRING CHALLENGES VARY BY STRUCTURAL AND CYCLICAL ISSUE IN THE ECONOMY.
One widely examined set of explanations for labor market mismatches are structural and cyclical factors, such as labor market regulations that make it hard to fire poorly-performing labor, rent agreements that keep workers tied to a place, and recessions that make employers pickier.[26] Compared to its OECD peers, the United States does relatively well across the many macroeconomic policies found to enable a flexible and responsive labor market, which helps workers move across firms and geographies and helps employers tap the right talent. The United States has relatively flexible labor regulations for employers to hire and fire; rental agreements to enable workers to move for a new, promising job; and bankruptcy laws that enable people to get a fresh start after a business failure.[27] When analyzing our OECD peers, economists anguish about employment laws that make it comfortable for a worker to stay in a company even if the individual is ill-suited for the work and rigid labor market regulations that make it hard for employers to fire workers.[28] Indeed, Bartelsman et al. (2013) find that an index of labor productivity in the U.S. manufacturing industry is 50 percent higher than it would be if employment shares were randomly allocated within industries. This figure would only be 20-30 percent in Western European economies.[29]

At the same time, several recent studies suggest that the geographic mobility of labor has decreased in the United States since the 1970s, either because the payoffs from moving elsewhere are less or because there is less demand elsewhere to begin with. There are multiple potential hypotheses as to why, laid out in an excellent paper by Molloy et al. (2016), but only a handful of hypotheses seem to bear empirical scrutiny.[30] In a pioneering paper on data from the late-1960s to the late-2000s, Molloy, Smith, and Wozniak (2013) find a decline in the wage gain associated with changing employers but no change in the wage gain associated with staying at the same employer (i.e., the return to firm-specific tenure). Meanwhile, there is limited evidence that increased restrictions on housing would have played a role in labor market mobility or that costs of moving would have increased and would be prohibitive of interstate moves.[31] However, one regulatory problem may have contributed to the reduced mobility: occupational licensure rules that hamper interstate movement of workers. In a recent study of 22 licensed occupations, the interstate migration rate for individuals in occupations with state-specific licensing exam requirements is 36 percent lower relative to members of other occupations.[32] Meanwhile, workers in occupations with national licensing exams do not experience limited interstate migration, and reciprocity agreements across jurisdictions also help increase interstate migration.

26. Baley and Figueiredo, "Mismatch Cycles."
27. Adalet McGowan and Andrews, *The Future of Productivity*; "Skill Mismatch and Public Policy in OECD Countries," OECD, Economic Department Working Papers, no. 1210, April 25, 2018, http://search.oecd.org/eco/growth/Skill-mismatch-and-public-policy-in-OECD-countries.pdf; and David M. Arseneau and Brendan Epstein, "The Welfare Costs of Skill-Mismatch Employment," Federal Reserve Board, June 5, 2014, https://www.federalreserve.gov/pubs/feds/2014/201442/201442pap.pdf.
28. Baley and Figueiredo, "Mismatch Cycles."
29. Eric Bartelsman et al., "Cross-Country Differences in Productivity: The Role of Allocation and Selection," *American Economic Review* 103, no.1 (February 2013), http://econweb.umd.edu/~haltiwan/Cross_Country_Differences_Productivity_AER_2013.pdf.
30. Raven Malloy et al., "Understanding Declining Fluidity in the U.S. Labor Market," Brookings Institute, February 2016, https://www.brookings.edu/wp-content/uploads/2016/03/molloytextspring16bpea.pdf.
31. Raven Malloy et al., "Declining Migration within the US: The Role of the Labor Market," Federal Reserve Board, April 2014, https://www.federalreserve.gov/pubs/feds/2013/201327/revision/201327pap.pdf.
32. Janna E. Johnson and Morris M. Kleiner, "Is Occupational Licensing a Barrier to Interstate Migration?" National Bureau of Economic Research, Working Paper 24107, December 2017, https://www.nber.org/papers/w24107.pdf.

To be sure, the decrease in labor market fluidity may also have been due to demand-side dynamics, specifically the decrease in business dynamism, new firm formation, and entrepreneurship since 2000.[33] Employment in America has become more concentrated in large and old firms, and employed workers are getting fewer offers to work at other firms. One manifestation of such concentration is a decrease in young firms' employment share, which has dropped by about 2 percent in manufacturing and over 10 percent in construction in 2000-2014.[34] Claims about reduced worker mobility do require further examination now that the United States is further from the Great Recession.

HIRING CHALLENGES VARY BY FIRM SIZE AND GEOGRAPHY.

Labor market mismatches can also be hypothesized to vary with firm characteristics, including size, sector, and geography. One idea is that small firms have more trouble filling jobs because they have fewer resources to stand out in the labor market and vet and engage candidates or because employees worry that small and young firms are likelier to fail. An opposing idea is that larger firms are likelier to have long-term vacancies: they may have a wider pool of workers to make up for the unfilled role and thus less urgency to fill a job than a smaller firm would have.[35] In our survey, smaller firms report somewhat greater challenges to attract high-skilled talent than large firms, but the time to fill hard-to-fill jobs is nonetheless quite similar across large and small firms. Small firms may also perceive being more challenged because one unfilled role is a bigger share of the total labor force in a small firm, and therefore absences are more visible and have greater impact.

Firms' geography can also shape recruitment challenges, for example, making it harder for remote and rural firms to access highly-skilled employees who tend to cluster in urban areas among their peers and emerge from educational establishments also located in major urban areas. However, in the author's small, indicative sample, firms that are semi-urban (within 30 miles from major metropolitan regions) or rural (far from metropolitan areas and with less than 30,000 residents) do not have significantly greater challenges than firms in metropolitan areas. This may be explained by the Weaver and Osterman study that suggests that firms in sector-specific geographic clusters are most hard-pressed to fill vacancies, likely because they look for highly specialized skillsets to differentiate themselves from their peers in the cluster, which then results in long-term vacancies.[36] Clusters do improve access to talent and cross-pollination of ideas across firms, but they also appear to result in greater competition among firms; more job-hopping, as frictions to depart and move to another employer down the street are low; and a need for firms to differentiate more from their peers. This does not of course negate the accounts of industry executives that set up a new plant in a remote or rural location with few other manufacturers and struggle to find workers for it.

HIRING CHALLENGES HAVE TO DO WITH FIRMS' HIRING AND RETENTION PRACTICES.

Other sets of explanations for the mismatches are less explored, particularly among economists. For example, firms' recruitment efficiency and frictions such as informational

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33. Mike Konczal and Marshall Steinbaum, "Declining Entrepreneurship, Labor Mobility, and Business Dynamism: A Demand-Side Approach," Roosevelt Institute, July 21, 2016, http://rooseveltinstitute.org/wp-content/uploads/2016/07/Declining-Entrepreneurship-Labor-Mobility-and-Business-Dynamism-A-Demand-Side-Approach.pdf.
34. Ibid.
35. Weaver and Osterman, "Skills Demands and Mismatch in U.S. Manufacturing."
36. Ibid.

asymmetries and behavioral dynamics between workers and employers can keep talent from quickly and optimally being sorted into jobs. Calls to analyze frictions in how employers attract and select from the pool of supply have grown in recent years among economists grappling with the industry claims of skills shortages.[37] The following seeks to provide some of those answers.

How Recruitment Processes Can Contribute to the Mismatch

The recruitment process can usefully be thought of as a funnel where at the top there is the full 100 percent pool of available workers in an occupation. A subset of this labor pool searches for jobs; a subsequent subset reads a job posting; another subsequent subset decides to apply; and finally a subset of those finishes an application. Those that apply may get their CVs screened by an automated "robo-screener" or sorted by a recruiter, which narrows the pool further, followed by an interview by an HR manager. Then some small share will be interviewed by the management team, and ultimately one person gets hired (Figure 7).
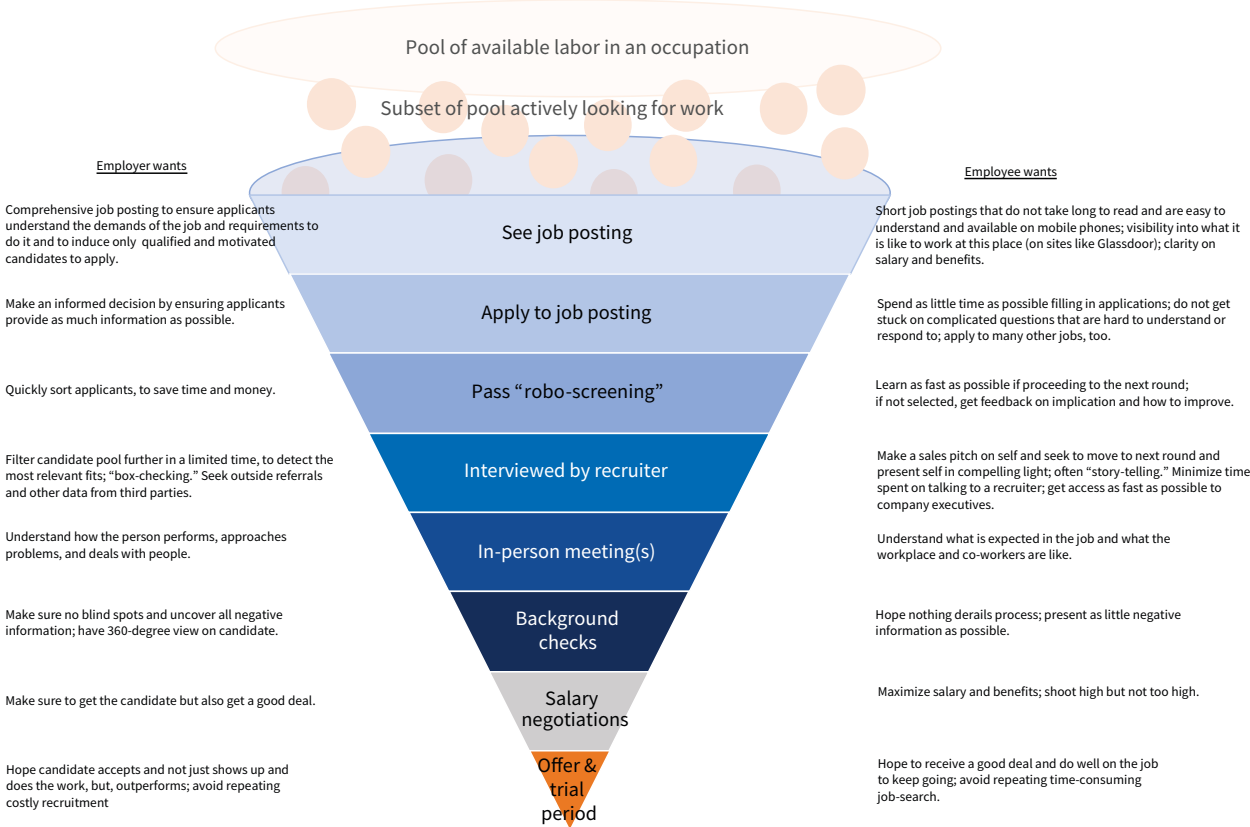
Any layer of the process offers ample opportunities for mismatches, especially as employers and employees tend to have different incentives and information. For example, the mismatch problem can occur at the top before candidates even get into the funnel: qualified and interested candidates may never see the company's job posting or, if they do, never apply, perhaps because they do not like the company, its location, or the job itself or because they self-censor and feel that they are not qualified. Candidates may also apply but happen to be faced with a recruiter that applies a very rigid check-the-boxes method to screen out candidates who could bring a great deal to the table.

The mismatch challenge can also occur across channels that are used to recruit workers. Manufacturers tend to recruit through many means: our survey suggests they use mostly online job platforms, their own websites, employee referrals, outbound queries on LinkedIn, and recruitment events. Similarly, candidates look at many sources: on average, over half of American job seekers use four or more sources to look to be hired, including online platforms, social media, and networking with friends, family, and colleagues.[38] As manufacturers and candidates look for each other in the marketplace, there are numerous opportunities for them to connect, but also numerous opportunities for them to fail to connect.

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37. Ibid. Also see: John Ydstie, "U.S. Employers Struggle To Match Workers With Open Jobs," NPR, August 31, 2017, https://www.npr.org/2017/08/31/547646709/u-s-employers-struggle-to-match-workers-with-open-jobs.
38. Aaron Smith, "Searching for Work in the Digital Era," Pew Research Center, November 19, 2015, https://www.pewinternet.org/2015/11/19/1-the-internet-and-job-seeking/.

Figure 7: Recruitment Mismatch: What Workers and Employers Want at Each Stage

Pool of available labor in an occupation

Subset of pool actively looking for work

Employer wants

Comprehensive job posting to ensure applicants understand the demands of the job and requirements to do it and to induce only qualified and motivated candidates to apply.

Make an informed decision by ensuring applicants provide as much information as possible.

Quickly sort applicants, to save time and money.

Filter candidate pool further in a limited time, to detect the most relevant fits; "box-checking." Seek outside referrals and other data from third parties.

Understand how the person performs, approaches problems, and deals with people.

Make sure no blind spots and uncover all negative information; have 360-degree view on candidate.

Make sure to get the candidate but also get a good deal.

Hope candidate accepts and not just shows up and does the work, but, outperforms; avoid repeating costly recruitment

Funnel stages (top to bottom):
- See job posting
- Apply to job posting
- Pass "robo-screening"
- Interviewed by recruiter
- In-person meeting(s)
- Background checks
- Salary negotiations
- Offer & trial period

Employee wants

Short job postings that do not take long to read and are easy to understand and available on mobile phones; visibility into what it is like to work at this place (on sites like Glassdoor); clarity on salary and benefits.

Spend as little time as possible filling in applications; do not get stuck on complicated questions that are hard to understand or respond to; apply to many other jobs, too.

Learn as fast as possible if proceeding to the next round; if not selected, get feedback on implication and how to improve.

Make a sales pitch on self and seek to move to next round and present self in compelling light; often "story-telling." Minimize time spent on talking to a recruiter; get access as fast as possible to company executives.

Understand what is expected in the job and what the workplace and co-workers are like.

Hope nothing derails process; present as little negative information as possible.

Maximize salary and benefits; shoot high but not too high.

Hope to receive a good deal and do well on the job to keep going; avoid repeating time-consuming job-search.

There are many viable hypotheses around the application phase, selection process, and sealing the deal (hiring a retention) as to why a company may struggle to hire a candidate it wants:

APPLICATION PHASE

Getting candidates in the funnel. Many studies have made the point that today's workers in America are uninterested in manufacturing and thus in getting into the manufacturing recruitment funnel to begin with. One idea is that manufacturing has a certain stigma around it as a dirty and dangerous profession focused on manual labor. Another idea is that manufacturing is seen as an unstable industry, given well-publicized layoffs over the past decade due to technological changes and import penetration from China. A 2017 survey by Deloitte and the Manufacturing Institute found that only 32 percent of Americans think jobs in manufacturing are clean and safe; only 31 percent believe manufacturing jobs pay more than jobs in other industries; only 28 percent believe the manufacturing industry provides adequate job security; and only 21 percent think jobs in manufacturing are increasingly available and accessible.[39] The perception problem affects the entire community surrounding a candidate, such as parents, teachers, and guidance counselors at middle and high schools. Fewer than 30 percent of Americans would

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39. Deloitte, National Association of Manufacturers, and the Manufacturing Institute, *A look ahead: How modern manufacturers can create positive perceptions with the US public* (New York: 2017), http://www.themanufacturingin-stitute.org/~/media/9607397D3AFC423AB68133505EE2C348/2017_US_Public_Perception_Manufacturing_Study.pdf.

encourage their children to pursue a career in manufacturing, but parents that are familiar with the manufacturing industry are two times more likely to do so.[40]

A recent interview-based CSIS study on skills development in manufacturing, which involved a range of manufacturers and manufacturing training centers that prepare workers for certain specific occupations in advanced manufacturing, such as for workers in machining and 3D printing, found that "everyone we spoke with mentioned there is a negative perception of manufacturing jobs" and that interviewees agreed it is "challenging finding applicants to advanced manufacturing training programs and that many potential students did not know about options for careers in advanced manufacturing."[41] In addition, most engineering programs no longer require students to take classes in manufacturing, which further curtails student exposure to those industries and limits the number of people able to teach manufacturing.

These findings are especially valid in certain manufacturing occupations and sectors, but they are about the future workforce and building up new talent. After all, an existing machinist is unlikely averse to manufacturing jobs. In addition, these studies cover only a set of workers in manufacturing, a hugely diverse industry employing engineers, mathematicians, clerks, and accountants; therefore, generalizations that the industry is doomed because of an image problem of dirty and dangerous work go only so far.

In addition, claims that manufacturing does not have pull with workers also assume that candidates see an employer as a "manufacturer" when it is quite plausible that candidates that see job postings by Tesla, GE, Apple, Boeing, or Coca-Cola could not care less about the fact that all these American icons are in fact manufacturers. And though candidates may avoid certain jobs and sectors in manufacturing, it is also likely that especially younger candidates are much more interested in the company's reputation, brand, and other company-specific characteristics than in judging it by the industry it happens to be in. According to a LinkedIn survey, 75 percent of candidates will research a company's reputation before applying for an opening, and 69 percent forego applying if they do not like what they see.[42] The overwhelming popularity of Glassdoor, a platform where employees can grade their employers, share salary information, and review work environments, also suggests that manufacturers are not necessarily victim to the entire industry being perceived negatively, at least not in all jobs; they may have to brand their businesses better and build awareness with candidates about their company, values, culture, and available jobs. In other words, getting candidates in the funnel is not only a function of image issues.

Other sectors offer better pay for the same talent. Especially passive candidates—the three-quarters or so of American workforce who are currently working and not actively looking to leave their jobs—are drawn by pay: 85 percent of them are ready to leave, and 61 percent would leave for better compensation.[43] Are manufacturers paying enough to lure

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40. Ibid.
41. Charles Carson et al., "Training the Next Revolution in American Manufacturing."
42. LinkedIn Talent Solutions, "The Ultimate List of Employer Brand Statistics for Hiring Managers, HR Professionals, and Recruiters," LinkedIn, https://business.linkedin.com/content/dam/business/talent-solutions/global/en_us/c/pdfs/ultimate-list-of-employer-brand-stats.pdf.
43. "Retaining Top Performers," Roth Staffing, http://www.rothstaffing.com/client/?p=4920.

these candidates? Some argue that there is a wage premium for jobs in the manufacturing industry, especially when considering the benefits offered in the industry, and that manufacturers are well-placed to recruit talent. This may be the case in certain occupational categories, but, purely comparing wages, employers in the manufacturing industry and selected sectors within it appear to pay less for the same occupations than industries like professional and business services, financial services, and information technology (Figure 8) (granted, a strictly apples-to-apples comparison would adjust these wages to location). Some of the largest occupational groups in manufacturing in nonmetropolitan regions are particularly poorly compensated, even compared to the same occupation in the same places in other industries. This suggests that manufacturers may not be paying well enough to get talent into the funnel or hired after it is in the funnel. Aerospace manufacturing, and at times computer and electronic production sectors, are exceptions; median wages in them are higher for workers in nearly all occupations than in other industries. Manufacturers have not been blind to the age-old method of paying better to attract and retain talent. In the Deloitte Survey in 2018, 83 percent of manufacturing executives said they had improved pay and benefits to attract more talent, up from 72 percent in 2015.[44]

Figure 8: Median Hourly Wages in Some of the Largest Manufacturing Occupations in Selected Industries, 2018

Source: "Occupational Employment Statistics," Bureau of Labor Statistics:,https://www.bls.gov/oes/current/oes_stru.htm.

44. Deloitte and the Manufacturing Institute, *2018 Deloitte and The Manufacturing Institute skills gap and future of work study*.

Candidates do not see the job posting: manufacturers recruit online but in the wrong sites, on the wrong screens, and with the wrong goals. According to a 2015 study by the Pew Research Center, 90 percent of recent job seekers in the United States have searched for jobs online, and 84 percent have applied through online job listings.[45] A third see online channels as the most important source for resources and information about jobs. In the author's survey, 53 percent of manufacturers report seeking candidates by posting jobs on online platforms and 46 percent by posting them on the company's site as well. Online postings are vital, especially among highly educated candidates and younger people: almost 80 percent of all 18-29-year-olds have applied for jobs online, compared to only 57 percent in the 30-49 age group.[46] Where manufacturers seem to fail is in using social media platforms: in our survey, only 24 percent of manufacturers actively use social media platforms to engage candidates. Yet among 18-29-year-olds, 43 percent of social media users have used social media to look for jobs, and 29 percent have applied for jobs they found on social media.[47] In a 2015 Careerbuilder survey, manufacturers did better, with 49 percent recruiting on social media, but this is well below the levels in information technology (76 percent) and financial services (64 percent), industries that manufacturers will be competing with for talent.[48]

Manufacturers have also yet to become "mobile-first," failing to prioritize candidates' extensive use of mobile phones in job searches and applications. In the Pew survey, 93 percent of college graduates browse jobs on their phones, 90 percent are likely to call a potential employer by phone, and 37 percent use phones to fill out job applications.[49] Mobiles are also used by segments that may not own a laptop or computer: households headed by African Americans or Hispanics and households with under $25,000 in yearly income tend to use smartphones more than other devices to connect online, and a small subset of them are "smartphone-only" and do not have a laptop or a computer.[50] Sixty-one percent of Americans with a high school degree report filling out job applications on their mobile devices, and 33 percent of them create résumés or cover letters on their mobiles.[51] Over half of 18-29-year-olds in the United States have used their smartphones as part of a job search, and of those, half have used their smartphones to fill out job applications. Furthermore, 44 percent of job seekers on Indeed.com search jobs only on a mobile device. Yet, 56 percent of Fortune 500 job applications are not mobile friendly; in our survey, only 47 percent of manufacturers enabled candidates to apply for jobs using their mobile phones.[52] In other words, candidates may go to different windows—including sites and screens—than employers.

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45. Smith, "Searching for Work in the Digital Era."
46. Ibid.
47. Ibid.
48. "Number of Employers Using Social Media to Screen Candidates Has Increased 500 Percent over the Last Decade," CareerBuilder, April 28, 2016, https://www.careerbuilder.com/share/aboutus/pressreleasesdetail. aspx?ed=12%2F31%2F2016&id=pr945&sd=4%2F28%2F2016; and "35 Percent of Employers Less Likely to Interview Applicants They Can't Find Online, According to Annual CareerBuilder Social Media Recruitment Survey," CareerBuilder, May 14, 2015, https://www.careerbuilder.com/share/aboutus/pressreleasesdetail.aspx-?ed=12%2F31%2F2015&id=pr893&sd=5%2F14%2F2015.
49. Smith, "Searching for Work in the Digital Era."
50. Ibid.
51. Ibid.
52. "Study: Which Companies Offer the Fastest Online Job Application Process?" Indeed, August 15, 2016, http:// blog.indeed.com/2016/08/15/fastest-job-application-process/; Smith, "Searching for Work in the Digital Era."

Of course, in some candidate segments, candidates are less likely to use the internet to search for jobs. For example, older workers are likelier to look at television and newspaper ads and participate in recruitment events. The use of the internet among workers that are over 65 years old stands at 67 percent, as opposed to 89 percent among 35-44-year-olds, and drops off further for poorer households in this age segment.

Candidates see a job posting but will not apply because they do not see the right signals: salary, benefits, advancement, and training opportunities. The recruitment advertising company Appcast's 2018 survey found a direct positive relationship between the number of non-cash benefits listed on a job listing and the application rate.[53] Surprisingly, many manufacturers do not list salary and benefits on their job postings, even if those are important for candidates. In our survey, 50 percent of manufacturers said they list the starting salary in a job ad, 54 percent list medical benefits, 52 percent list training opportunities, if offered, and 38 percent list if they would cover moving expenses. But in the author's read of what manufacturers actually say in 50 job postings by a diverse range of manufacturers, only 16 percent stated starting salary, 22 percent listed medical benefits, 8 percent listed training possibilities, and only one company listed relocation assistance. Of course, employers have an incentive to hide this information to be able to negotiate it, just as candidates have an incentive to obtain it to understand where to apply and place their bets.

Candidates see the posting but do not apply or finish applications due to long and complex job descriptions or personal impatience. For potential applicants searching for employment opportunities, online job listings are often the first impression they gain of a company. An engaging and well-structured job listing can prompt more applicants to apply for and research a company, whereas a poorly-written or overly complicated job listing is likely to turn applicants away. This may be because hiring managers and recruiters do not quite understand what the job entails—hiring managers often believe recruiters do not understand what they should be looking for—and because they want to raise the bar in order to attract only good fits, ensure they get excellent fits to apply, and acquire as much information on candidates as possible.

However, the candidate has opposing incentives: an individual will want to proceed as quickly as possible through an application, to look at further postings, or perhaps get back to a current job. Especially in boom times, candidates find many job postings that seem interesting and have only so much time to apply to any one job, especially if they are already working. Complicated postings and demanding application requirements create a selection process where only the highly motivated and persistent candidates will last until the end. But they can also result in "cart abandonment" by candidates that may be qualified but instead decide to spread their bets and apply with, say, three to four competitors whose application process is shorter. Thus, they may apply to three to four places instead of just one in the same amount of time. Some 30 percent of candidates and 57 percent of those earning $100,000 want to move very fast and will not spend longer than 15 minutes on an application.[54]

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53. Appcast, *2018 Recruitment Media Benchmark Report* (Lebanon, NH: 2018), https://cdn2.hubspot.net/hubfs/1859609/FINAL percent20CONTENT percent20PDFS/Reports/2018 percent20Recruitment percent20Media percent20Benchmark percent20Report percent20 percent5BAppcast percent5D.pdf.
54. "Study: Which Companies Offer the Fastest Online Job Application Process?" Indeed.

Thus, the length of the application also shapes the applicant pool manufacturers see. The longer the application, the larger the share of candidates deterred by it. The average Fortune 500 application includes 62.8 screener questions, yet companies with 45 or more screener questions are losing 89 percent of potential candidates, who abandon the process before completion.[55] Each 20 additional questions results in a 40 percent loss of applicants.[56] When AT&T reduced its screener questions by half, it saw applicant drop-off decline by 55 percent and received 100,000 additional quality applications.[57]

Possible skills inflation. The number of qualification requirements also shapes the pool. According to the Appcast survey, the more qualification requirements listed on a job posting, the lower the application rate.[58] Employers that look for the "purple squirrel," the perfect candidate that may not even exist, turn perfectly qualified candidates away from applying. Candidates who see elaborate skills requirements, particularly female ones, may self-censor: men apply for a job after meeting only 60 percent of the qualifications required in a posting, while women tend to apply only if meeting 100 percent of the requirements, typically because they do not believe they would get the job if they were not perfectly qualified or because they were following guidelines on who should apply more than men do (and not because of lack of self-confidence).[59]

There may be something to this challenge in manufacturing. In our survey, 32 percent of manufacturers believe that one of the top three likeliest reasons why a qualified candidate might not get hired is that the "candidate starts to respond to a job posting but quits, perhaps because the posting is too demanding or candidate is lazy." In a casual read of 50 job postings in manufacturing, we found that college degrees were required in 72 percent of jobs and specific skills in 66 percent of jobs. However, most of the postings that required college degrees were for engineering jobs or software development; machinists did not require a college degree, and two-thirds of CNC machine programmers did not require a college degree. Weaver and Osterman (2017) find that skills requirements in most manufacturing positions are not overwhelming—most manufacturers require candidates to have higher-level math and reading skills—and that demand for these basic skills is a statistically significant explanation for the length of vacancies. Meanwhile, computer, critical-thinking, and problem-solving skills are not statistically significant drivers of the length of vacancies in manufacturing.[60]

One reason behind the inflation of educational credentials, to the extent it exists today in manufacturing, may be that firms use degrees and education as proxies for soft skills.[61] Another may be companies' low retention rate and interest in hiring the perfect fit, which have made hiring managers and recruiters both cast a wider net and grow more demanding of skills and qualifications. Importantly, the purple squirrel problem is found

55. Ibid.
56. Ibid.
57. Ibid.
58. Appcast, *2018 Recruitment Media Benchmark Report.*
59. Tara Sophia Mohr, "Why Women Don't Apply for Jobs Unless They're 100% Qualified," *Harvard Business Review*, August 25, 2014, https://hbr.org/2014/08/why-women-dont-apply-for-jobs-unless-theyre-100-qualified.
60. Weaver and Osterman, "Skills Demands and Mismatch in U.S. Manufacturing."
61. Lawrence Lanahan, "Need a college degree to get a job? These companies say skills matter more," NBC News, May 4, 2019, https://www.nbcnews.com/news/us-news/need-college-degree-get-job-these-companies-say-skills-matter-n1001526.

to be cyclical. Employers are found to relax skill requirements in boom times, when most plausible candidates are already working and jobs are abundant, but then increase skill requirements for positions during a recession, when there is a greater applicant pool to choose from.[62] In other words, the perceived skills gap and long vacancies may not be caused by some sudden skills shortage but a sudden and arguably unnecessary increase in demand by employers for workers to have a range of skills.

Candidates do not care for online applications and believe (often correctly) that networking is a path to a job. That a person does not fill out a job application for a particular opening does not mean that they are not pursuing it. Some 80 percent of candidates with incomes between $100,000 and $150,000 report applying directly through sending an email to the hiring manager rather than by plowing through an online form and getting an automated response.[63] Several surveys indicate that personal contacts and networking are ultimately how most people land their jobs.[64] Particularly for passive candidates that look for jobs casually, networking is by far the likeliest way to apply for a new job. For employers, this means job postings may be far less likely than personal connections to reach currently employed people who are open to new positions.

Candidates suspect phantom jobs and handpicking and do not bother to apply. The low hires-to-vacancies ratio may also be due to an inflation of vacancies and online job listings. Empirically, there exists a problem of "phantom jobs," where the company has already selected its hire but must advertise the job in order to meet a corporate fair hiring policy. And employers may advertise vacancies but not put too much effort into following up and actually filling the role. This belief is not unfounded: a quarter of jobs landed by passive lookers are internal. Yet handpicking a candidate for a role has resulted in hires that perform more poorly than those hired when the job had been posted and widely advertised.[65] This underperformance is due to hiring managers lacking a good sense of the talent and capabilities they already have vis-à-vis the broader market. Granted, the intensity by which employers seek to get a person for an advertised job varies with economic times; empirically, the intensity dropped during the Great Recession, when demand was weaker.[66] In other words, firms may advertise an open position but end up not being desperate to fill it when demand is slow, and thus a phantom job results again. Of course, savvy candidates know this practice exists and may be loath to spend time responding to online job ads or get discouraged quickly when they do but never hear back.

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62. Alicia Sasser Modestino et al., "Upskilling: Do Employers Demand Greater Skill When Workers Are Plentiful?" Harvard University, Working Paper, Revised February 2016, https://scholar.harvard.edu/files/shoag/files/modestino_shoag_and_ballance_022316_final.pdf.
63. Nicole Fallon, "4 Things Job Seekers Hate About Online Applications," Business News Daily, January 8, 2014, https://www.businessnewsdaily.com/5732-online-job-application-problems.html.
64. See: Gina Belli, "How Many Jobs are Found Through Networking, Really?" PayScale, April 6, 2017, https://www.payscale.com/career-news/2017/04/many-jobs-found-networking; and Lou Adler, "New Survey Reveals 85% of All Jobs are Filled Via Networking," LinkedIn, February 29, 2016, https://www.linkedin.com/pulse/new-survey-reveals-85-all-jobs-filled-via-networking-lou-adler/.
65. JR Keller, "The Best Way to Hire from Inside Your Company," *Harvard Business Review*, June 1, 2015, https://www.ilr.cornell.edu/sites/ilr.cornell.edu/files/The%20Best%20Way%20to%20Hire%20from%20Inside%20Your%20Company.pdf.
66. Steven J. Davis et al., "Recruiting Intensity during and after the Great Recession: National and Industry Evidence," *American Economic Review* 102, no. 3 (May 2012): 584-88.

Poor candidate engagement reduces the applicant pool. The process after a worker has applied has changed. Today especially, younger applicants expect potential employers to proactively engage them on social media and email, and some companies are responding through "continuous candidate engagement" (CCE) strategies. However, most employers have yet to: (1) engage a candidate after the candidate has applied or during the application process; (2) notify candidates about initial decisions in the hiring process, especially candidates who have been passed over; or (3) respond quickly to basic inquiries.[67] Candidates who face a long and complex hiring process or are not told why they were not hired are less likely to apply with the company again. Sixty percent of job seekers surveyed for a Career Arc study responded that they have had a poor candidate experience, and 80 percent said they would be less likely to consider other similar job openings at a company that failed to update them on the status of their initial application.[68] Poorly handled candidates may also be lost as clients. In a Virgin Media analysis, 18 percent, of 130,000 candidates (about 23,000 individuals) who applied for positions with the company were also Virgin Media customers. But because of the company's poor candidate engagement, 7,500 job candidates canceled their subscriptions and switched to a competitor, costing the company over $5 million.[69]

Candidate engagement may be more challenging to smaller firms that have less staff bandwidth and resources than large firms to deal with candidate experience. Yet they can be a valuable pool of people, as they have already come to and through the door once. In our survey, getting candidates in the door and "getting qualified candidates to apply" was highlighted by 51 percent of manufacturers as one of the top two challenges in recruitment, and "getting enough candidates to apply for jobs we post" was highlighted by 34 percent as a top two challenge (Figure 9). Some 31 percent of manufacturers agreed they would consider previously rejected applicants for new openings "sometimes," and a third say they would definitely consider previously rejected candidates.

67. Ibid.
68. Herefish, "The Case for Candidate Engagement: Smart, strategic ways to set your firm apart and up for success," Bullhorn, http://pages.bullhorn.com/rs/131-YQK-568/images/Case_for_Candidate_Engagement_Guide.pdf.
69. Melissa Blazejak, "Time to Rethink Your Recruiting Strategies with Continuous Candidate Engagement," HR Daily Advisor, September 24, 2018, https://recruitingdailyadvisor.blr.com/2018/09/time-to-rethink-your-recruiting-strategies-with-continuous-candidate-engagement/.

Figure 9: What Could Possibly Go Wrong? Percent of Manufacturers Agreeing that a Statement Is One of the Top Two Reasons to Derail Hiring of a Perfectly Qualified Candidate, 200 Manufacturing Firms
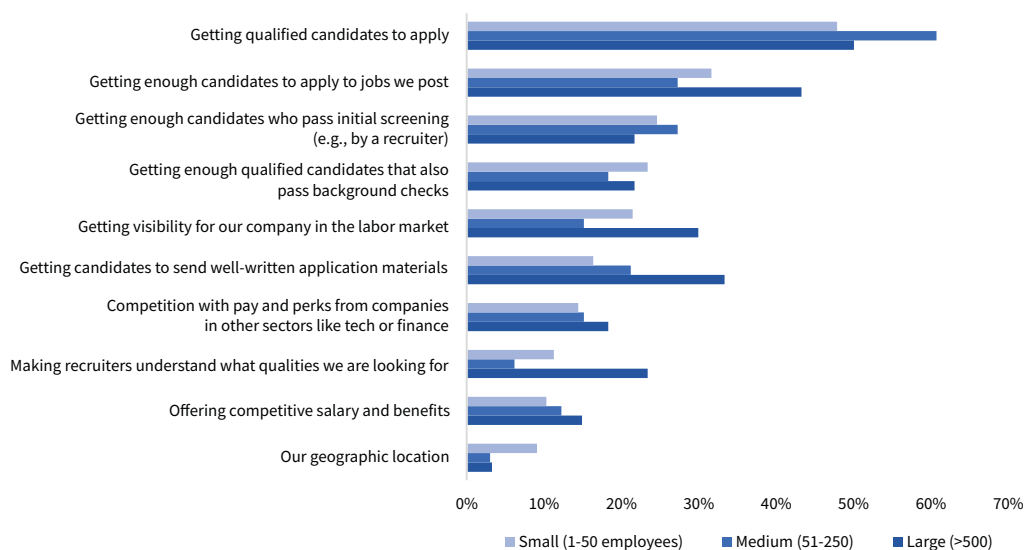
Source: Online survey by author of 200 U.S. manufacturers on May 5-30, 2019.

SELECTION PROCESS

Robo-screeners and recruiters may be too rigid: Employers understandably want to narrow the funnel enough to focus on only a few particularly relevant candidates; recruiters want to give employers candidates that are a very close fit to the job description; and candidates would like to stay in the game and feel they could do the job well. However, hiring managers and recruiters have a notoriously tense relationship—the internet is full of guides on how they can "play nice"—and hiring managers tend to think recruiters do not have a very good sense of what the ideal applicant looks like.[70] In our survey, 21 percent used outside recruiters, but only 15 percent believed outsourcing recruitment to a recruiter is a good strategy. Moreover, 20 percent stated "when candidates are interviewed by a recruiter" as one of their top two reasons why perfectly good candidates may get screened out of the funnel, about the same as the number of respondents who believed the wide-spread practice of using applicant tracking system software (ATS) that automates the initial sorting of résumés may cause perfectly good candidates to be rejected.

The main advantages of ATS include reducing time-to-fill and cost-per-hire, leaving recruiters and hiring staff more time to interact with candidates or attend to other tasks. In one survey, 94 percent of users report that software has improved their hiring process (Box 1).[71] However, applicants can find ATS-driven recruitment opaque and impersonal and are often flummoxed by their CVs being filtered out. The jury on ATS is still out—it

70. "Majority of Hiring Managers Believe Role of Recruiters Will Change with Rise of Technology, Plan to Increase Utilization of Staffing Firms in Next Five Years," CareerBuilder, January 31, 2019, https://www.prnewswire.com/news-releases/majority-of-hiring-managers-believe-role-of-recruiters-will-change-with-rise-of-technology-plan-to-increase-utilization-of-staffing-firms-in-next-five-years-300787006.html.
71. J.P. Medved, "Recruiting Software Impact Report," Capterra, May 6, 2015, https://www.capterra.com/recruiting-software/impact-of-recruiting-software-on-businesses

may not result in mismatches or poor candidates, but it may screen out a larger set of people than a human recruiter.[72]

Mostly manufacturers blame the top part of the funnel rather than ATS or recruiters; however, about a third believe "candidates with right skills do not find us online," "candidates find our criteria demanding," or "candidates quit responding to a job posting before it is finished" are one of their top two reasons why perfectly good candidates do not end up being hired. Of course, the respondents do not necessarily have much empirical basis for the first two claims; they are hunches about candidates they believe exist but in reality never see.

BOX 1: TECHNOLOGY TO SORT WHEAT FROM CHAFF IN RECRUITMENT

What Are Applicant Tracking Systems?
A survey commissioned by Bullhorn, a workforce digital solutions company, found that 80 percent of firms acknowledged that proactive engagement with candidates is valuable to their overall business and that 83 percent believed that ATS data is valuable to that engagement.[73] What is ATS, then? Utilizing ATS, employers can set parameters to rank applications or filter out applications prior to review by hiring managers or recruiters. ATS filters are often based on algorithms that hunt for keywords, such as skills and titles that match the title of the job opening or skills required in the job description. Other key data points ATS can search for include education and experience. However, ATS does more than filter applications. It can store résumés for review for future openings, assist in scheduling interviews, and streamline onboarding once a hire has been made. Bullhorn's survey shows that automatically logging candidate information saved their users 8.3 hours per week.[74] As ATS becomes smarter, including by utilizing Artificial Intelligence (AI), recruiters and hiring managers will have more time for in-person interaction with premier candidates.

ATS can also provide analytic feedback on the recruitment process. This feedback can include valuable data on the number of applicants who applied for a position, the speed at which positions are filled, how many positions are filled, salary requests, how many applicants met the required qualifications, where applicants applied from, and how applicants heard about the opening. ATS also streamlines the job posting process. Instead of navigating to each individual job site, employers can utilize ATS to post applications to multiple job sites at once.[75]

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72. About 40 percent of U.S. companies have outsourced the hiring process to specialized firms that in turn often use subcontractors, typically in India and the Philippines, that identify and target candidates on LinkedIn and social media. This is especially the case of technology jobs such as programmers. Peter Cappelli, "Your Approach to Hiring Is All Wrong."
73. Herefish, "The Case for Candidate Engagement: Smart, strategic ways to set your firm apart and up for success."
74. Ibid.
75. Pritha San, "Applicant Tracking System (ATS): What Job Applicant Needs To Know?" RezRunner, March 5, 2019, https://www.rezrunner.com/blog/applicant-tracking-systems/.

While ATS offers a suite of tools for employers, the résumé scanner portion of the software is most relevant for applicants. For applicants, ATS often creates an initial make-or-break test that applicants are unaware of completely or have little insight into. ATS résumé scoring algorithms are usually opaque for applicants. Entire websites are devoted to educating applicants about ATS, how to format résumés to ensure they are readable by ATS résumé scanners, and tips to optimize résumés to make it past a range of ATS software.[76] Rezrunner.com offers a tool to emulate an ATS scan and score a résumé against a specific job description. RezRunner bills itself as a "resume optimizing solution" that "provides recommendations to your resume to improve your chances of getting interview calls" and provides suggestions that "make your resume rank better in the Applicant Tracking System (ATS) used by companies."[77]

Other Advantages and Disadvantages of ATS

While ATS résumé screening may result in top talent being passed over, research suggests that machines pick superior candidates than humans, even when humans are extremely familiar with the organization they are hiring for and have access to more information than the data processed by the hiring algorithm. An analysis of 17 studies of applicant evaluations found that a computer crunching applicant data in the context of a job description yielded better results than human hiring decisions by at least 25 percent.[78] That research also found that humans tend to overemphasize details with little relevance to the job opening, improperly weigh information, and suffer from conscious or subconscious bias. Of course, algorithms can also have built-in biases. But this does not mean hiring algorithms and ATS should be abandoned; it means they can be improved.

ATS providers are upgrading their software to ensure applications are user-friendly, integrate with social media and job boards, and include advanced search functions for recruiters to better identify talent. Improving candidate experience is a focus of modern ATS. Some companies are exploring predictive intelligence to match candidates with job openings, alert recruiters that certain skilled candidates are searching for jobs that fit an opening and inform recruiters on how best to contact potential candidates.

Risk aversion due to high buyer's remorse. Hiring may also be slow and suppressed because of employers' risk aversion. While manufacturers are eager to hire workers for hard-to-fill roles and tap talent when it comes available, they can also be slow to hire for certain roles because of the high costs of recruiting again if the recruit flops, and

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76. Such as jobscan.com and rezrunner.com.
77. Such as Rezrunner.com
78. Nathan Kuncle, Deniz Ones, and David Klieger, "In Hiring, Algorithms Beat Instinct," *Harvard Business Review*, May 2014, https://hbr.org/2014/05/in-hiring-algorithms-beat-instinct; Nathan R. Kuncel et al., "Mechanical versus clinical data combination in selection and admissions decisions: A meta-analysis," J*ournal of Applied Psychology* 98, no. 6 (2013): 1060-1072.

perhaps because of a certain "fear of missing out." In our survey, manufacturers did report some buyer's remorse, with 35 percent stating that candidates that get hired typically underperform, half stating new hires perform as expected, and 9 percent indicating that new hires outperform expectations.[79] A manufacturer seeing this pattern may "hire slow, fire fast," with a long vacancy resulting. At the same time, few companies know definitively if they have hired the right person at the end. Only about a third of U.S. companies monitor whether their hiring practices lead to successful employees; few of them do so carefully, and only a minority even track cost per hire and time to hire.[80]

The (fading?) challenge of background checks. Manufacturers frequently cite challenges in finding candidates who accomplish such basic things as showing up to work on time and passing a background check. In our survey, 22 percent of manufacturers and 26 percent of HR personnel in manufacturing firms stated that "getting enough qualified candidates that also pass background checks" was a top two biggest challenge of filling a hard-to-fill job, out of the top 10 challenges. Positively, employers have begun revisiting some of their background checks. Drug tests proliferated in the 1990s but by the mid-2000s were used by only half of employers; now their numbers are falling further.[81] For example, many manufacturers are ending the practice of testing for marijuana use in the many states that have legalized marijuana, except in occupations requiring mechanical skills or security management.[82] Soon they may have to do so by law. New York recently proposed a bill to ban pre-employment marijuana testing altogether.[83]

Employers' attitudes on hiring ex-felons are also changing. In a recent survey by the Society of Human Resources Management, only 14 percent of HR managers said they would not consider hiring ex-offenders, especially if those candidates had sought to better themselves in prison, and 82 percent of executives say their ex-offender hires have been at least as successful as their average hire.[84] Yet still only 5 percent of HR managers actively recruit ex-offenders. The RAND Corporation has found a remedy: 59 percent of employers would consider an ex-offender with one conviction if they were given an incentive through a tax credit, which they are offered under federal law, or if they could recover staffing-agency fees paid to find workers who end up leaving.[85] Some states have sought to incentivize companies as well: in 2012, New York launched the "Work for Success" initiative, which trains and matches formerly incarcerated individuals with employers

79. Manufacturers may simply hire, especially in low- and medium-skilled categories, workers that do not meet the requirements but can probably do the job. Research finds a reduction in supply of workers with vocational skills previously acquired in high school "industrial arts" curriculum, which covers mechanical skills. The average number of credits taken per student in that training fell to half in 2000-2005, and thus employers who relied on vocational education to train hires may feel a supply-side crunch.

80. Nick Corcodilos, "Employers are hiring all wrong," Ask the Headhunter, July 29, 2019, https://www.askthe-headhunter.com/13257/employers-hiring-wrong.

81. Margot Roosevelt, "In the age of legal marijuana, many employers drop 'zero tolerance' drug tests," *Los Angeles Times*, April 12, 2019, https://www.latimes.com/business/la-fi-marijuana-drug-test-hiring-20190412-story.html.

82. Ibid.

83. "NYC Passes Bill to Ban Pre-Employment Marijuana Drug Testing," JD Supra, April 17, 2019, https://www.jdsupra.com/legalnews/nyc-passes-bill-to-ban-pre-employment-88601/.

84. Tim Mullaney, "Why companies are turning to ex-cons to fill slots for workers," CNBC, September 18, 2018, https://www.cnbc.com/2018/09/18/why-companies-are-turning-to-ex-cons-to-fill-slots-for-workers.html.

85. Priscillia Hunt et al., "Incentivizing Employers to Hire Ex-Offenders: What Policies Are Most Effective?" RAND Corporation, 2018, https://www.rand.org/pubs/research_briefs/RB10003.html.

in the state.[86] Employers receive candidate matching services at no cost and the state's Department of Labor works with employers to create training programs if the individuals do not yet possess all the necessary skills.[87]

Some analysts also suggest that manufacturers relax their demands for candidate attitudes and maturity if hiring 18-year-olds and focus on ensuring that these candidates develop their maturity and attitudes on the job. This is of course challenging if the candidate actually does what manufacturers claim a larger set of hires do nowadays: not even show up regularly for work.

SEALING THE DEAL

The problem is not just matching; it is knowing what a good match is. The sense that there is a skills or hiring gap in an industry even if jobs are filled quickly may reflect dissatisfaction with hires that are made: perhaps employers feel an urgency to hire, but they also have to choose from a set of candidates that are not ideal fits. But this argument also assumes that employers are perfectly aware of the type of candidate they want when employers often do not know what constitutes a successful hire or how well their past hires have done.[88] Manufacturers do not necessarily know the value they get from a worker because they do not measure it well, so they also do not have a good sense of which candidate is a great fit. It can also be that industry jargon does not translate well. For example, managers looking to hire veterans are found to struggle with military jargon and effectively evaluating military experience and skills against skills in the civilian workforce.[89]

The problem of incomplete understanding of what makes a great hire and what a potential hire offers permeates the recruitment funnel and is particularly significant in the interview phase, when hiring managers or other senior staff interview candidates that have made it through the funnel. Interviews have become a favorite way to screen talent, and sequential interviews are widely employed, which is reflected in the doubling of time that employers spend on interviews in the past decade.[90] While a candidate's future performance is most significantly shaped by his or her past performance, managers often approach candidate interviews in a subjective and cavalier manner, applying their own beliefs and recipes rather than a tight script that would get at the past performance and skills.[91] Employers of course like to interview to assess a cultural fit, but they often have a poor sense of what exactly their work culture is. In other words, manufacturers may feel like they are not getting ideal candidates simply because they do not know what the ideal candidate is or how to identify "ideal" when interviewing.

86. "Governor Cuomo Annouonces that 'Work for Success' Initiative Is Providing More Employment Opportunities for the Formerly Incarcerated," New York State Department of Labor, February 12, 2014, https://labor.ny.gov/pressreleases/2014/february-12-2014.shtm.
87. "Work For Success," New York State Department of Labor, https://www.labor.ny.gov/formsdocs/factsheets/pdfs/p455.pdf.
88. A study by Mitchell Hoffman, Lisa B. Kahn, and Danielle Li found that even when companies test for skills, hiring managers often ignore them and apply their own weights and criteria—which according to research leads to worse outcomes than if a standard formula were used. See: Mitchell Hoffman et al., "Discretion in Hiring," National Bureau of Economic Research, Working Paper no. 21709, November 2015, https://www.nber.org/papers/w21709.
89. "SRI International Launches SkillMil to Help Match Military Veterans with Civilian Job Opportunities," SRI International, April 26, 2018, https://www.prnewswire.com/news-releases/sri-international-launches-skillmil-to-help-match-military-veterans-with-civilian-job-opportunities-300637155.html.
90. Cappelli, "Your Approach to Hiring Is All Wrong."
91. Ibid.

The problem is not in hiring; it is bad retention. Wharton's Peter Cappelli argues that today's employee shortage problem is perhaps even less a problem of hiring than a problem of retention.[92] Indeed, one very plausible explanation for the puzzling fact that manufacturers keep complaining about skills gaps when they seem to fill most positions quickly is the accelerating churn and frequency of need to hire for any given role, which creates a sense of constant lack of and chase for talent. However, manufacturers may not be as used to it as their peers in other industries; manufacturing workers have tended to have the highest average tenure out of any private industry.[93]

Until the 1970s, some 90 percent of jobs were filled internally through promotions and lateral assignments.[94] Today, the number is about 30 percent, and internal hires are generally not an important source for talent managers.[95] The churn is a testimony to decreasing tenures and the rise in voluntary separations in manufacturing, which may be driven by reductions in internal recruiting in large companies. Per the Weaver and Osterman study, certain occupations in the manufacturing industry have become so niche and specialized that companies are looking for hyper-specific skills that few outsiders would ever have, yet companies wait for the purple squirrel rather than offering training. Only half of U.S. manufacturing plants provide formal training to production workers, down from 70-80 percent in the 1990s.[96] The shrinkage of manufacturing plants may be a structural driver of reduced interest in training workers due to lower economies of scale for training.[97] Still another explanation may be that technology has reduced both employers and employees' opportunity costs of looking at each other: they now go online and choose preferred qualities in a candidate or employer within seconds rather than circling job ads on the Sunday paper.

Employer interest in hiring talent from outside rather than spending on training and cultivating talent within results in a vicious cycle. Employees that know internal promotions are harder to come by are likelier to look for them outside the company and leave, which then leads companies to avoid spending on training due to worry that trainees will bolt for better-paying roles elsewhere. Such scenarios can result in the company failing to internalize its investment. Employers across the job market are thus collectively creating a setting where they are stuck hiring and competing for talent from outside. They are like cars on a highway seeking to get ahead by endlessly changing lanes but collectively only slowing traffic down. This strategy may cost more than reskilling an existing worker. The retention problem has also led to technology solutions such as Jobvite and HiQ, that seek to determine employee "flight risk" so that management can intervene and offer better pay to high-performers that are likely to leave, based on their social media activity and other data.

If hiring remains on overdrive and its costs climb, firms may end up offering more internal training to satisfy demand for skilled workers.[98] A study of Swiss manufacturing workers

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92. Ibid.
93. "Table 5. Median years of tenure with current employer for employed wage and salary workers by industry, selected years, 2008-2018," U.S. Bureau of Labor Statistics, https://www.bls.gov/news.release/tenure.t05.htm.
94. Cappelli, "Your Approach to Hiring Is All Wrong."
95. Ibid.
96. Andrew Weaver, "The Myth of the Skills Gap," MIT Technology Review, August 25, 2017, https://www.technologyreview.com/s/608707/the-myth-of-the-skills-gap/.
97. Weaver and Osterman, "Skills Demands and Mismatch in U.S. Manufacturing."
98. Marc Blatter et al., "Hiring costs of skilled workers and the supply of firm-provided training," Insti-

reveals a clear statistical relationship between hiring costs and the likelihood of internal training: a $10,000 increase in average hiring costs increased a firm's supply by two training positions, whereas a $10,000 increase in average net training costs reduces a firms supply by two training positions.[99] It is not clear how sensitive training at U.S. firms is to recruitment costs, but employees want it. Adults in the United States are more interested in participating in job-related training than adults in most other OECD nations: in an OECD survey, 65 percent of Americans participated or wanted to participate in training, and almost half of those who participated in training wanted more training.[100] Training and reskilling internally appears to also be good public policy: the OECD finds that greater flexibility in wage negotiations and higher participation in lifelong learning are associated with a better matching of talent to jobs.[101] Public policy can also make training workers a more preferable strategy than hiring recruiters to find workers from outside the firm.

tute for the Study of Labor (IZA), IZA Discussion Papers no. 6344, 2012, https://www.econstor.eu/bit-stream/10419/58619/1/715401432.pdf.

99. Ibid.

100. OECD, *Getting Skills Right: Future-Ready Adult Learning Systems* (Paris: OECD Publishing, 2019), http://www.oecd.org/publications/getting-skills-right-future-ready-adult-learning-systems-9789264311756-en.htm.

101. Ibid.

4 | How to Bring Talent into Manufacturing Faster?

Manufacturing is a colorful field with numerous sectors and diverse occupations of varying skill intensities and future prospects. We have found that manufacturers have, in general, less trouble filling low-skilled positions; meanwhile, some large manufacturers find challenges in recruiting medium-skilled workers and other high-skilled workers. Medium-skilled occupational categories are large and need to be replenished, but they are also gradually shrinking. However, the need for workers is growing in some other occupations, such as high-skilled engineering and IT-related occupations, and in a large medium-skilled category, such as machinists. Manufacturing firms will be increasingly focused on identifying workers in these occupations. Research suggests that they will have most trouble hiring highly specialized talent in these categories.

No labor market sorts talent perfectly into available jobs. The previous section discusses frictions in the recruitment process that are both firm-specific and industry-wide and occur both before and after a candidate enters the hiring funnel. On the demand side, manufacturers, like many other industries, turn candidates off with complex job postings, long and challenging applications, failing to list salaries and benefits on listings, poor candidate engagement on social media, and overly-rigid recruiters and screening parameters, like background checks. They also appear to offer poorer pay than their peers in other industries. On the supply side, candidates are often already working and thus dedicate only a limited part of their time on looking around, have high expectations of being engaged by employers on social media even if they were a poor fit for the job, and give up quickly when faced with long applications.

One of the main drivers of the challenges to match workers to jobs is that there is so much matching to be done, and much more than has been the case in manufacturing, where workers have tended to stay in the same firm through their careers. Manufacturers increasingly need to hire, as workers are constantly departing, partly because manufacturers are constantly hiring rather than reskilling internally. This dynamic may be the worst in jobs where manufacturers already face the most struggle to hire—where they require highly specialized talent that may be costly to train.

Helping manufacturers tap the right talent faster will require a multipronged strategy, one that is tailored to occupations with different skill intensities and, perhaps to an extent, to firms of different geographies. Some strategies useful for all manufacturers include:

APPLICATION PHASE

Use channel management technologies to fan out job postings, and Use ATS to manage them. The Manufacturers Association of the Hudson Valley has spearheaded the Collaborative Recruiting Initiative (HVCRI), which is designed to allow Hudson Valley manufacturing companies to cooperate on promoting the manufacturing sector, attract candidates, and find work for them.[102] Companies that participate gain access to the initiative's ATS. Access to the ATS allows companies to post jobs to the Collaborative Recruiting Initiative board, which will automatically push postings out to multiple career sites, such as Indeed, Hotjobs, Monster, Zip Recruiter, LinkedIn, and Glassdoor. Companies also gain access to the ATS applicant dashboard and control the online application process and candidate pipeline. According to the Council of Industry, similar ATS software would cost each individual company up to $15,000 a year; however, companies can participate in the HVCRI at a cost of just $2,000 a year. Participating companies also benefit from marketing done by HVCRI.

Get onto social media and go mobile-first. Spreading awareness of manufacturing careers, particularly among younger generations, requires a diversified online presence, one that particularly engages people on social media. Generation Z members get most of their products and services through firms' engagement, friends' recommendations, and popular influencers on social media. Engaging job seekers on mobile platforms could provide another avenue for manufacturers to attract more attention to the industry, particularly among younger users. Glassdoor can be a particularly effective recruiting tool in the manufacturing industry. An executive of SageGlass, a Minnesota-based electrochromic glass manufacturer, credited her company's active Glassdoor presence with the hiring of several current employees.[103] The site enables workers to see their peers' ratings of employers and enables employers to gain visibility with over 30 million unique monthly users, of which about 10 million are millennials.[104] Three-quarters of the site's users are more likely to apply for a position if the company actively manages its profile by updating information and responding to reviews.[105] Even small businesses can easily take advantage of this opportunity, as basic features such as responding to employee reviews, which attracts users, are free.[106] Firms can also buy additional recruitment services.

Twenty-two percent of manufacturers in our survey placed "better use of social media" in their top three pieces of advice for other manufacturers to improve recruitment, out of 18 options (Figure 10). There are excellent, widely-cited examples of social media excellence

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102. "Join the Recruiting Initiative," The Council of Industry: The Manufacturers Association of the Hudson Valley, https://careers.councilofindustry.org/manufacturing#benefits.

103. Laura Putre, "Millennial Recruiting Magic: Solutions from Manufacturers Large and Small," IndustryWeek, November 21, 2016, https://www.industryweek.com/dell-recruiting.

104. "50 HR and Recruiting Statistics for 2017," Glassdoor, https://resources.glassdoor.com/rs/899-LOT-464/images/50hr-recruiting-and-statistics-2017.pdf.

105. Ibid.

106. Susan Adams, "How Companies Are Coping With The Rise Of Employee-Review Site Glassdoor," Forbes, February 24, 2016, https://www.forbes.com/sites/susanadams/2016/02/24/how-companies-are-coping-with-the-rise-of-employee-review-site-glassdoor/#2138e4d66263.

by manufacturing and other companies, such as General Mills, Coca-Cola, Ford, Microsoft, Zappos, UPS, and Marriott. Each has created strategies specific to social media platforms—Instagram, Snapchat, Facebook, LinkedIn, YouTube, and Twitter—and also policies for current employees' use of social media. For example, Zappos's Instagram includes "day in the life," company culture, and important dates for prospective interns (e.g., application deadlines). One of the best parts has to be their internship spotlights at the conclusion of interns' programs. They feature a photo of the intern and a quote about their experience, a clear show of employee recognition.[107] Microsoft uses the "Microsoft Life" page on Facebook with live interviews with a few Microsoft recruiters. Potential candidates could send in their questions before the event and tune in during a live broadcast. UPS uses Twitter and Facebook to reach a broader group of applicants than recruiters would typically bring in and highlights employees' volunteer efforts and the company's diverse employee base.[108] Active lookers are not as keen on great pay as on better work and career opportunities.[109]

Figure 10: Percent of Manufacturers Who Place a Method to Attract Candidates to Hard-to-Fill Jobs in their Top Three Methods, 200 Manufacturing Firms
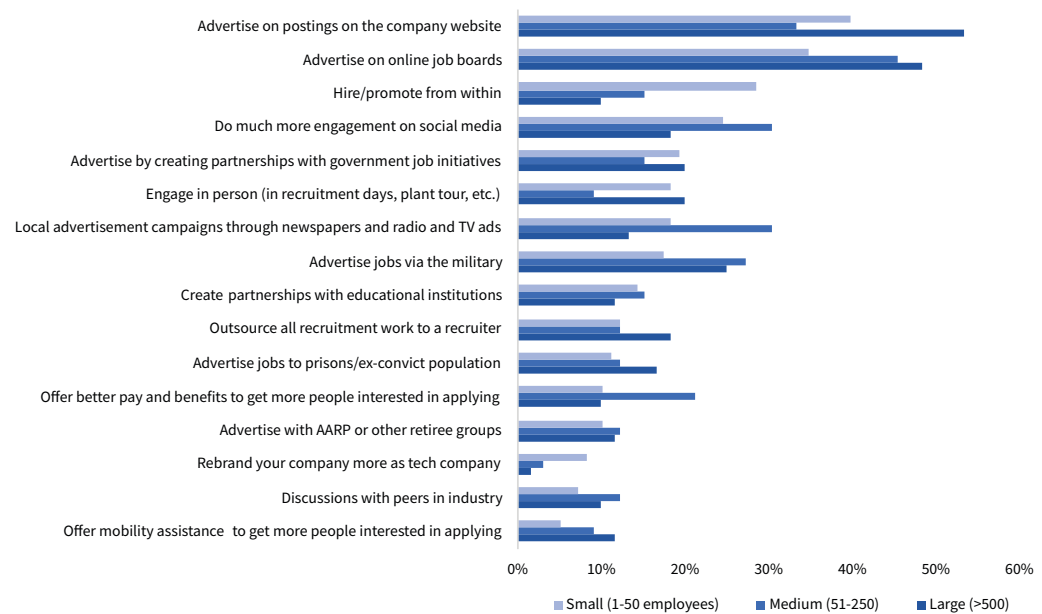
Source: Online survey by author of 200 U.S. manufacturers on May 5-30, 2019.

Adopt strategies that bring more quality, not quantity, and make candidates self-select better. In our survey, 51 percent believed that "getting qualified candidates to apply" is a top two challenge in recruiting, and 40 percent believe that recruiting via online platforms is one of the top three methods to fill hard-to-fill vacancies, out of 18 methods (Figure 3). The widely favored approach to cast a wide net reflects the realities of the internet age: most candidates are online and if you do not advertise online, everyone else still does. But

107. Audrey Agot Fox, "20 Companies Slaying the Social Recruiting Game," KRT Marketing, February 1, 2017, https://www.krtmarketing.com/blog/social-recruiting-10-companies/.
108. "5 Companies that have Nailed Social Media for Recruiting," TINT, December 2, 2014, https://www.tintup.com/blog/5-companies-that-have-nailed-social-media-for-recruiting/.
109. "Retaining Top Performers," Roth Staffing.

it may also reflect the general tendency to think that filling the recruitment funnel "to the brim" will deliver more qualified candidates.

However, bringing more people in the door and making it easier to apply is not a sufficient answer. Onboarding a vast pool has its costs: the résumés have to be filtered and advanced to the next stage of selecting the right fit, which employers are not necessarily good at. Moreover, each candidate that comes through is a legal risk, because the company has obligations to candidates (such as anti-discrimination and equal opportunity) just as it does to employees.[110] How to then narrow the pool getting into the funnel and make it appropriate?

The current strategy to narrow the funnel among manufacturers and other employers appears to be to list requirements, ask candidates countless screening questions, and request them to send in elaborate materials, the idea being that candidates self-select into jobs. They will endure the application process if the job meets their utility functions and the opportunity is compelling enough. This has its merits: the stamina to fill out long applications and do so to many roles may be a useful proxy for discipline, perseverance, and motivation for the job—the attributes employers over and over decry workers lack. But in a tight labor market, many desirable candidates are already working and do not have the same sense of urgency or time to fill long applications as candidates that are out of jobs and actively looking. There could be an easier way to get appropriate self-selected applicants into the funnel, such as making candidates self-assess if they are a good fit and using gamified approaches that frame a situation in a work environment as an interactive game to help candidates understand what their workday would look like, a tactic used by Google. This is a much more effective way to push out bad fits than listing requirements. Companies like Marriott have also combined "day in the life" approaches with pre-employment tests to enable candidates to see how well they might score before they applied, providing an opportunity for them to self-select out of the process.[111]

These techniques may also help manufacturers avert the many technologies that claim to test candidates' aptitudes and have spawned an industry of technologies that help candidates score well on these tests, which again may tilt the playing field in favor of the candidates who also have good SAT scores and did well in college but will not necessarily outperform on the job.

Face-to-face interactions still matter. In our survey, 16 percent of manufacturers vouched for face-to-face recruitment events as a top three strategy to fill hard-to-fill roles. Long-term unemployed and retired people who have relevant skills especially in the medium- and low-skilled categories are least likely to use the internet for job searches; reaching this segment will also require face-to-face campaigns. GenMet, a Wisconsin-based metal fabricator, sends younger employees to career fairs to engage with students and demonstrate that manufacturing jobs are attractive to young people.[112] Another company, GetMet, also ingeniously hired school teachers for short summer jobs; they would then

110. Cappelli, "Your Approach to Hiring Is All Wrong."
111. Brookings suggests manufacturers implement more flexible hiring standards and relax formal education requirements to attract more applicants. See: Mark Muro et al., *America's Advanced Industries: What They Are, Where They Are, and Why They Matter* (Washington, DC: Brookings Institution, February 2015), https://www.brookings.edu/wp-content/uploads/2015/02/AdvancedIndustry_FinalFeb2lores-1.pdf.
112. Ibid.

return to schools and share ideas on manufacturing careers with students.[113] As another example, Auto Truck Group, a work truck upfitter, held open houses at production plants where they set up instant meetings with hiring managers for attendees; 12 out of 30 attendees were hired.[114]

There are many ways to appeal to older workers. In 2015, some 27 percent of manufacturing workers were 55 or older, similar to other industries. According to a survey of 268 firms run at the time, only 4 percent of manufacturers had a strategy for retaining these workers, 2 percent had a strategy for recruiting them, and 58 percent stated they do not actively recruit older workers.[115] However, American companies have in recent years been reaching out to older workers in the tight labor market. Partly as a result, unemployment is very low among those ages 55 and over (roughly 3.2 percent), and the ranks of older workers are swelling as many stay in the labor market, return to it, or start their own businesses. The annual growth of the labor force of those ages 65 to 74 is 4.5 percent and of those 75 years and older is about 6.4 percent, far above national averages.[116]

Also, the ranks of the long-term unemployed, which overlaps to a degree with the category of older workers, is dwindling. The share of people out of jobs for 15 weeks or longer has shrunk from over 5 percent of the workforce in June 2009 to 1.3 percent in June 2019.[117] The comprehensive indicator U-6 (which measures the unemployed plus marginally attached plus part time for economic reasons) has dropped from 16.5 percent to 7.2 percent during that period.[118] In short, a growing share of both the older and previously unemployed workers are working, much like the rest of the American labor market. Manufacturers have discovered that the older segments have far more experience and much less absenteeism than younger workers and can be excellent mentors for younger generations.[119]

There is no single magic bullet strategy to reach this demographic. Employers can collaborate with the AARP Foundation's "BACK TO WORK 50+" program, which helps employers find qualified candidates, seeks employee referrals, and stages formal face-to-face recruitment programs at local libraries and community centers.[120] Employers seeking older workers can also recruit online with such specialized firms as retirementjobs.com and seniors4hire.org but need to run an inventory of their biases and details like whether graduation dates are required in CVs to avoid turning older workers off.

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113. Dori Meinert, "HR Gets Creative to Hire Manufacturing Workers," Society for Human Resource Management, November 1, 2015, https://www.shrm.org/hr-today/news/hr-magazine/pages/1115-manufacturing-recruitment.aspx.
114. Ibid.
115. "Preparing for an Aging Workforce," Society for Human Resource Management, June 2015, https://www.shrm.org/hr-today/trends-and-forecasting/research-and-surveys/Documents/Preparing_for_an_Aging_Workforce-Manufacturing_Industry_Report.pdf.
116. Mitra Toossi and Elka Torpey, "Older workers: Labor force trends and career options," Career Outlook, U.S. Bureau of Labor Statistics, May 2017, https://www.bls.gov/careeroutlook/2017/article/older-workers.htm.
117. See U-6 at 7.2 percent in "Official unemployment rate little changed at 3.7 percent in June 2019," Bureau of Labor Statistics, July 10, 2019, https://www.bls.gov/opub/ted/2019/official-unemployment-rate-little-changed-at-3-point-7-percent-in-june-2019-u-6-at-7-point-2-percent.htm?view_full.
118. Ibid.
119. "Preparing for an Aging Workforce," Society for Human Resource Management.
120. National Center of Workforce Development/Adult, "Recruitment and Retention of Older Workers: Considerations for Employers," Institute for Community Inclusion, 2008, https://www.communityinclusion.org/article.php?article_id=231.

If you poach, pay and incentivize. Passive lookers move if paid considerably more than they currently earn, but manufacturers may need to pay still more. Rural companies may have to reach even further. While competition for talent may be fiercer in industry clusters than remote areas, it is also the case that there are fewer skilled workers readily available in rural areas or seasoned manufacturing workers in places without existing manufacturing industries. These are settings where companies will likely see a skills shortage. But with savvy national recruitment, they can fill gaps. For example, the *New York Times* reported on Alexandria Industries, based two hours north of Minneapolis, which has lured workers by offering a free health clinic within a block of its facility and increased overtime work available for workers.[121] Wigwam Mills in Sheboygan, Wisconsin has turned to referrals, offering cash bonuses to employees who bring in new recruits who stay at least 60 days.

Reward employees for good referrals. Many passive lookers come in the door through being referred by a current employee: in a LinkedIn survey of 4,000 corporate talent acquisition leaders, up to 48 percent of hires are recommended by an existing employee.[122] In our survey, manufacturers highlighted referrals as the most useful way to fill hard-to-fill jobs (Figure 11). This strategy can reduce hiring costs by a third and enhance the performance of new hires. Employees who make referrals will likely also shepherd the referral to a good start internally, as a referral's success will reflect on the referrer.[123] A referral tends to outperform nonreferrals because of this relationship, and this dynamic can be stoked by rewarding referrers with bonuses when a referral outperforms. Also, candidates look to be referred: 66 percent of job seekers turned to personal connections with close friends or family members, 63 percent turned to professional or work connections, and 55 percent turned to acquaintances or friend of friends.[124] However, employers also need to be mindful that they may not necessarily know how the new handpicked hire performs vis-à-vis the broader market of candidates and that they are less likely to end up with a diversified employee pool when using employee referrals, as employees are likely to refer people that are more similar to themselves.

121. Ellen Rosen, "Manufacturers Increase Efforts to Woo Workers to Rural Areas," *New York Times*, August 3, 2018, https://www.nytimes.com/2018/08/03/business/manufacturers-worker-shortage-rural.html.
122. Vivian Giang, "5 Reasons Why You Aren't Getting Quality Hires," LinkedIn Talent Blog, October 12, 2016, https://business.linkedin.com/talent-solutions/blog/trends-and-research/2016/5-reasons-why-you-aren-t-getting-quality-hires.
123. See: Roberto M. Fernandez and Emilio J. Castilla, "How Much is That Network Worth? Social Capital in Employee Referral Networks," *Social Capital: Theory and Research*, pp. 85-104, http://web.mit.edu/ecastill/www/publications/How%20Much%20is%20That%20Network%20Worth%20(Chapter).pdf.
124. Smith, "Searching for Work in the Digital Era."

Figure 11: Most Useful Ways to Attract Candidates to Hard-to-Fill Jobs, 200 Manufacturing Firms
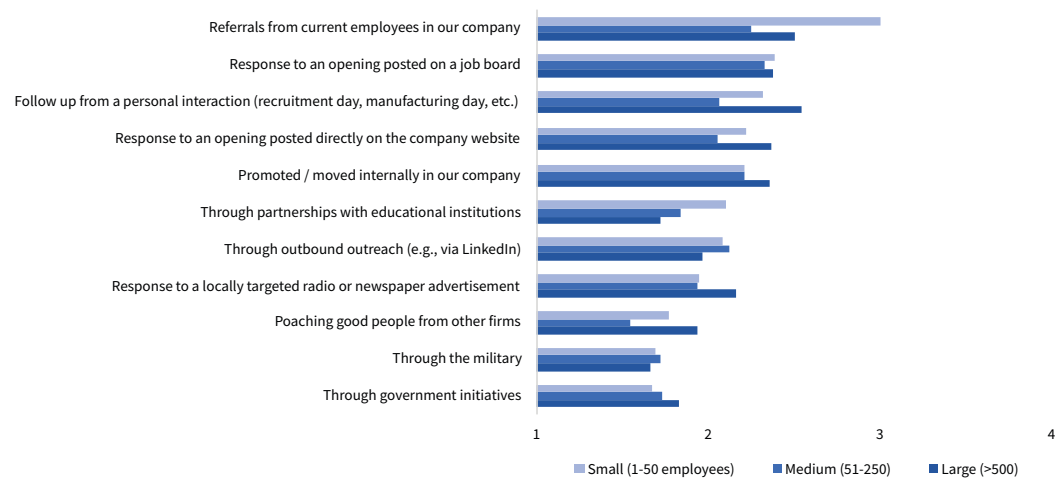
Source: Online survey by author of 200 U.S. manufacturers on May 5-30, 2019.

Note: 1 = not at all useful; 5 = extremely useful

SELECTION PROCESS

Improve measurement of what works in recruitment. There is no question that advances in machine learning and data analytics will enhance firms' abilities to predict the future performance of candidates and help firms with outbound recruitment identify the right candidates. Manufacturers should put their data to work to find the most cost-effective ways to recruit, get the right talent into the funnel, and narrow the funnel. They should start by leveraging their own data on hiring processes and candidates' performance after they have been hired to understand which types of candidates have been perfect fits and outperformers and how and from where those candidates were recruited.[125] Indian conglomerate Tata is getting results and spending less per hire because of its excellent data analytics that tell Tata which schools produce best-performing hires and which type of talent stays the longest.[126]

However, if models only use data on existing employees to predict future fits, they miss the mark, producing more of the same rather than a best-fit set of employees drawn from the labor market who are collectively most suitable for producing the product. Moreover, more work today is done in teams, which amplifies the need to analyze how candidates' attributes would fit with the rest of a specific team. It can also be useful to use service providers that predict turnover—or simply use a company's own internal data to predict flight risk—and enable employers to intervene to reduce attrition.

Use AI to improve and accelerate engagement, hiring, and retention. AI offers a powerful way to match people to right jobs and to tease out skills and attributes that individuals may not be able to articulate themselves. It can also help produce more inclusive and less biased hiring practices. For example, IBM uses its Watson computer system to leverage

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125. See: Cappelli, "Why Good People Can't Get Jobs: The Skills Gap and What Companies Can Do About It."
126. Cappelli, "Your Approach to Hiring Is All Wrong."

structured and unstructured data and learn from the 3 million job applications IBM receives each year. Watson is used to rank candidates with a process aimed to be freer of bias and improve matches of candidates to jobs, essentially augmenting its ATS. The Watson Candidate Assistant augments the company's ATS system by inferring specific attributes and skills from the roles on a candidate's résumé—for example, a candidate who worked in advertising can be inferred to have digital marketing skills—and then presents the candidate with several job opportunities that they might be qualified for based on the inferred skills.[127] Other companies have also turned to AI to assist with hiring and retention. LinkedIn's AI services help employers assess the quality of the technology talent pool in a geography where the employer looks to open an office. Citizens Bank NA uses AI-powered career coach "Myca" to suggest to employees new jobs, training, videos to watch, and periodicals to read based on employees' career interests.[128]

AI can also be helpful in translating military jargon into skillsets recruiters understand and target. The online job-matching platform SkillMil uses AI technology to match veterans seeking employment with employers looking to hire veterans. It does so by providing employers with a skill score that assesses the degree the veteran's military experience matches the required skills listed in the job description on a percentage scale.[129] SkillMil also lists training and skills required to achieve a 100 percent score match so veterans know exactly what type of training they need to qualify for the open position. AI can also help complete background checks—including social media history, public records, and financial backgrounds, among others—more quickly and comprehensively than hiring managers and help with the growing demands of candidate engagement and retention. There will be more innovations ahead; for example, blockchain technology could help make a candidate's job history unalterable and easily confirmable.

Associations, non-profits, and chambers are also using AI and algorithms to match workers to jobs. For example, the Minnesota Chamber of Commerce has partnered with the organization RealTime Talent to create MN Job Match, an online job platform that uses algorithms to match job seekers with employers based on skills, interests, and job requirements.[130] Both employers and job seekers fill out profiles and questionnaires and then receive a list of matches to connect with. Unlike traditional online job boards, MN Job Match uses job seekers' and employers' answers to a questionnaire in the initial stage of the matching process to remove some of the human bias in the hiring process, which usually focuses on the applicant's name, education, and work history.[131] WhenPeopleWork is an online job matching platform for formerly incarcerated individuals and those who are currently incarcerated but nearing release.[132] The site is free of charge to both employers

127. Sara Castellanos, "HR Departments Turn to AI-Enabled Recruiting in Race for Talent," *Wall Street Journal*, March 14, 2019, https://www.wsj.com/articles/hr-departments-turn-to-ai-enabled-recruiting-in-race-for-talent-11552600459.
128. Eric Rosenbaum, "IBM artificial intelligence can predict with 95% accuracy which workers are about to quit their jobs," CNBC, April 3 2019, https://www.cnbc.com/2019/04/03/ibm-ai-can-predict-with-95-percent-accuracy-which-employees-will-quit.html.
129. "Skillmil: Precision Hiring," Skillmil, https://www.skillmil.com.
130. "MN Job Match," Minnesota Chamber of Commerce, https://www.mnchamber.com/grow/mn-job-match.
131. Ibrahim Hirsi, "How a state-funded job-matching system hopes to improve employee recruitment — and reduce hiring bias," *MinnPost*, September 15, 2017, https://www.minnpost.com/good-jobs/2017/09/how-state-funded-job-matching-system-hopes-improve-employee-recruitment-and-reduce/.
132. "About Us," When People Work, https://www.whenpeoplework.com/about.

and job seekers, and it uses algorithms to match candidates with relevant jobs based on skills, personal attributes, and government requirements related to the transition of the formerly incarcerated into the workforce.

Update background check requirements. Manufacturers that have not calibrated their background checks to the growing legalization of marijuana or the potential for employing people with criminal records can learn from their peers and update their practices. For example, trailer-maker BMT Manufacturing in rural Tennessee has a program for inmates nearing release to train them in technical and life skills.[133]

SEALING THE DEAL

Curb hiring frenzy and retrain to retain. In our survey, 19 percent of manufacturers believed that promoting from within is one of the top three strategies to fill vacancies, and 67 percent agreed that it is more preferable to train a well-performing and motivated worker than to seek talent from outside. Training on the job makes sense in light of the manufacturer's problem of finding specialized and hyper-specialized workers: it enables firms to cultivate talent for specialized roles no educational institution can replicate; it enables firms to differentiate by training; and it is training through direct observation and practice that enables worker to learn by doing. Reskilling and promoting from within are also good strategies in that the employer will have had a significant amount of time to assess the employee's performance, character, and motivations, something that a sequential interview process or IQ tests aimed to identify that elusive perfect fit do not necessarily reach. In training-oriented businesses, the recruiting process could then also change from finding a person for a job via listing specific skills to identifying trainable candidates.[134]

Outsource. In our survey, 25 percent of manufacturers indicate they would "absolutely" outsource work in occupational categories that are hard to fill to specialized firms rather than only seeking to hire an internal candidate for them, and 44 percent said they might outsource. The Deloitte study finds similar trends: 42 percent of manufacturers were very open to hiring contract manufacturers for production roles, for example.[135] The pros and cons of cost, control, retention of skills, IP, and so on are for manufacturers to weigh; what seems clear is that smaller firms could easily outsource specialized non-core tasks such as the social media management they need to attract and retain employees. Given the proliferation of outsourced manufacturing facilities and 3D printing shops, manufacturers can even consider outsourcing some of their core competences to enterprising smaller firms.

Role for Public Policy

There are several federal, state, and local initiatives to better match workers to jobs:

- The National Labor Exchange (NLx) is an online job board created in 2007 in a public-private partnership between the National Association of State Workforce Agencies and the DirectEmployers Association.[136] NLx collects job openings from over 25,000

133. Ellen Rosen, "Manufacturers Increase Efforts to Woo Workers to Rural Areas."
134. Accenture and the Manufacturing Institute, *Out of Inventory: Skills Shortage Threatens Growth for US Manufacturing* (Dublin: 2014), http://www.themanufacturinginstitute.org/Research/Skills-and-Training-Study/~/media/70965D0C4A944329894C96E0316DF336.ashx.
135. Ibid.
136. "What is the National Labor Exchange," National Association of State Workforce Agencies, https://www.

corporate career sites and state job banks and lists them on their job board. The NLx service is free to both employers and job seekers, and the site only lists unduplicated job listings from vetted employers. In 2017, NLx also partnered with LinkedIn to distribute its job postings via LinkedIn, generating over 2.4 million additional applicants for companies listing job openings on NLx.[137]

- All 50 states run a job bank that can be found in the Department of Labor-sponsored CareerOneStop. One example is OhioMeansJobs, a one-stop-shop for online career counseling and job resources created by the Ohio state government and powered by the private job search company Monster.[138] It includes several physical regional centers, which are all part of the American Job Center network. OhioMeansJobs provides a vast amount of resources for both job seekers and employers.[139]

- CareerOneStop's "mySkills myFuture" subsite provides job seekers with a list of potential career options based on their current or previous job experience.[140] The Defense Department has the so-called "skills-bridging" program for those nearing the end of their enlistments and has partnered with the Manufacturing Institute to build the "Heroes MAKE America" program to offer manufacturing skills training for people leaving the military and to connect them with employers.[141]

- Small places can match workers when doing it together. For example, four counties in Ohio—Auglaize, Darke, Mercer, and Shelby, all of which have around 50,000 inhabitants or less—created a local job board and résumé database to promote job listings, including for 35 advanced manufacturing companies.[142]

State and local governments are also incentivizing workers to move to more remote places with open jobs. For example, workers relocating to "rural opportunity zones" in Kansas can possibly get a state income tax waiver for five years and student loan repayment of up to $15,000.

Research is needed to understand how well government matching and incentive programs perform in calibrating demand with supply in the labor market. We do not know if the government should be a staffing agency or if it would be a good one. What does seem to work is using tax breaks and reimbursement schemes to encourage employers to hire from potential employee pools, such as ex-felons. The Work Opportunity Tax Credit (WOTC), a federal income tax break and wage subsidy available to employers that hire members of targeted groups, such as low-income workers, felons, and the military, also seems to work. Studies find it increases the probability of getting a job, the length of employment, wages, and the possibility of tenure.[143] Public policies could also be key in encouraging retention

naswa.org/national-labor-exchange/what-national-labor-exchange.

137. "U.S. National Labor Exchange," LinkedIn, July 2018, https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/download/Case_Study_LinkedIn_National_Labor_Exchange_09_17_18_v6.pdf.

138. "Ohio Means Jobs," Monster, https://jobseeker.ohiomeansjobs.monster.com/.

139. "State Jobs Bank," CareerOneStop, https://www.careeronestop.org/JobSearch/FindJobs/state-job-banks.aspx.

140. "CareerOneStop," CareerOneStop, https://www.careeronestop.org/.

141. Ellen Rosen, "Manufacturers Increase Efforts to Woo Workers to Rural Areas."

142. "Advanced Manufacturing (Robotics, Welding, CNC)," Hometown Opportunity, https://hometownopportunity.com/industries.php?id=261.

143. WOTC equals 40 percent of eligible first-year wages paid to an employee, up to a maximum of $6,000 of wages, a maximum credit of $2,400 per employee. See: Bill Bischoff, "How to get a tax credit for hiring 'targeted' workers," MarketWatch, October 24, 2017, https://www.marketwatch.com/story/how-to-get-a-tax-credit-for-hir-

and reskilling by firms by lowering the costs of cultivating the hyper-specialized talent internally vis-à-vis the costs of recruiting such needles in the haystack.

In addition, on-the-job training can be much more useful than educational institutions for delivering the specialized talent employers need. In a 2014 report, the Department of Labor singled out federally-supported on-the-job training (OJT) as "an important approach that meets employer needs and worker skills development."[144] Employers participating in the program receive financial incentives (50-60 percent of the wages the firm pays to a new worker for some months) when they teach trainees skills to succeed in specific positions at the firm and keep the trainees as permanent workers after the training.[145]

Boeing usefully catalogues lessons learned from Boeing Manufacturing On-the-Job Training: OJT was found to be useful for customizing training to the employer's specific needs and helping workforce development programs strengthen existing partnerships with employers and build new ones. At the same time, according to Boeing, the process could be more useful if reporting requirements and bureaucracy were streamlined, low-skilled workers were targeted more, the OJT model went beyond new hires to include training to incumbent workers, and employer training strategies and professional development for supervisors were included. Registered apprenticeship programs are also found to be quite effective in training workers, though some experts have discussed the need for more capacity-building to help employers understand how to leverage publicly-funded training and apprenticeships, as well as the need for new Classification of Instructional Programs (CIP) Codes to denote new occupational categories, given that CIP Codes are required for employers to apply for public-sector support for retraining. Over half of U.S. states have sectoral training strategies to focus on the workforce needs of an industry within a regional labor market, and these too have been found to work and boost worker productivity when targeted.[146]

The voluminous literature on skilling and upskilling is beyond the scope of this paper given our focus on matching talent rather than building it up from scratch, but continued reviews of these programs will be useful to understand how to best cultivate talent in American manufacturing.

Public policy will also need to pay attention to the growing evidence of the declining geographic mobility of American labor and its sources. Early evidence suggests the decline in mobility is associated with decreasing payoffs from moving and decreased business dynamism in America. Literature roughly concludes that people move less than in the 1970s because it does not pay off to move and there is less demand to be elsewhere. The solutions to these challenges, to the extent they will live on past the post-recession era, are wide-ranging, from tax reforms to new incentives for startups. Regulatory frictions

ing-targeted-workers-2017-10-24; and Peter Cappelli, "Assessing the Effect of the Work Opportunity Tax Credit," National Conference of State Legislatures, http://www.ncsl.org/documents/Task_forces/Assessing_The_Work_Opportunity_Tax_Credit.pdf.

144. U.S. Department of Labor et al., *What Works In Job Training: A Synthesis of the Evidence* (Washington, DC: July 2014), https://www.dol.gov/sites/dolgov/files/OASP/legacy/files/jdt.pdf; See also: Harry Holzer, "Job Market Polarization and U.S. Worker Skills: A Tale of Two Middles," Brookings Institution, April 2015, https://www.brookings.edu/wp-content/uploads/2016/06/polarization_jobs_policy_holzer.pdf.

145. Deborah Kobes, *Making On-the-Job Training Work Lessons from the Boeing Manufacturing On-the-Job Training Project* (National Fund for Workforce Solutions 2.0, November 2013), https://files.eric.ed.gov/fulltext/ED561308.pdf.

146. U.S. Department of Labor et al., *What Works In Job Training: A Synthesis of the Evidence*.

seem to play a lesser role in dampening interstate mobility—except, as discussed in Chapter 2 above, for the proliferation of diverse occupational licensing schemes that disincentivize worker mobility due to local or state-specific licensing requirements.

5 | Conclusion

The debate on why manufacturers cannot find the talent they need is emotionally charged and politicized and rests on surprisingly shaky empirical grounds. While manufacturers bemoan hiring challenges, point to skills shortages in the American labor market as the culprit, and call for public and educational entities to step up, academic researchers tend to see fewer challenges in hiring in general and are more inclined to attribute hiring challenges to frictions in how talent is sorted into jobs. Most studies that analyze such frictions focus on structural and cyclical factors, such as labor market regulations and employers' changing skill demands in recessions. This report has focused on a less explored but potentially very fruitful set of frictions in firms' recruitment processes that may keep talent and opportunity from meeting in the U.S. manufacturing sector. It explored the strength of evidence for a range of hypotheses about frictions that may contribute to skills gaps and put forth a set of actions manufacturers can take in their talent acquisition and retention to reduce such frictions, bring talent in the door, and keep it current.

For some, this focus may be of secondary importance to the debate on ways to attract and groom young workers into certain manufacturing occupations, perhaps especially machinists and production workers. Yet the lens on frictions that may keep demand and supply in the manufacturing labor market from meeting is tremendously important and useful, for at least three reasons. First, it can help reconcile the contradictory views held between manufacturers and academics. It sheds light on why manufacturers perceive skills shortages and have difficulty hiring while researchers find that manufacturers fill vacancies at the same pace as firms in other industries. Second, the ways in which workers seek and apply for work are changing and require manufacturers to adopt best-in-class techniques, especially as they will increasingly be competing for talent against firms in other industries. As this report has shown, manufacturing is much, much more than production workers and will be increasingly made up of occupations that have demand across industries, such as aircraft mechanics and service technicians, mechanical engineers, biomedical engineers, financial managers, operations research analysts, market research analysts, and marketing specialists. Third, our focus is also useful because identifying the extent and root causes of the hiring challenges reported by manufacturers is critical for informing public policy.

That recruitment practices are unexplored as a driver of challenges to fill manufacturing vacancies does not mean they do not matter; they may be hugely relevant, only we do not

know much about them. This report has only scratched the surface. We have shown there are multiple potential frictions that render employers blind to talent and to understanding what pre-existing talent can offer, leading them to look for wrong talent. Similarly, candidates can be blind to the perfect opportunity: they may be too busy with their existing jobs to even realize that a recruiter has approached them about an opportunity; they do not necessarily know how their skills could be applied best in a different firm or sector; and they may have biases about an industry. Furthermore, advances in technology are showing that candidates may not accurately describe or even be aware of their best and most sought-after talents. Information gaps abound even within firms. Employers with an "ideal" candidate in their minds may not see readily trainable talent under their noses, and employees may not be aware of jobs opening right around them in their own companies. However, our knowledge of how relevant these various information gaps are and how much they shape outcomes in labor markets, including firm productivity and employee welfare, is still limited and a promising area for future research.
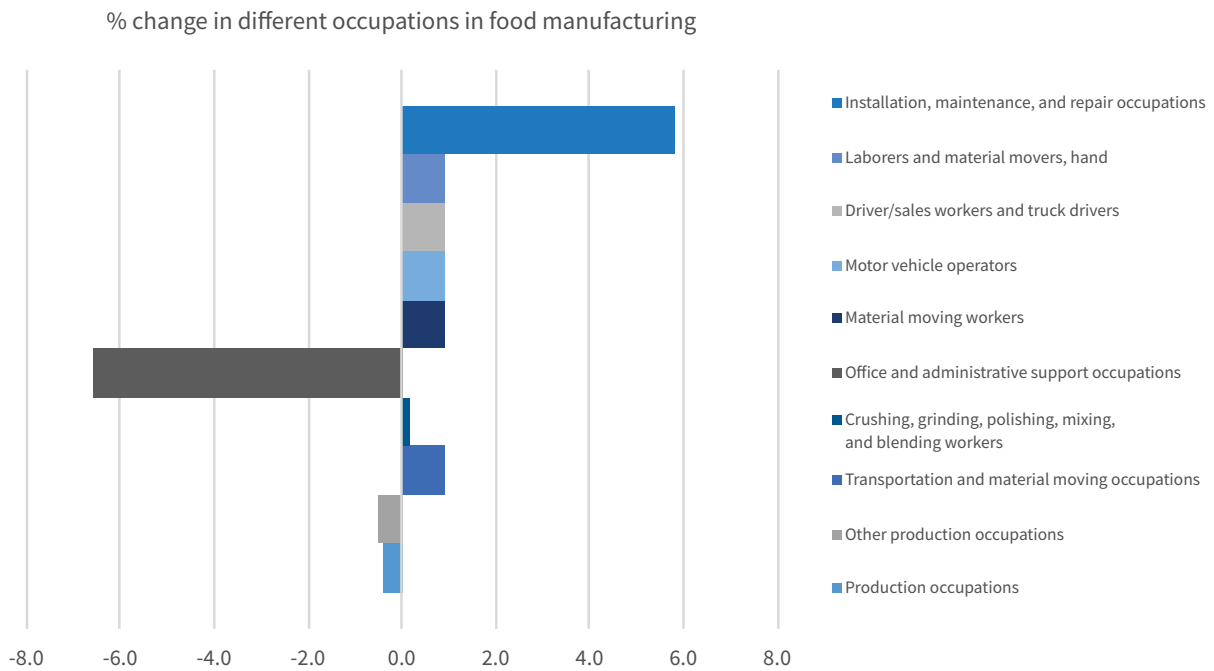
Our initial findings, albeit based on rather limited data, suggest that improving the matching of workers to the right jobs will take work on many fronts. Manufacturers can take a range of measures to identify, vet, engage, manage, upskill, and retain talent. Candidates need to be open to opportunities in sectors and companies they may not have considered and reskill themselves for new jobs in new companies. And the government needs to maintain policies that continue enabling labor to be mobile across sectors and geographies and support firms in upskilling their talent pools, such as supporting on-the-job training for existing employees to reskill and upskill, as technologies and business models change. There are also potentially useful public-sector incentives to bring the right talent to remote areas thin on workers and to match supply to demand. And some large manufacturing occupations such as machinists, even if not growing much in the coming years, will need new talent as existing workers retire. But again, manufacturers themselves need to do work rather than push schools to train new workers by offering and widely publicizing better pay, benefits, and commitment to lifelong learning and their companies' brands, values, and ethics. That collective effort will allow for young people to actually be excited about a career in manufacturing.

As the manufacturing industry evolves, more nuanced approaches are needed to understand how the hiring and communication dynamics—and hiring challenges, skills shortages, and mismatches in general—vary across manufacturing occupations, sectors, and geographies. Sweeping generalizations are not helpful for moving policy forward; the coming debates on manufacturing jobs should focus on specific occupations and specific sectors within the industry.

Appendix

Growth of Employment in the Top 10 Largest Occupations in 2016-2026, Selected Manufacturing Sectors

All figures in appendix from: "Employment Projections: Industry-occupation matrix data, by industry," Bureau of Labor Statistics, https://www.bls.gov/emp/tables/industry-occupation-matrix-industry.htm.

% change in different occupations in food manufacturing

Legend:
- Installation, maintenance, and repair occupations
- Laborers and material movers, hand
- Driver/sales workers and truck drivers
- Motor vehicle operators
- Material moving workers
- Office and administrative support occupations
- Crushing, grinding, polishing, mixing, and blending workers
- Transportation and material moving occupations
- Other production occupations
- Production occupations

% change in different occupations in beverage and tobacco manufacturing

Legend:
- Installation, maintenance, and repair occupations
- Driver/sales workers and truck drivers
- Motor vehicle operators
- Food preparation and serving related occupations
- Material moving workers
- Office and administrative support occupations
- Sales and related occupations
- Transportation and material moving occupations
- Other production occupations
- Production occupations

% change in different occupations in computer and electronic manufacturing

Legend:
- Software developers and programmers
- Office and administrative support occupations
- Management occupations
- Electrical, electronics, and electromechanical assemblers
- Computer occupations
- Computer and mathematical occupations
- Assemblers and fabricators
- Engineers
- Architecture and engineering occupations

% change in different occupations in machinery manufacturing

Legend:
- Other production occupations
- Welding, soldering, and brazing workers
- Management occupations
- Engineers
- Office and administrative support occupations
- Architecture and engineering occupations
- Miscellaneous assemblers and fabricators
- Assemblers and fabricators
- Metal workers and plastic workers
- Production occupations

% change in different occupations in motor vehicle manufacturing

Legend:
- Other installation, maintenance, and repair occupations
- Miscellaneous production workers
- Supervisors of production workers
- Engineers
- Architecture and engineering occupations
- Installation, maintenance, and repair occupations
- Metal workers and plastic workers
- Other production occupations
- Production occupations
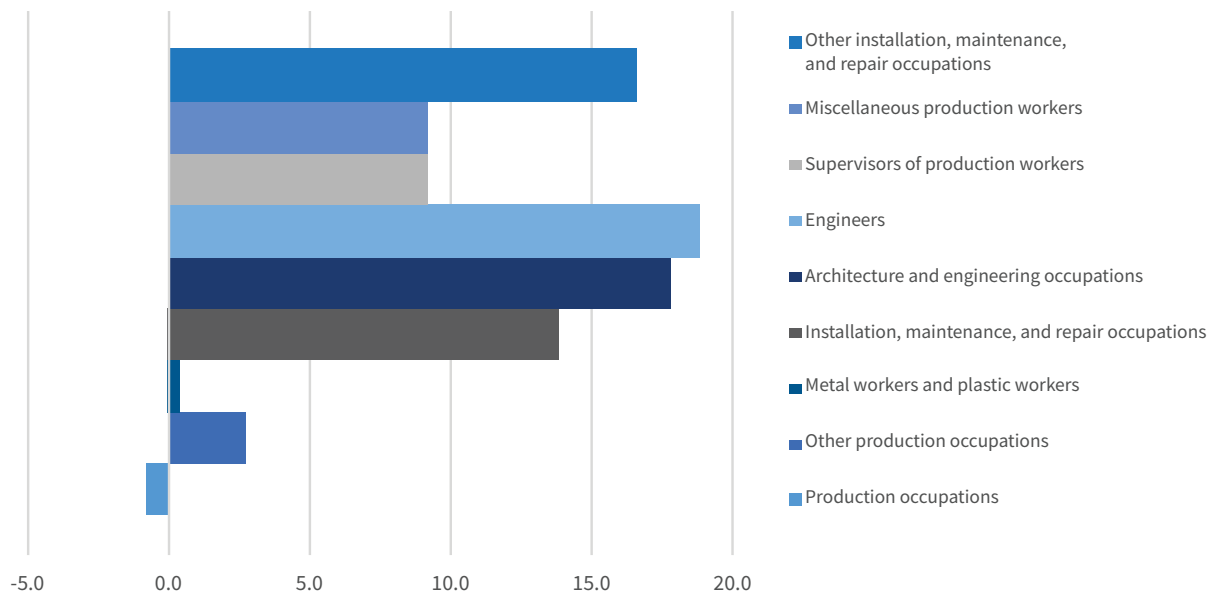
% change in different occupations in chemical manufacturing

Legend:
- Transportation and material moving occupations
- Architecture and engineering occupations
- Installation, maintenance, and repair occupations
- Crushing, grinding, polishing, mixing, and blending workers
- Chemical processing machine setters, operators, and tenders
- Management occupations
- Life, physical, and social science occupations
- Office and administrative support occupations
- Other production occupations
- Production occupations

% change in different occupations in aerospace manufacturing

Legend:
- Installation, maintenance, and repair occupations
- Computer occupations
- Computer and mathematical occupations
- Business operations specialists
- Business and financial operations occupations
- Metal workers and plastic workers
- Assemblers and fabricators
- Engineers
- Architecture and engineering occupations
- Production occupations

% change in different occupations in plastics and rubber manufacturing

Legend:
- Miscellaneous production workers
- Material moving workers
- Office and administrative support occupations
- Transportation and material moving occupations
- Miscellaneous assemblers and fabricators
- Assemblers and fabricators
- Molders and molding machine setters, operators, and tenders, metal and plastic
- Other production occupations
- Metal workers and plastic workers
- Production occupations

% change in different occupations in fabricated metal products manufacturing

Legend:
- Transportation and material moving occupations
- Management occupations
- Miscellaneous assemblers and fabricators
- Welding, soldering, and brazing workers
- Machine tool cutting setters, operators, and tenders, metal and plastic
- Assemblers and fabricators
- Office and administrative support occupations
- Other production occupations
- Metal workers and plastic workers

About the Author

Kati Suominen is an adjunct fellow with the CSIS Europe Program. She is founder and CEO of Nextrade Group, a Los Angeles-based data and analytics company that helps governments, multilateral development banks, and Fortune 500s enable world trade through technology. Dr. Suominen has created countless data and analytics products to help Nextrade clients understand and solve challenges to world trade, and ideated and built six global initiatives and public-private partnerships to drive digitization of trade and ecommerce development worldwide, such as eTrade for All now championed by the United Nations and 40 leading trade and development agencies, Alliance for eTrade Development between USAID and 13 leading global companies, and Digital Standards Initiative now led by Asian Development Bank and International Chamber of Commerce. She is the author and editor of 10 peer-reviewed books on trade, technology, and globalization, notably *Revolutionizing World Trade: How Disruptive Technologies Open Opportunities for All* (Stanford University Press, 2019), *Peerless and Periled: The Paradox of America's Leadership in the World Economic Order* (Stanford University Press, 2012) and *Globalization at Risk: Challenges to Finance and Trade* (Yale University Press, 2010, one of Foreign Affairs' best international affairs books of the year). She also serves as Adjunct Professor at the UCLA Anderson School, where she teaches MBA courses on international business economics and the economics of global digital disruption. She has provided commentary in the *Wall Street Journal*, Bloomberg, BBC, CSPAN, CNN, *Washington Post*, *Los Angeles Times*, *Politico*, *USA Today*, *Time*, Economist Intelligence Unit, and U.S. News and World Report. Dr. Suominen holds a BA from the University of Arkansas, an MA from Boston University, an MBA from the University of Pennsylvania's Wharton School, and a PhD from the University of California, San Diego. She is a life member of the Council on Foreign Relations.