



THE AGING OF THE MANUFACTURING WORKFORCE:

Challenges and Best Practices

July 2019

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The Manufacturing Institute, the 501(c)(3) workforce and education partner of the National Association of Manufacturers, is driving an agenda to research and support manufacturing excellence, innovation and talent, and deliver solutions to make manufacturers in America globally competitive. In partnership with some of the leading consulting and economic research firms in the country, the Institute studies the critical issues facing manufacturing and then applies that research to develop and identify solutions that are implemented by companies, schools, governments and organizations across the country.

The Institute's Center for Manufacturing Research collaborated with Keybridge Research for this study. Keybridge is a boutique economic and public policy consulting firm that serves as economists, policy experts and strategic advisers to a diverse clientele, including Fortune 500 companies, global financial firms, trade associations, non-profit organizations, federal agencies and other institutions that operate at the intersection of economics and public policy. Keybridge provides clients with a suite of analytical and advisory services, ranging from macroeconomic risk assessments, economic modeling studies, policy impact studies, qualitative policy evaluations, survey design and analysis and strategic consulting.

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INTRODUCTION / EXECUTIVE SUMMARY

According to the National Association of Manufacturers' most recent outlook survey, attracting and retaining a quality workforce constitutes one of the top challenges facing the manufacturing industry. Amid an extended economic expansion and record-low U.S. unemployment, the manufacturing industry faces a labor shortage exacerbated by the aging of the manufacturing workforce and gradual retirement of the baby boomer generation—as of 2017, nearly one-quarter of the sector's workforce are age 55 or older. Recognizing that a quality workforce is crucial to productive and successful businesses, manufacturers have responded to the scarcity of suitable workers in a variety of ways, including boosting recruitment efforts, adopting new technologies and taking steps to retain and maximize the productivity of their older workers.

Through a survey of manufacturers and a series of interviews with industry leaders, The Manufacturing Institute has sought to learn more about this response. This report distills the findings of that research process, evaluating the extent to which the manufacturing sector is aware of the aging of its workforce, the nature of the industry's concerns surrounding this demographic shift and how manufacturing firms have adapted to this trend.

To that end, Section I of this report provides a review of relevant literature to address the scope of the issue and place it in the broader context of the aging American population and workforce. Section II uses survey results and information obtained in interviews to evaluate the degree to which manufacturing firms are aware of the sector's aging workforce and the nature of the concerns that have risen as a result of this demographic change. Finally, Section III relies on insights obtained through interviews with industry leaders and context provided by the survey to share best practices that have enabled manufacturing firms to successfully navigate the aging of the workforce.

Key findings of the report include:

- Most manufacturing firms are both aware and concerned about the aging of the manufacturing workforce. Almost all (97 percent) survey respondents report being aware of the issue, and the vast majority (78 percent) indicate that they are very or somewhat concerned about this change.
- Manufacturing firms are particularly concerned about brain drain (i.e., the loss of institutional and technical knowledge): 97 percent of firms express at least some concern about brain drain and almost half of firms indicate that they are “very concerned” about the issue. Survey results also show that many firms are concerned about a shortage of labor, declining productivity, and rising costs.
- Firms across the manufacturing sector are taking steps to mitigate the impact of the aging workforce on their business. Almost 90 percent of companies surveyed reported capitalizing on the talents and experiences of their older workers, and of these, 46 percent report benefitting from older workers “to a great extent.”
- Results from the survey and information collected during interviews with manufacturing firms show that those who have successfully dealt with the aging of their workforce target four main objectives, each of which can be achieved through a suite of underlying best practices. These goals can be mapped to the best practices in the table on the following page.

KEY OBJECTIVES AND BEST PRACTICES

Early Awareness	<ul style="list-style-type: none"> • Create open communication channels • Bring up retirement with employees as retirement age nears • Ensure that employees feel valued and secure
Knowledge Transfer	<ul style="list-style-type: none"> • Establish and strengthen mentorship and apprenticeship programs • Collect and archive older workers' knowledge using centralized electronic records • Hire older workers with needed knowledge
Retention and Productivity Maximization	<ul style="list-style-type: none"> • Make ergonomic adjustments and use robotics • Allow workers to transfer to another position internally • Adopt to workers' needs with flexible hours or phased retirement • Encourage workers to return part time or through project contracting
Boost Recruitment	<ul style="list-style-type: none"> • Incorporate older workers into recruitment efforts • Use referrals from older workers

Overall, the manufacturing firms surveyed and interviewed appear aware of the challenges associated with the aging of their workforce, are appropriately concerned about consequences and have identified helpful steps to mitigate its impact on their business. Based on these findings, firms within the manufacturing sector, as well as those with similarly aging workforces in other industries, are likely to find the best practices described in this paper useful in designing and refining their response to this demographic challenge.

I. OVERVIEW

1.1 The aging workforce in a tight labor market

The United States is undergoing a dramatic demographic transformation as society ages faster than ever before. By 2030, one in five Americans will be 65 years or older. By 2035, for the first time in U.S. history, retirement-age Americans will outnumber Americans under 18.¹

Two main trends are responsible for this phenomenon. Many Americans are living longer, healthier lives: life expectancy has increased significantly in the last several decades, driven partly by a decline in deaths from leading health conditions such as heart disease and cancer. At the same time, fertility has trended downward over the last 20 years, shrinking the relative size of today's youth population. In 2018, the U.S. population grew by just 0.62 percent, the lowest rate since 1937.² As immigration rates have plateaued, most of the growth slowdown can be attributed to a steady decline in the birth rate.³

The aging of the overall U.S. population is driving the aging of the U.S. workforce. In 2016, the median age of an American worker was 42.0, compared to 40.8 in 2006 and 38.3 in 1996.⁴ As older Americans increasingly outnumber their younger counterparts, a growing share of the workforce is comprised of workers in their 50s and 60s. But population aging is not the only contributor to the aging workforce. Americans are more frequently delaying retirement for financial and personal reasons, a choice made possible by improving health prospects. As more Americans choose to work beyond traditional retirement age, the average age of an American worker will continue to rise.

Such a dramatic transformation in the makeup of the U.S. labor market will affect businesses and employers in many ways and will force businesses to adapt to remain competitive. For example:

- Demographic aging across the entire U.S. population is likely to exert increasing pressure on public finances—as well as private pension and healthcare plans—as relatively fewer younger workers must support a growing retired population. Businesses may observe this reality through a higher tax burden and rising labor costs associated with their retirement and healthcare benefits.
- Closer to home, many employers are likely to notice the effects of an aging workforce within their own organizations. Human resources professionals may witness a growing number of workers staying on well past retirement age due to desire, financial need or employer encouragement. Older workers may struggle to complete tasks as efficiently as younger workers due to physical limitations or the absence of skills applicable to the new economy—or they may be constrained by the perception that they are less productive.
- Declining birth rates mean that relatively fewer 16 year olds enter the labor force each year. Combined with the ongoing, large-scale retirement “wave” accompanying the aging of the baby boom generation, employers are likely to experience worker shortages, and may struggle to recruit entry-level employees and retain talented workers. This, in turn, may lead to higher wages and salaries and accelerate the deployment of technology like robotics and artificial intelligence to boost worker productivity. This trend is likely to be compounded by the immediate labor market environment. With unemployment below 4 percent, employers must take extra steps to recruit and retain workers or make do with less labor.

However, the aging workforce also poses opportunities. Longer lives mean that older workers—who are often more experienced and more knowledgeable than the average worker—can comfortably work for longer. Organizations may benefit from the greater range of ages represented among their workforce if they are able to capitalize on the wider variety of experiences and methods held and practiced by their employees. Despite the challenges, an organization that effectively leverages its older employees is likely to gain an edge in a changing economy.

1.2 The aging workforce in a tight labor market: effect on the manufacturing sector

An aging U.S. population will affect all organizations across the entire American economy. However, the phenomenon is likely to have a particularly pronounced effect on the manufacturing industry due to several factors that make the sector unique. In fact, evidence suggests that these effects are already well underway.

- The manufacturing workforce is already older—and aging faster—than the overall U.S. labor force. The median age of a manufacturing worker rose from 40.5 in 2000 to 44.1 in 2018 compared to a median age of 39.3 in 2000 and 42.2 in 2018 for the total U.S. labor force.⁵ The manufacturing workforce is older in part because the industry itself has existed for longer than many services industries that have emerged in recent decades, and in part because of a more concerted effort on the part of manufacturing employers to retain their older workers by encouraging them to delay retirement. However, manufacturing often struggles more than other industries to attract younger workers. Research and anecdotal evidence from the interviews conducted for this study show that this stems from a combination of 1) younger people’s perceptions that manufacturing work is dangerous or behind-the-times; 2) a declining emphasis on vocational education and apprenticeships over the last several years; and 3) a geographic mismatch between younger talent, who often prefer to live near large, growing cities and manufacturing offices and factories, which are often located outside large urban centers.
- Due to the technical nature of manufacturing production work, the manufacturing sector suffers acutely from labor shortages in an environment of population aging and labor market tightness. This effect is deemed the manufacturing “skills gap.” A 2018 study conducted by Deloitte and The

Manufacturing Institute estimated that 2.4 million job openings in manufacturing—accounting for half of all open positions—will go unfilled between 2018 and 2028 as a direct consequence of the skills gap.⁶ Compounding the skills gap and labor shortage issue is the fact that manufacturing, unlike many other industries, demands a wider variety of skills from its recruits because manufacturing requires both highly skilled and lesser skilled labor on the production side, and salaried labor on the management and administration side.

- Ongoing technological change, especially the advance of robotics and artificial intelligence, is transforming the use of labor within the manufacturing industry. Implementation of new technologies has had profound implications for the workforce, including for older workers, necessitating the need for more continuous training and exacerbating the “skills gap” challenge.⁷

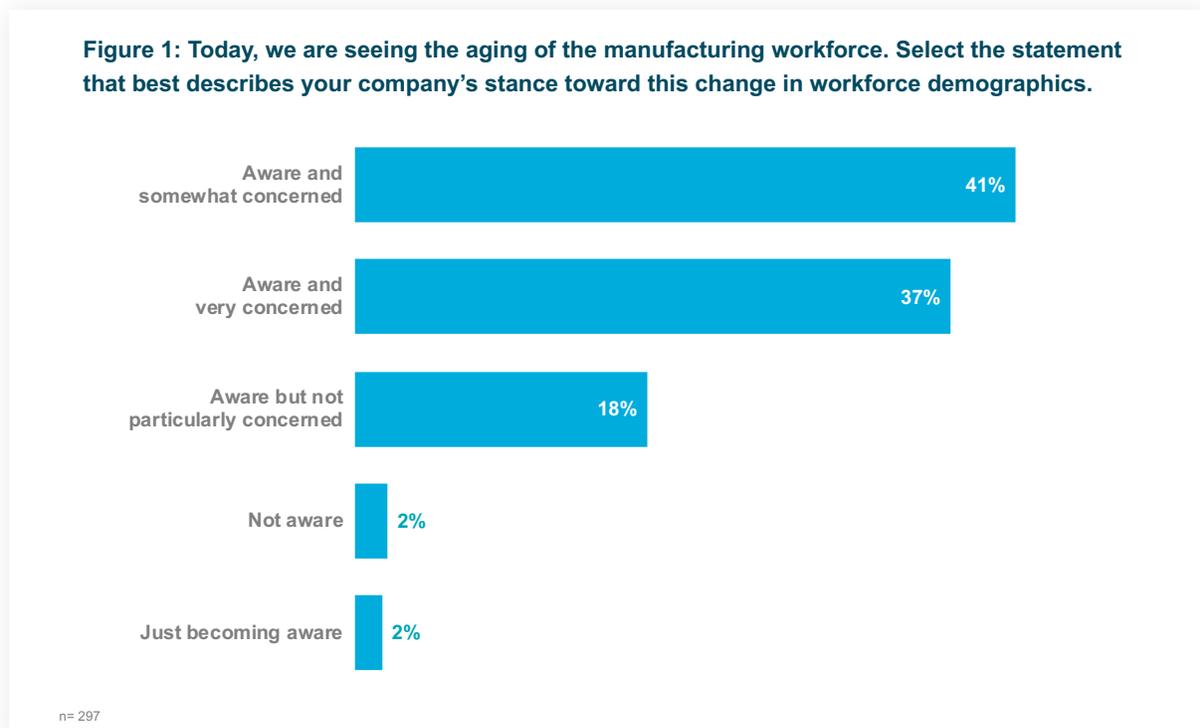
Taken together, these manufacturing-specific factors indicate that the manufacturing sector is at the frontier of the aging workforce trend. An older-than-average workforce means that the sector is witnessing the effects of workforce aging earlier than many other industries, all while bearing the brunt of the trend more acutely due to the skills gap, and experiencing a more rapid transformation in workforce dynamics due to the widespread deployment of automation technology.

Because the manufacturing sector faces a unique set of challenges and opportunities in confronting the aging workforce, manufacturing firms are likely to respond differently from firms in other industries. Through a survey of 300 companies and series of interviews with more than 15 manufacturing industry leaders, this report assesses the degree of awareness and nature of the concerns surrounding the aging workforce in the manufacturing sector, and explores the ways in which companies are successfully adapting to this trend.

II. AWARENESS AND CONCERNS

2.1 Awareness and degree of concern

The manufacturing sector appears well-aware of the aging of its workforce and the unique challenges posed by this demographic change. In fact, a survey of 302 manufacturing companies shows that the majority of firms are both aware and at least moderately concerned about this shift.



Almost all (96 percent) survey respondents reported being aware of the issue of the aging of the manufacturing workforce, and the vast majority (78 percent) indicated that they were very or somewhat concerned about this change. Interviewees also indicated that the issue of the aging workforce receives substantial attention at their company. For example, a leading producer of plastics reported regularly assessing the years of experience lost to the firm due to retirement in order to inform its recruitment efforts. Similarly, a producer of industrial equipment reports tracking its older workforce demographics by “retirement eligible” and “retirement likely” buckets in order to assess the potential impact of impending retirements on the company.

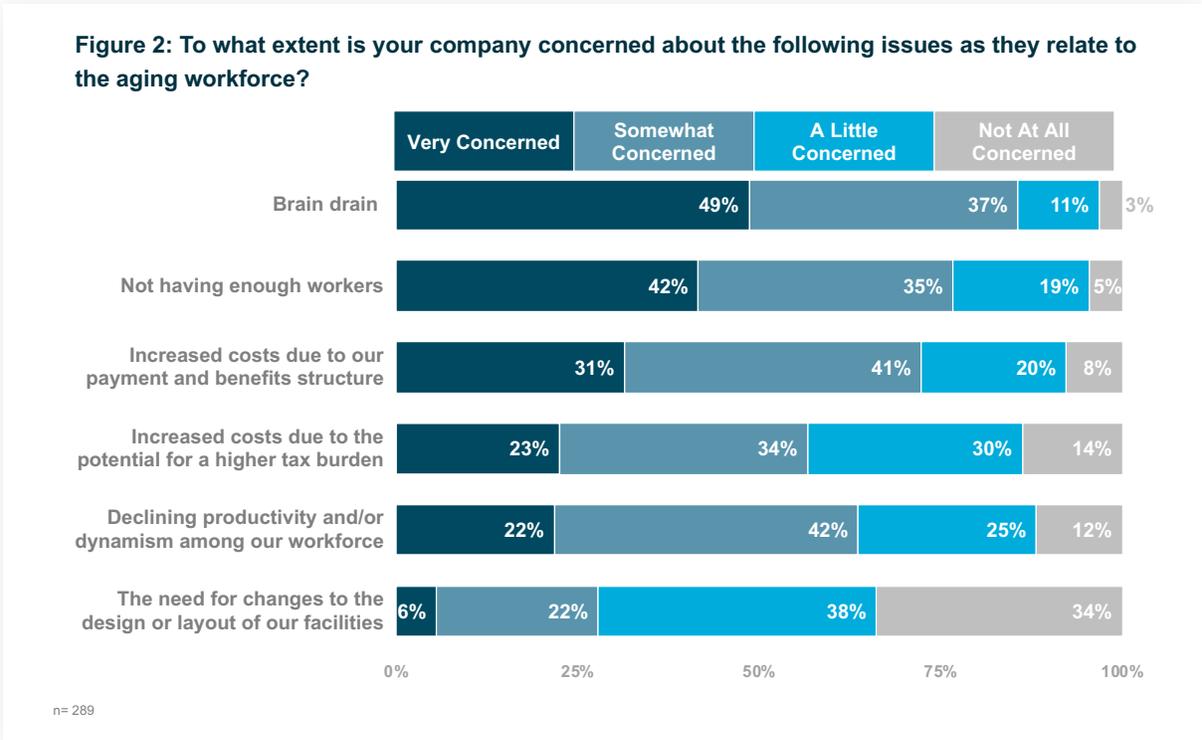
While a minority of survey respondents (less than 20 percent) indicated that they were not particularly concerned about the aging of their workforce, this lack of concern appears correlated with the relative youth of their particular workforce. Of the firms indicating that they were not concerned, less than 50 percent have workforces where more than a fifth of employees are over 55 years old, compared to 72 percent of those reporting greater concern.

That said, a relatively younger workforce is not the only factor that explains less concern over the aging workforce issue. Interviews suggest that companies may be less concerned if they have already established initiatives to address the demographic shift, and thus feel prepared to face associated challenges. For example, Atlas Machine & Supply, Inc. (Atlas) began implementing measures to address the aging of its workforce nearly a decade ago, and while the firm continues to monitor demographic changes, the company’s leadership reports that Atlas is well-placed to handle such shifts.

Overall, survey results and interviews suggest that firms across the manufacturing sector are paying attention to the aging of the industry’s workforce and are concerned about its impact.

2.2 Nature of the concern

In contrast to other industries, where employers cite worries about declining workforce productivity, dynamism and outdated skillsets, the manufacturing industry’s greatest concern associated with the aging workforce is “brain drain,” the loss of institutional and technical knowledge. This is largely because most manufacturing leaders contend that older workers possess a tremendous amount of skill and knowledge, and worry that these valuable workers will retire without passing their knowledge to the next generation. Survey results also show that many firms are concerned about a shortage of labor, declining productivity and rising costs.



2.2.1 BRAIN DRAIN

According to both the survey of manufacturers and interviews with business leaders, manufacturing firms are primarily concerned that the aging of the workforce will result in the loss of their older workers' institutional and technical knowledge. Specifically, 97 percent of firms express at least some concern about brain drain, and almost half of firms indicate that they are “very concerned” about the issue.

Interviewees indicated that this concern stems primarily from the fact that older workers have accumulated the bulk of experience and knowledge about a given firm and its production process—as one would expect in any industry. However, interviewees reported that this issue is aggravated in the manufacturing sector by the lack of technical skills training available to manufacturing-sector candidates. In particular, a waning emphasis on vocational education programs, as well as the high degree of technical skill required in specialized industries, mean that new recruits frequently lack the level of skill sought by the sector.

The problem of the aging workforce has been exacerbated by a decline in emphasis of vocational skills training in the public school system. – *Rich Gimmel, Chairman, Atlas Machine & Supply, Inc.*

Most workers coming out of school understand computerized systems but don't have manual skills and lack the nuanced knowledge that our workforce has built over time. – *Genoveva Perez, Human Resources Manager, ACE Clearwater*

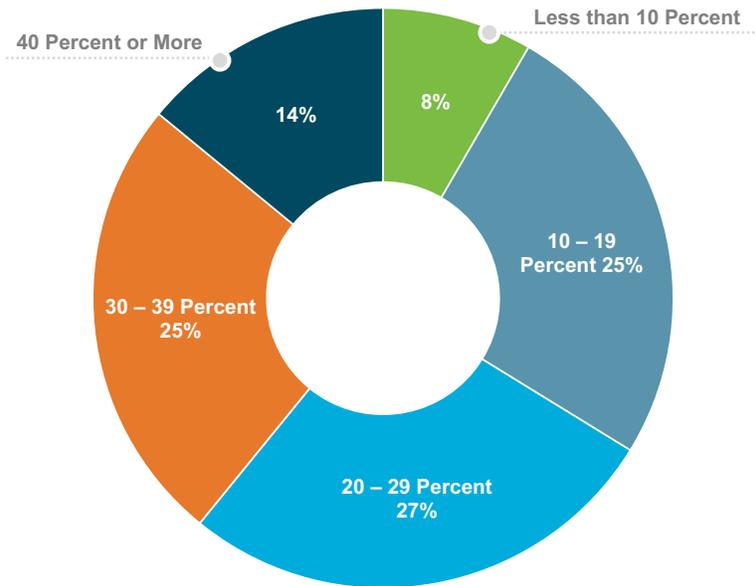
Overall, many firms worried that their older workers will retire before passing on their full body of knowledge to the next generation. This concern is particularly acute for firms whose cultures tend to rely on passive information transfer and interpersonal connections to share knowledge. In such instances, firms may not have a playbook for institutionalizing and preserving such information, and knowledge may be lost when older workers depart. For this reason, many firms place great emphasis on knowledge transfer and, specifically, on mentorship and apprenticeship programs.

2.2.2 LABOR SHORTAGES

Companies across the manufacturing sector also expressed concern over the potential for labor shortages as older workers retire. In fact, 96 percent of survey respondents cited “not having enough workers” as an issue over which they experience at least some degree of concern, with 42 percent of companies specifying that they are “very concerned.”

Interviews indicated that much of this anxiety stems from the fear that older workers will retire en masse as they approach their mid-60s. This concern may stem at least partially from the fact that for many companies, a large share of their workforces is approaching retirement age: 66 percent of survey respondents indicated that workers age 55 and older comprise at least 20 percent of their workforce.

Figure 3: What percentage of your existing workforce would you estimate to be 55 years of age or older?



n= 299

However, survey results did not yield a statistically significant correlation between degree of concern about a labor shortage and the demographic structure of the company workforce. In other words, companies with a higher share of older workers did not universally display greater concern about the possibility for worker shortages. This suggests that there are other factors beyond workforce age driving concerns about a labor shortage. For example, some companies interviewed for this report indicated that their concerns about not having enough workers are mitigated by the fact that their older workers already tend to work well past typical retirement age due to financial need. Conversely, companies whose workers normally retire on time tend to express a greater degree of concern about an impending labor shortage. In addition, existing company policies designed to delay or smooth the retirement wave—such as phase-in retirement programs—may likewise ease concerns about a labor shortage.

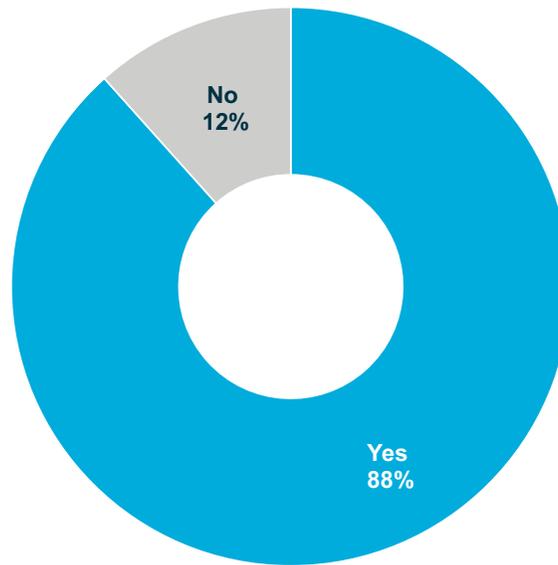
Overall, survey results show that labor shortages and brain drain constitute the main sources of concern among manufacturers, and the two issues appear to be the primary drivers of companies' responses to the aging workforce.

2.2.3 DECLINING PRODUCTIVITY AND DYNAMISM

Survey results suggest that the potential for declining productivity and dynamism constitute a secondary area of concern associated with the aging workforce: 64 percent of manufacturers surveyed indicated that they were either very or somewhat concerned about this issue.

However, there is evidence to suggest the manufacturing sector maintains less concern about this issue in comparison to other industries. Deloitte's 2018 *Global Human Capital Trends* report finds evidence of significant age bias against older workers across a variety of companies and industries because of the perception that older workers constitute a competitive disadvantage.⁸ However, 89 percent of companies participating in the survey indicated that they would like to keep their older workers for longer, if possible—suggesting that most companies view their older workers as valuable assets rather than a drain on company productivity and dynamism.

Figure 4: If your company could keep its older workers for longer, would you?



n= 284

Interviews bear out this finding: the vast majority of interviewees indicated that their older workers are a tremendous asset to their firm, and expressed interest in retaining these employees for as long as possible.

2.2.4 COSTS AND LIABILITIES

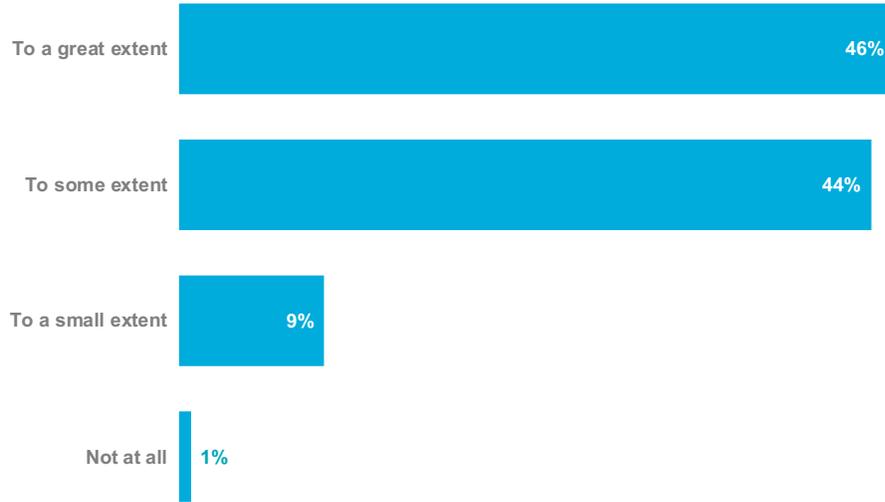
Companies surveyed were slightly less concerned about the potential for increased costs and liabilities associated with the aging of the workforce, and the sources of these costs vary. About 70 percent of survey respondents are very or somewhat concerned about the potential for increased costs associated with their compensation and benefits structure, 57 percent are very or somewhat concerned about the potential for increased costs associated with a higher tax burden and 28 percent are very or somewhat concerned about the need for structural and ergonomic changes to their factories and offices.

Interviewees did not frequently cite compensation structure or a higher tax burden as a significant area of concern for their companies. Rather, a minority of companies discussed the need for structural and ergonomic changes to their factories and offices—primarily to aid older workers on the job, ensure their safety and maintain productivity.

III. BEST PRACTICES

Aware of the challenges associated with the aging of their workforce, firms across the manufacturing sector are taking steps to mitigate its impact on their business. In fact, results from the survey show that almost 90 percent of companies are capitalizing on the talents of their workers, and of these, 46 percent report benefitting from their older workers “to a great extent.”

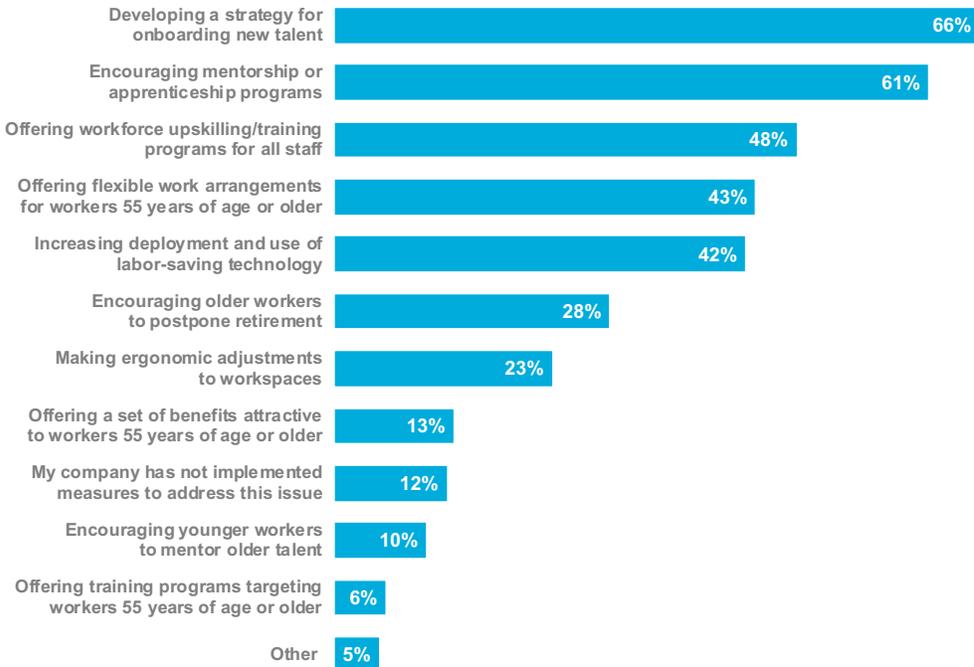
Figure 5: Overall, to what extent do you believe your company is capitalizing on the talents and experiences of its employees 55 years of age or older?



n= 269

Results from the survey and information collected during interviews with manufacturing firms show that those who have most successfully dealt with the aging of their workforce target four main objectives. These objectives include 1) ensuring early awareness of workers' retirement plans, 2) facilitating knowledge transfer from older to young workers, 3) maximizing the longevity of older workers' careers, and 4) boosting recruitment. The following sections lay out suites of best practices and tools described in the survey and by interviewees that have enabled companies to achieve these goals.

Figure 6: What is your company doing to address the potential changes related to an aging workforce? Check all that apply.



n= 288

KEY OBJECTIVES AND BEST PRACTICES

Early Awareness	<ul style="list-style-type: none"> • Create open communication channels • Bring up retirement with employees as retirement age nears • Ensure that employees feel valued and secure
Knowledge Transfer	<ul style="list-style-type: none"> • Establish and strengthen mentorship and apprenticeship programs • Collect and archive older workers' knowledge using centralized electronic records • Hire older workers with needed knowledge
Retention and Productivity Maximization	<ul style="list-style-type: none"> • Make ergonomic adjustments and use robotics • Allow workers to transfer to another position internally • Adopt to workers' needs with flexible hours or phased retirement • Encourage workers to return part time or through project contracting
Boost Recruitment	<ul style="list-style-type: none"> • Incorporate older workers into recruitment efforts • Use referrals from older workers

3.1 Early awareness

Learning of an employee's plans to retire as early as possible grants companies time to develop a clear succession plan and ensure a smooth transition. For this reason, interviewees emphasized the need to find out as early as possible about an employee's retirement plans, and described several practices that have encouraged their employees to bring up their retirement plans with as much as several years notice. These practices include 1) establishing open communication channels at an early stage in employees' careers. 2) encouraging leadership to bring up retirement planning as an employee approaches retirement eligibility, and 3) taking steps to ensure that employees feel valued and secure.

3.1.1 CREATE OPEN COMMUNICATION CHANNELS

Establishing open communication channels at an early stage in employees' careers provides workers with a trusted means of exchanging ideas, concerns and, eventually, retirement plans with managers. Regular use of these channels throughout an employee's tenure creates a culture and habit of communication, such that when employees consider retirement, they have an established way of sharing their plans. Interviews suggest that regular, formal check-ins with employees and programs focused on retirement planning constitute effective communication channels, particularly when the directive to prioritize the use of these channels comes from the firm's top leadership.

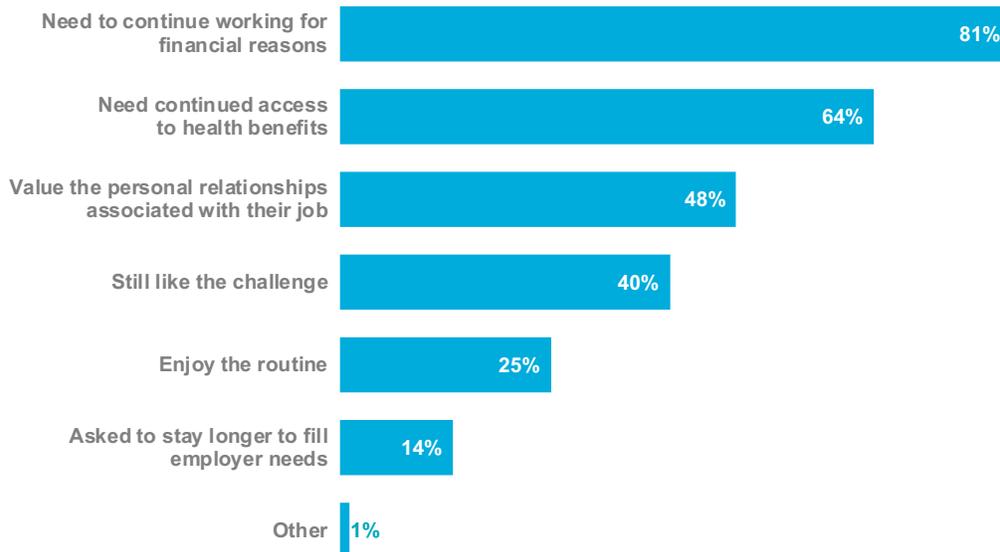
- **Organize consistent, formal check-ins:** Interviewees pointed out that holding regular check-ins with employees gives workers a recurring opportunity to bring up their retirement plans in a private and comfortable setting.

For example, as part of highly successful initiative to boost employee engagement, Ingersoll Rand encourages managers to hold regular check-ins with employees. To ensure that these conversations are effective, the company provides managers with training and a toolkit of best practices, including how to spot effective entry points into a check-in conversation, avoid assumptions, seek feedback and inquire about workers' happiness, aspirations and priorities. Ingersoll Rand reports that the trust established during these "re-recruitment" conversations has boosted older workers' willingness to bring up retirement plans far in advance of their departure.

Similarly, Behlen Mfg. (Behlen) ensures that management seeks out conversations with older workers to inquire about their evolving needs, interests and priorities, and maintain dialogue regarding retirement. Citing the success of these conversations in boosting retention and obtaining early awareness of their employee’s retirement plans, Behlen is formalizing these conversations into “stay interviews” focused on career development and planning for workers approaching retirement age.

- **Help workers prepare early:** Programs that promote employees’ financial wellness and retirement preparedness serve as natural conduits for conversations around retirement plans. For example, a manufacturing firm specializing in heavy machinery described establishing a financial preparedness program that engages all employees regardless of age. In addition to boosting financial literacy and helping workers understand their retirement plans, the preparedness program constitutes a designated channel for conversations about retirement as employees age. Similarly, Ford Motor Company’s (Ford) Work or Retire program allows employees to assess their financial health and retirement options, opening up dialogue around retirement plans. Results from the survey suggest that such financial wellness initiatives are likely to resonate with a broad base of employees across the manufacturing sector, since 81 percent of survey respondents reported that their retirement-eligible employees continue to work for financial reasons.
- **Start the tone at the top:** During interviews, firms that established open communication channels and gained early insight into older workers’ retirement plans often attribute their success to the vision and perseverance of their leaders. For example, at Behlen and Ingersoll Rand, top executives personally emphasize the importance of open communication between managers and older workers, ensuring that employees at all levels of the firm make check-ins both regular and meaningful.

Figure 7: If retirement-eligible employees remain with your company, what are their primary reasons for doing so? Select up to three answers.



n= 273

3.1.2 BRING UP RETIREMENT WITH EMPLOYEES AS RETIREMENT AGE NEARS

Once communication channels are in place, management can bring up retirement with employees in a private, trusted setting as they approach retirement age. Interviewees report that engaging employees starting around age 55, or whenever they reach retirement eligibility, is crucial to securing advance notice of an employee's retirement plans.

- **Engage at the point of retirement eligibility:** Several interviewees described an employee's arrival at retirement age or eligibility as a key entry point into conversations around their retirement plans. For example, human resources administrators and team supervisors at QCC work together to give employees the opportunity to discuss their careers and retirement when workers become Social Security eligible. At that point, human resources administrators check in with workers to ensure that they are aware of their retirement options, while simultaneously clarifying that employees are welcome to stay as long as they wish. Other interviewees suggested holding conversations with employees nearing retirement age regarding their plans and aspirations, both personal and professional.
- **Offer formal coaching:** Retirement coaching offers employers a way to bring up retirement with older workers by offering them an opportunity to build a retirement plan around personal interests and financial goals. For example, employees who enroll in Air Liquide's retirement coaching program complete an assessment that a retirement coach uses to help them create a comprehensive retirement plan. Air Liquide has found that training its own employees to serve as coaches has encouraged participation and the provision of advanced notice of retirement since employees are more at ease with coaches they recognize than with a third-party provider.
- **Do more listening than telling:** Interviewees at Behlen emphasized the importance of listening to employees during conversations around retirement and asking workers what works best for them and their families, rather than entering into conversations with expectations or solutions.

One of the most important things is not having all the answers going into the conversation, but to come up with mutually agreed upon solutions through respectful discussion. This is the time for leadership to listen, because these employees are mature citizens. – *TR Raimondo, Chairman, Behlen Mfg.*

3.1.3 ENSURE THAT EMPLOYEES FEEL VALUED AND SECURE

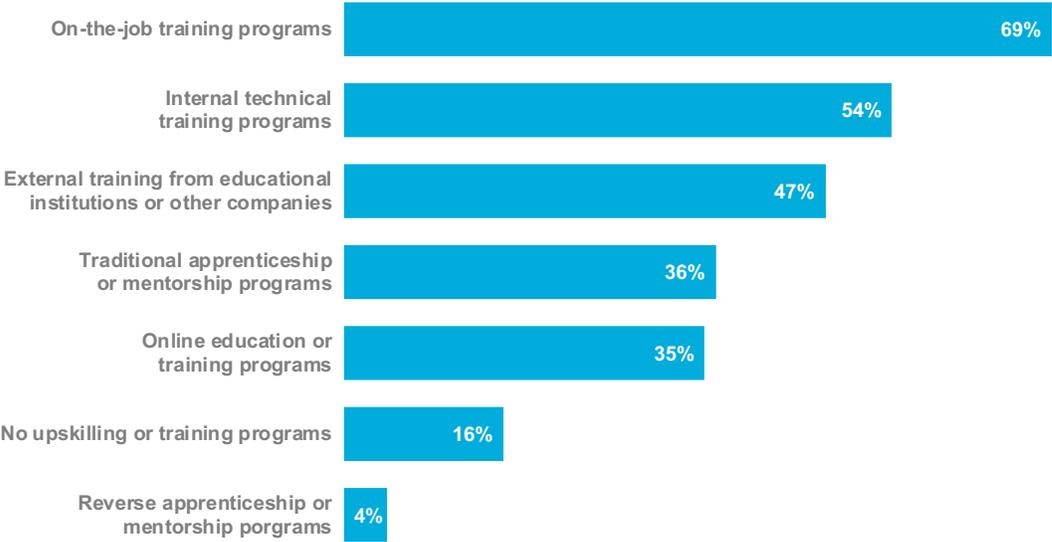
Employees who feel valued and secure are more likely to engage with employers in retirement and succession planning. To encourage workers to speak up about their retirement plans as soon as possible, companies can take steps to ensure that their employees see themselves as valuable contributors to the firm's well-being.

- **Recognize employees:** Recognizing employees for their years of service constitutes a simple but powerful way of making employees feel valued at work. For example, Atlas celebrates employees whose tenure reaches 15 years by designating them Atlas Veteran Performers. Along with this award, workers receive a uniform patch or medal, perks and recognition at the company's annual luncheon. Executives at Atlas suggest that this clear value signaling has not only improved retirement notice; it has also been crucial to retention efforts. Other interviewees, including those at Ball and Vermeer, also described recognition as an effective retention-boosting tool.

No matter what generation you're from, you want to be recognized for doing a good job. People need to feel that what they do is important. – *Scott Morrison, Chief Financial Officer, Ball Corporation*

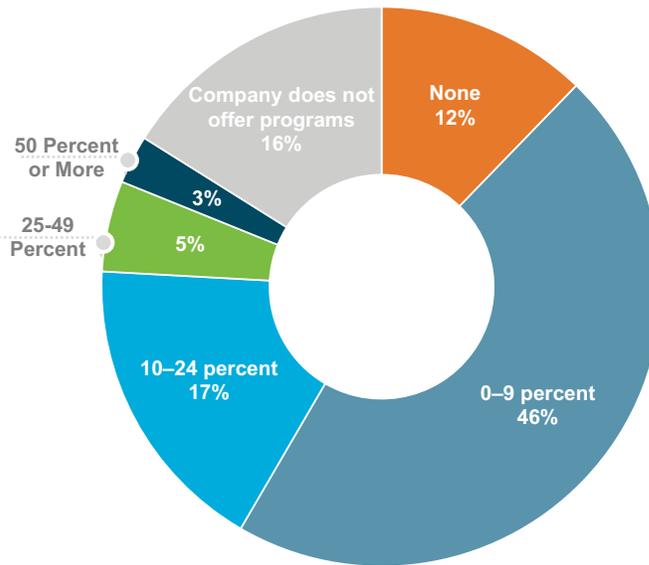
- Target engagement:** Whether engagement takes the form of regular communication with managers, membership on an internal committee or participation in mentorship and apprenticeship programs (described in Section 4.2.1 below), higher levels of engagement at work help employees feel valued and secure. For example, by encouraging managers to enter into more frequent, high-quality conversations with their team members, Ingersoll Rand has witnessed a significant improvement in employee engagement. At Behlen, older workers remain engaged by joining internal committees, such as the 401k Committee, Activities Committee, or even company board: one longtime employee who was awarded the title of honorary board member attended every meeting until the age of 85. Regardless of its shape, engagement has the ubiquitous effect of making employees feel valued.
- Offer training programs:** Interviewees almost universally confirmed that older workers in the manufacturing sector are experts in their respective fields. As such, they do not need upskilling or training courses to raise their productivity, unlike their younger cohorts. For this reason, older workers are unlikely to opt into training and upskilling programs designed to help newer hires acquire and refine skills fundamental to their work. Survey results support these findings: almost half of respondents offer upskilling and training programs to all staff, but older workers make up less than 10 percent of such programs' participant pools, despite making up a higher average share of the labor force.

Figure 8: What are some examples of workforce upskilling or training programs that your company has implemented to address the potential changes associated with an aging workforce? Check all that apply.



n= 288

Figure 9: Among the employees in your upskilling or training programs, what percentage do you estimate are 55 years of age or older?



n= 286

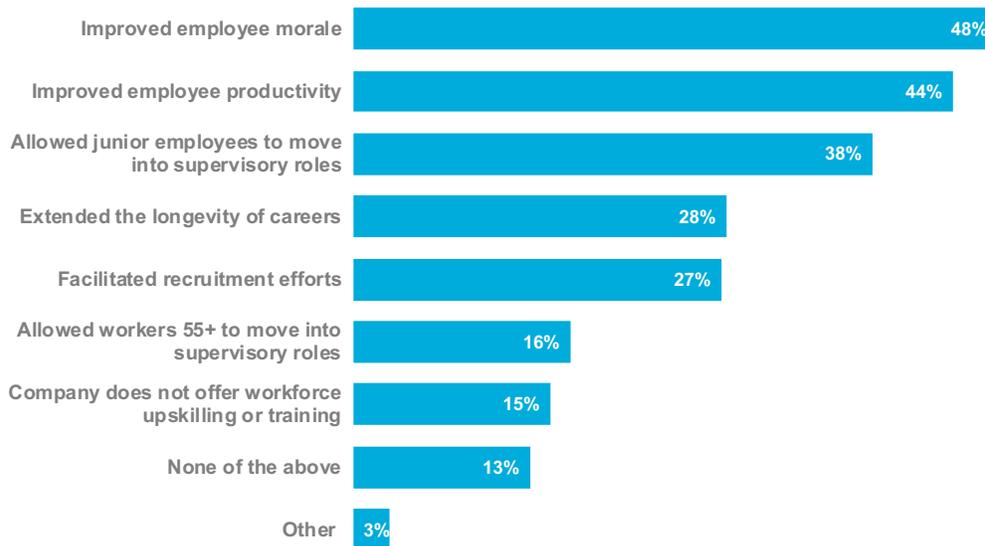
That said, several interviewees noted that other educational opportunities that attract and include both younger and older workers boost morale and engagement among participating older workers, making them more inclined to continue working longer. Examples of such programming include group instruction regarding the use of new equipment, training in skills valued by employees but perhaps tangential to their core activities or courses led by older workers to train new hires. The resulting boost to morale from these opportunities helps promote stronger feelings of engagement in work and loyalty to the company, which may inspire older workers to stay with the company for longer or contribute to the company in other ways.

The power of inclusion constitutes a clear benefit of having employees of all ages and seniorities in training classes together. Our greatest strength is our people and our connection to each other. – *Rebecca Teeters, Manufacturing Operations Model Director, 3M*

[Training] does much more for attitude and morale, and give[s] employees what they need to feel they're getting better and better at adding value. – *Jerry Letendre, Chief Executive Officer, Greenerd Press and Machine Co.*

Similarly, when asked how upskilling and training programs have influenced their workforce, approximately half of survey respondents reported that they have improved employee morale. This effect was significantly greater among companies reporting older worker participation in such programs, which were more likely to report improvements to morale in comparison to companies where no older workers participated in training.

Figure 10: How have these workforce upskilling or training programs influenced employee careers at your company? Check all that apply.

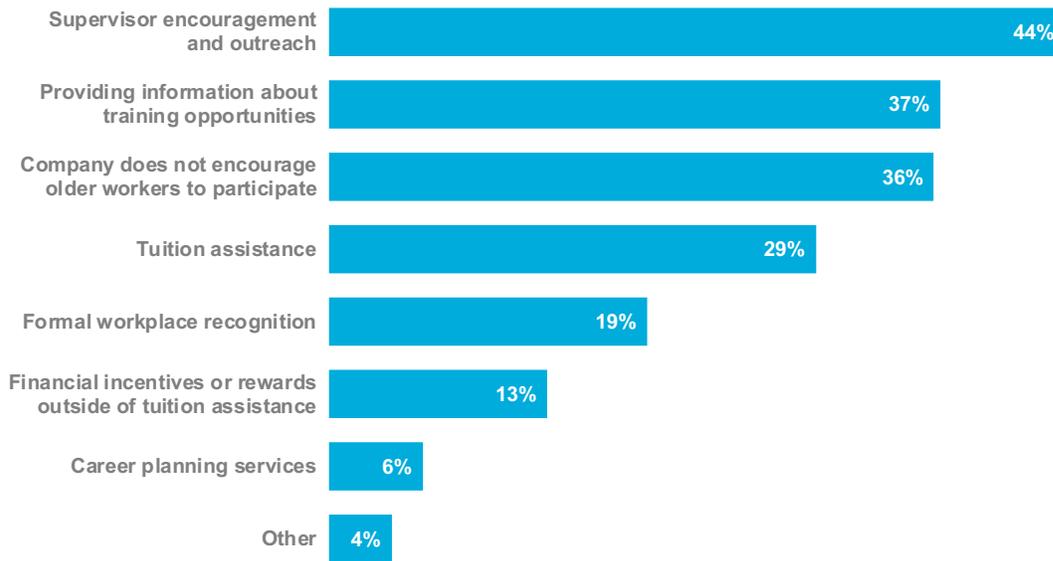


n= 268

Given these findings, companies aiming to increase the retention of their older workers may wish to offer training courses that entice both older and younger workers to participate—for example, by ensuring that the training programs offered target skillsets that older workers are interested in developing or by encouraging older workers to lead the instruction themselves. In particular, on-the-job and internal technical training programs—both forms of education widely offered by survey respondents and preferred by interviewees—allow workers to cultivate relationships with their community of coworkers.

Finally, training programs offer a touch point between employees and employers that can serve to facilitate conversations between workers and management regarding retirement options and plans. For example, 44 percent of survey respondents reported encouraging their older workers to participate in training and upskilling programs through supervisor outreach, suggesting the presence of a communication channel between older workers and their managers. Similarly, offering tuition assistance and formal workplace recognition for participation in programs—both steps undertaken by survey respondents—might boost trust and feelings of security among employees, and thus improve their comfort bringing up retirement with management. Employers may also be able to take advantage of the channels through which they provide information on training opportunities to boost employee awareness of initiatives designed to help older workers stay with the firm beyond retirement age. For example, several interviewees reported describing their retirement programs in company announcements, letters and emails that detail training opportunities.

Figure 11: What steps are you taking to encourage workers who are 55 years of age or older to participate in workforce upskilling or training programs? Check all that apply.



n= 267

- Set a precedent:** It is crucial to treat older workers with great respect and care, not only to retain the current generation of older workers, but also to procure the trust of future generations. Interviewees pointed out that the rest of a firm’s workforce is likely evaluating the treatment of today’s older workers as a means of understanding their own prospects down the line. Because of this dynamic, Air Liquide encourages employees who have participated in its retirement planning initiatives—including retirement coaching and phased retirement—to share their experience with other workers. These workers thus serve as ambassadors for the programs, boosting older worker participation and engagement.

3.2 Knowledge transfer

Given their concern about brain drain, it is no surprise that manufacturers have prioritized efforts to transfer knowledge from their older workers to newer recruits. In particular, survey respondents and interviewees highlighted mentorship and apprenticeship programs as a tried-and-true means of passing skills and information between generations. Several interviewees also described efforts to gather and store their older workers’ knowledge as electronic records, allowing them to preserve and distribute institutional knowledge at scale. Finally, interviewees noted successfully hiring older employees with desirable skillsets into their workforce as a means of regaining knowledge lost as other employees retire.

3.2.1 ESTABLISH AND STRENGTHEN MENTORSHIP AND APPRENTICESHIP PROGRAMS

Survey results and interviews show that across the manufacturing sector, mentorship and apprenticeship programs constitute a popular means of transferring knowledge. About 60 percent of survey respondents reported that in response to the aging of their workforce, they encourage older workers to mentor younger talent through mentorship or apprenticeship programs. Similarly, all companies interviewed reported cultivating informal mentorship relationships or establishing formal mentorship or apprenticeship programs. Interviewees noted that beyond transferring technical knowledge, mentorship programs have the added benefit of teaching new employees the soft skills and professional behaviors needed to be responsible workers.

Interviews reveal that in addition to limiting brain drain and cultivating new hires' professional skills, mentorship programs boost morale and engagement among older employees by fostering new personal relationships, which survey results show are one of the primary reasons why older workers postpone retirement. For example, Atlas reports that participation in mentorship programs contributes to employees' decisions to continue working because they find interactions with younger workers stimulating and rewarding. Similarly, 3M notes that senior employees enjoy mentorship and appreciate the opportunity to "leave a legacy and connect to a new generation of employees."

When you give someone responsibility for helping to grow someone's skills, if it's someone who takes pride in their work, they feel good about that and take ownership of it. Gives them enhanced meaning beyond just doing typical job, so they feel good about work and are more inclined to stick around. – Rich Gimmel, Chairman, Atlas Machine & Supply, Inc.

- **Train mentors to train mentees:** Companies with successful mentorship programs have either encouraged interested employees to opt-in to mentorship programs—relying on self-selection to build a team of skilled mentors—or have trained employees to become effective teachers. For example, Winton Machine (Winton) enrolls older employees in external workshops to learn teaching skills they use as mentors and share with colleagues. Similarly, Ball conducts internal trainings to prepare its older workers to be effective mentors. At Siemens US, shop floor supervisors select experienced workers who they believe have the time, ability and willingness to transfer their knowledge to new recruits to participate in the company's apprenticeship program. Those who become teachers also receive training in how to share their knowledge and evaluate apprentices' performance. Although formats vary, interviews suggest that training mentors is crucial to full and efficient knowledge transfer.
- **Share the benefits of mentorship with potential mentors:** Occasionally workers may prove reluctant to participate in mentorship programs, particularly if they fear replacement or are uncomfortable with the idea of teaching. In such instances, interviewees report successfully boosting participation by speaking with employees about the value of their skills and the importance of mentorship.
- **Make mentorship a long-term experience:** Complete and thorough knowledge transfer from one person to another requires time. For this reason, interviewees noted that mentors and mentees should collaborate repeatedly and for as long as possible prior to the senior worker's retirement. For example, Behlen paired a senior manager with his successor as soon as he expressed an interest in retiring, allowing for a 14-month mentorship experience and a smooth transition. Similarly, Ball ensures that mentorship relationships among its employees endure over time and are not isolated to one-off experiences.
- **Pair mentorship with other forms of education:** To make mentorship or apprenticeship more economical, companies may consider pairing such programs with other training opportunities to maximize the time younger workers have to learn new skills and minimize the amount of time senior employees spend away from productive work. For example, in addition to mentorship programs, Siemens utilizes community colleges for the academic component of the apprenticeship program. Apprentices have the opportunity to learn skills in college labs and then demonstrate those skills under the watchful eye of their shop floor mentor.
- **Try alternative forms of mentorship:** Beyond traditional mentorship programs, several interviewees reported successfully implementing alternative forms of mentorship such as reverse and group mentorship. Although such programs remain rare (less than 10 percent of survey respondents reported encouraging younger workers to mentor their older counterparts through reverse mentorship programs), interviews reveal that such non-traditional mentorship relationships offer distinctive benefits.

Interviews suggest that in many cases, reverse mentorship occurs informally. For example, at Anchor Glass older workers in mentorship relationships with younger workers have gradually grown more comfortable with new technologies as their mentees introduce them to new programs and features. Similarly, older workers at Ingersoll Rand have benefited from informal guidance offered by younger colleagues regarding new technologies and improvements.

Although relatively rare, some manufacturers offer formal reverse mentorship programs. For example, 3M has established a program for two-way mentorship in which the direction of mentorship alternates between sessions. Senior executives have generally taken advantage of this model to boost their familiarity and comfort with modern tech-based communication tools.

Finally, several companies reported a nascent interest in group mentorship models. In these instances, the interviewed firm encouraged a single senior employee to mentor 10 or more younger colleagues. For example, one worker at ACE selected a team of 10 trainees with whom he worked closely to successfully transfer knowledge. Similarly, Anchor Glass gives experienced workers the opportunity to lead training sessions, and Greenerd has plans for seasoned workers to offer classroom style instruction and demonstration to younger workers.

3.2.2 COLLECT AND ARCHIVE OLDER WORKERS' KNOWLEDGE USING CENTRALIZED ELECTRONIC RECORDS

In addition to mentorship and apprenticeship programs, companies have also had success using electronic records to collect and safeguard their older employees' knowledge. Although there are costs to building and maintaining these electronic records, collecting information centrally has the benefit of making knowledge transfer scalable, since electronic records can be accessed by multiple employees at any time.

For example, ACE has developed ACETube, a database of videos that captures the knowledge of the company's older workers through a series of interviews. Employees seeking information access these videos on a computer and iPad, ensuring that they can obtain necessary information anytime, anywhere. Similarly, Ball documents its senior employees' expertise by translating older workers' knowledge into virtual reality (VR) training programs. These VR trainings offer younger workers the chance to visualize technical work, guided by the knowledge of prior generations.

3M takes a particularly human-centered approach to knowledge collection by offering older employees "storytelling opportunities." To facilitate knowledge capture, senior workers are interviewed and the information they provide is entered into an internal database. The database is leveraged to create a digital coaching network that offers new hires relevant video content and written materials and directs them to current workers with relevant expertise.

3.2.3 HIRE OLDER WORKERS WITH NEEDED KNOWLEDGE

Several interviewees reported combatting brain drain by hiring older workers with the same or similar knowledge and skills as the company's retiring workers, thus replacing any knowledge lost. For example, Greenerd reports that 40 percent of its older workforce is comprised of newly hired workers with knowledge and skillsets the firm needs. Interviews suggest that the company not only benefits from these individuals' invaluable knowledge, but also from their professionalism, work ethic and productivity on par with that of younger workers.

We chose to be open to hiring older folks who retired but who have since decided they want to return to work and have the skills we're seeking. For example, one of our machinists—who we hired over two years ago—is about to turn 80 and says he hasn't been happier in years . . . Newly hired older workers are very grateful and really enjoy having the opportunity to apply their trade . . . their work ethic is so strong that they are as about as productive as younger workers, and their enthusiasm winds up boosting broader morale. – Jerry Letendre, Chief Executive Officer, Greenerd Press and Machine Co.

3.3 Retention and productivity maximization

Companies facing labor shortages must strengthen and expand their recruitment efforts to address the aging of their workforce in the long term. However, several best practices can help companies retain their older workers and maximize their productivity until new talent can be acquired: 1) employing automation to handle repetitive manual labor so older workers can prioritize tasks that require their unique skills and knowledge; 2) allowing workers to transfer internally to another position; 3) offering flexible hours or phased retirement; and 4) encouraging workers to return part time after their initial retirement.

3.3.1 MAKE ERGONOMIC ADJUSTMENTS AND USE ROBOTICS

About a quarter of survey respondents reported making ergonomic adjustments to workspaces in response to the aging of their workforce. Such changes were also frequently cited by interviewees, who highlighted several best practices ranging from simple, inexpensive fixes like installing padded mats to advanced solutions like the use of robotics.

- **Make light touch fixes:** Ergonomic adjustments do not have to be complex, disruptive or expensive to be effective. For example, several interviewees built additional seating and provided padded mats in recognition of the fact that the most physically challenging part of an older worker's job is often standing on their feet all day. Interviews also suggest that changes designed to increase visibility, such as the installation of brighter lighting or use of clear containers, are also highly effective. Interviewees also explained that they encourage older workers to request helpful modifications to their workspaces.

The key when someone can't do a job is how he reaches out and asks for help. – *Jerry Letendre, Chief Executive Officer, Greenerd Press and Machine Co.*

- **Root out safety challenges:** The unique physical constraints of older workers may pose safety concerns that can and should be addressed. With regards to safety, interviewees emphasized that proactive identification of risks can prevent harmful and costly accidents. For example, a major manufacturer of machinery deploys continuous improvement teams and safety ergonomic risk assessment techniques to implement changes and prevent accidents. The same company also subsidizes preventive healthcare for its older workers to improve their fitness and safety and maximize productivity.
- **Provide a robotic assistant:** Many companies have turned to robotics and technology to address the aging of their workforce: 43 percent of survey respondents reported deploying robotics, AI and other labor-saving technology in response to these demographic changes. Interviews also highlight the deployment of technology to help older workers continue working. For example, Ingersoll Rand provides older employees with VR glasses that allow them to guide a younger service technician in the field. This allows experienced technicians to guide the diagnosis and repair problems remotely, while teaching younger employees valuable technical skills and expertise. Similarly, a major machinery manufacturer uses VR, automation and artificial intelligence to handle physically demanding production tasks, making the process less reliant on older workers' physical strength and maximizing their efficiency.

Technology has made it safer and easier for workers who have been here a long time to stay longer. – *Phil Raimondo, President & CEO, Behlen Mfg.*

3.3.2 ALLOW WORKERS TO TRANSFER TO ANOTHER POSITION INTERNALLY

Several companies described situations in which older workers who would have otherwise retired have extended their careers by transitioning to new roles within the firm. Whether motivated by a new interest or by evolving physical constraints, these transfers also benefit the firm by filling positions with workers steeped in the company's history and culture.

- **Move workers to a role that aligns with a new interest:** Survey results show that 40 percent of retirement-eligible workers who remain with their company do so because they continue to enjoy the challenge. For this group of workers, transferring to another role within the same firm offers a chance to encounter new challenges while helping the employer fill vacant roles. For example, Behlen's older workers frequently use an internal job posting system to find new positions at the firm that suit their evolving needs and interests rather than enter retirement. In one particularly compelling case, interviewees described a welder who chose to become the firm's newest security guard at age 80.
- **Move workers to a role that is similar to their current role, but less physically demanding:** For workers who wish to continue performing the tasks with which they're familiar, transfer to a comparable but less physically demanding position can offer a satisfying and productive middle ground. Interviewees at QCC, Greenerd and Ball all described accommodating their older workers' changing physical needs by moving them into production positions that involve lighter-weight materials and tools.

3.3.3 ADAPT TO WORKERS' NEEDS WITH FLEXIBLE HOURS OR PHASED RETIREMENT

Offering alternative work schedules may encourage older employees to postpone retirement by giving them the chance to begin enjoying some of the benefits associated with retirement. Survey results indicate that such schedules are already popular: more than 40 percent of survey respondents reported offering flexible work arrangements—such as retirement phase-in plans, part-time work, flexible hours and remote work—for workers age 55 and older. Interviews shed additional light on how these arrangements play out in practice, and what works best for employers and employees alike.

- **Let workers space their labor out over a six-day week:** Several companies found that employees benefited from working shorter days over a six-day week. Interviews indicate that this adjusted schedule allows employees to maintain maximum productivity during their working hours and minimizes daily fatigue.
- **Leave scheduling to the employee:** Other companies prefer to allow their employees to develop their own schedules, finding that employees appreciate the chance to create a schedule that aligns with their shifting needs and priorities. For example, 3M's Intentional Flexibility Initiative allows any employee to propose an alternative or flexible work schedule to their supervisor. Generally, older employees have used this initiative to ease into their desired lifestyle as they approach retirement.
- **Offer phased retirement or part-time work:** Many interviewees reported that formal phased retirement options or part-time schedules offer a way to retain older workers and gain time to identify successors and transfer knowledge. For example, employees who enroll in Ford's phased retirement program immediately begin implementing a part-time schedule while the company develops a succession plan. Several other interviewees also offer phased retirement programs that allow workers to reduce their hours to 10–36 hours per week over a period ranging from six months to three years. Phased retirement programs thus prove helpful in obtaining advanced notice of retirement plans and maximizing time for succession planning. Furthermore, interviewees reported that these programs have proved extremely popular among employees who appreciate the opportunity to work a reduced schedule and the flexibility to pursue their personal goals.

3.3.4 ENCOURAGE WORKERS TO RETURN EITHER PART TIME OR THROUGH PROJECT CONTRACTING

Interviews indicate that many manufacturing firms and their workers have found tremendous benefit in developing consulting or part-time work relationships after an employee initially retires. This economically efficient practice allows employers to continue to access their older worker's valuable knowledge and skillsets into their retirement. Simultaneously, it offers employees the freedom and flexibility of retirement alongside continued access to the personal relationships, challenges and routines that survey results suggest motivate many workers to work beyond retirement age. Interviews with manufacturing firms suggest several best practices for firms seeking to take advantage of these benefits and reemploy retired workers as consultants or part-time workers.

- **Create formal “return-to-work” programs:** Establishing a formal process can encourage workers to return to work post-retirement by reducing logistical obstacles and normalizing the return process. Examples of formal return-to-work initiatives include Ingersoll Rand's “My Encore” program for workers who have retired but who wish to continue exercising their skills. The company reports that reintegrating these workers is faster and more effective than hiring new workers, since returning employees already have the skills, trust and institutional knowledge to fit seamlessly into new projects. Similarly, Vermeer has established a “Friends of Vermeer” program that allows retirees to return as a “Friend” of the company and work part time or on a temporary basis. Vermeer reports that its Friends have proved tremendously valuable to the firm, working as mentors and team leaders on the production floor and as lawyers, archivists and IT specialists in its corporate space.
- **Hire retirees as consultants:** Asking workers to return as consultants offers a way to take advantage of the benefits of a formal return-to-work program, but on a smaller scale. Several interviewees noted that retirees have returned to their firms as consultants on specialized, short-term projects, and that these workers are particularly well-equipped for the work thanks to both their skillset and institutional knowledge. For example, Behlen described establishing consulting relationships with several engineers to address issues in the field and serve as subject matter experts. Similarly, Ford has contracted with retired industrial engineers to return as consultants focused on improving plant efficiency.
- **Re-think managing re-employed workers:** Interviews suggest it may be beneficial to train managers in how best to work with re-employed workers. For example, Ingersoll Rand has developed a toolkit for managers with guidelines to help them welcome and take advantage of the experience and knowledge of returning employees while accommodating their unique needs and schedules.
- **Maintain communication with retirees:** To invite employees to return, firms need to be able to contact their retired workers. Interviewees highlighted the importance of developing and maintaining communication with retired employees to facilitate their return. For example, interviewees described including retirees in the distribution lists of company-wide email updates, sending retirees invitations to quarterly and annual meetings and events, and relying on informal networks between current and past employees to maintain contact with retired workers.
- **Discuss return prior to retiree's departure:** Alternatively, companies who recognize the benefits of bringing certain employees back to work described bringing up the possibility of return prior to the individual's formal retirement. For example, management at ACE and Anchor Glass approaches retiring employees to encourage them to return for contracted project work prior to their initial departure. Both companies also reported that employees frequently offer to return before management even inquires, suggesting that employers may benefit from encouraging workers to step forward with proposed return-to-work plans. Generally, interviewees noted that pre-departure conversations, whether led by management or by employees themselves, expedite the employee's return, allowing the company to take advantage of these helpful relationships sooner and for longer.

3.4 Boost recruitment

Two-thirds of survey respondents reported developing a strategy for onboarding new talent in response to the aging of their workforce, highlighting the sector's need to recruit a new generation of reliable workers and build its talent pipelines. While much of this work can be achieved through collaboration with high schools and technical schools, several interviewees explained that incorporating older workers into these recruitment efforts boosts applicant interest, volume and quality in a tight labor market.

3.4.1 INCORPORATE OLDER WORKERS INTO RECRUITMENT EFFORTS AT HIGH SCHOOLS AND TECHNICAL SCHOOLS

Interviewees reported that incorporating older workers into their “roadshows” at local high schools and vocational schools generates greater interest in their firm among candidates. 3M and Atlas both noted that older workers can share compelling stories with potential recruits and dispel misperceptions about the manufacturing industry while offering insight into the industry's modernization. Simultaneously, older employees benefit from the chance to share their experience and stories, driving up morale.

Having senior workers on the recruitment team has resonated with young candidates . . . We all have an attraction to wisdom. – *Rebecca Teeters, Manufacturing Operations Model Director, 3M*

3.4.2 USE REFERRALS FROM OLDER WORKERS TO BUILD A LARGER POOL OF RELIABLE CANDIDATES

Several interviewees noted that their older workers prove a valuable source of referrals. For example, Oceanaire reports that about half of its new employees were referred by the firm's older workers, and both Oceanaire and Anchor Glass noted that referred candidates are more reliable and exhibit higher rates of retention than those found through other recruitment channels.

IV. CONCLUSION

As the American workforce ages, the manufacturing sector will have to adapt in order to raise productivity and remain competitive. Fortunately, many manufacturing firms appear to be not only aware of this ongoing shift, but actively pursuing steps to ensure that they are capitalizing on their older workforce while preparing for the future. Widespread concern about brain drain and labor shortages associated with an impending retirement wave is inspiring manufacturing firms to communicate early and effectively with their older workers about their retirement plans, offer upskilling and training programs, establish knowledge transfer mechanisms, offer flexible work options and boost recruitment efforts—among other successful approaches. Firms that have instituted these strategies report that they have raised employee engagement and morale, extended employee careers and boosted employee productivity. In doing so, they are helping their companies capitalize on the aging workforce trend.

APPENDIX I: METHODOLOGY

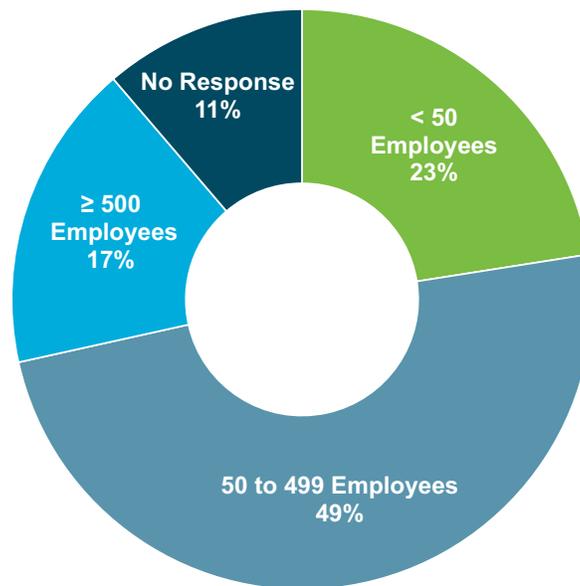
This report relies on research compiled through a survey of members of the National Association of Manufacturers as well as a series of interviews conducted with business leaders from the manufacturing sector. The following paragraphs describe these research tools and provide a breakdown and assessment of participant profiles.

Survey

The Institute’s survey asked 2,882 NAM member companies to respond to a set of questions designed to evaluate respondents’ 1) awareness of the aging of the manufacturing workforce, 2) extent of concern related to this issue, 3) action taken in response to this demographic shift, and 4) the results of these actions. The survey instrument was distributed on January 24, 2019, and collected February 7, 2019, remaining in the field for two weeks. In total, 302 companies submitted responses.

Regarding the size profile of respondents, about 50 percent of survey participants were midsize companies, ranging from 50–499 employees. Roughly one-quarter were small companies, with fewer than 50 employees and about 20 percent were large companies, with over 500 workers. Given that only 1 percent of the manufacturing industry is comprised of firms of over 500 employees, survey results may be overly representative of the views of larger firms.

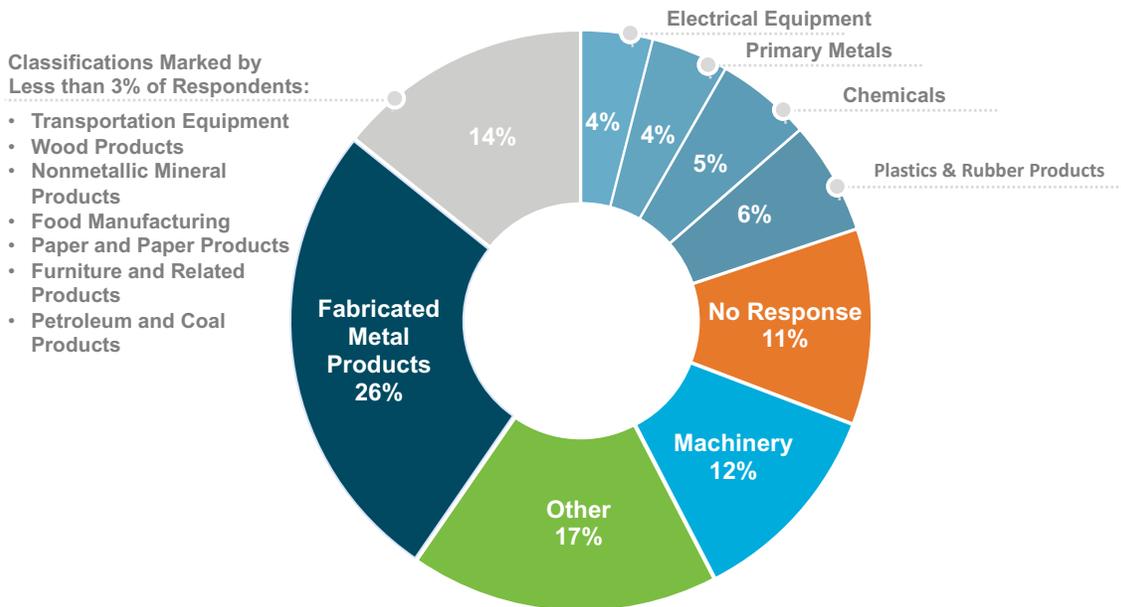
Figure 12: What is your firm size (i.e., the parent company, not your establishment)?



n= 302

Turning to classification profile, survey participants hailed from a range of manufacturing sectors; however, about one-quarter of participants indicated “fabricated metal products” and 12 percent indicated “machinery” as their primary industrial classifications, suggesting that the views of firms specializing in these sectors may be overly represented in survey results. That said, the 17 percent of survey respondents who marked “other” as their primary classification did not appear to be concentrated in any classification. Rather, most indicated belonging to a niche classification such as production of pumps, springs, specialty textiles, industrial ceramics and conveyor belting.

Figure 13: What is your company's primary industrial classification?



n= 302

Interviews

To supplement information gathered through the NAM membership survey and glean insights into best practices, interviews were conducted by telephone with 17 industry-leading companies from March 21 to April 26, 2019. Individual firms were represented by company executives, directors and human resource managers. Approximately half of interviewees were selected after indicating on their NAM membership survey response that they were interested in speaking with the Institute about their efforts to address the aging of their workforce. The remaining half (who did not participate in the survey) were invited to interviews in light of their exceptional initiatives to respond to this demographic change.

Regarding the profile of interviewees, approximately 18 percent were small firms with fewer than 50 employees, another 18 percent were midsize firms with 50 to 499 employees and 65 percent were large firms with 500 or more employee. Additionally, while interviewees hailed from a variety of sectors, more than half were producers of either machinery or fabricated metal products. This suggests that, like the NAM membership survey, interview findings may be weighted somewhat toward the perspectives and experiences of large firms and of firms specializing in machinery and fabricated metals.

ENDNOTES

1. U.S. Census Bureau, [2017 National Population Projections](#).
2. U.S. Census Bureau, [2017 National and State Population Estimates](#).
3. William H. Frey, "[US Population Growth Hits 80-Year Low, Capping Off Year of Demographic Stagnation](#)" (December 2018), *Brookings Institution*.
4. U.S. Bureau of Labor Statistics, [Employment Tables](#).
5. William H. Frey, "[US Population Growth Hits 80-Year Low, Capping Off Year of Demographic Stagnation](#)" (December 2018), *Brookings Institution*.
6. Deloitte & NAM Manufacturing Institute, "[2018 Deloitte and The Manufacturing Institute skills gap and future of work study](#)."
7. PWC and the NAM Manufacturing Institute, "[Navigating the fourth industrial revolution to the bottom line](#)."
8. Deloitte, *Global Human Capital Trends 2018*, "The Longevity Dividend."

