



FRONTLINE AI

A GUIDE FOR MANUFACTURERS



(Estimated reading time: 7 minutes)

EXECUTIVE SUMMARY

Retention and recruitment in the frontline workforce are a challenge for US manufacturers, both large and small. Some firms are turning to automation to solve these problems, but initial research shows that deploying automation without also making job quality improvements may do more harm than good.

For manufacturers that are considering integrating automation, be it AI or otherwise, into their operations, the recommendations presented here provide guidance, based on interviews, research, and best practices from leading firms in the field, on how to deploy it in a way that raises job quality, improves retention and recruitment, and protects their bottom line.

THE CHALLENGE

- 1 Reduced human oversight in AI and data-driven automation bring a new set of risks.
- 2 New and changing technologies require new skillsets, but manufacturers are struggling to source suitable talent.
- 3 Automation deployment in manufacturing can lead to deskilling and higher churn, intensifying retention challenges for the industry and contributing to institutional brain drain.

BUSINESS MOTIVATIONS

Manufacturers are turning to AI tools to increase the productivity of plants (reducing downtime, reducing waste, increasing capacity per line) while reducing the amount of human capital (both number of workers and hours worked) required to perform certain tasks. The tax structure in the US incentivizes automation, since [taxes are higher for labor and lower for capital](#).

"At one extreme, AI adopters in Canada are 6.2 times more likely to favor replacing over retraining. At the other end, Germany is just 1.7 times more likely to favor replacing employees."

— [DELOITTE \(2020\)](#)

Severe production disruptions instigated in part by the COVID-19 pandemic have created a very strong incentive to automate work. A study by Oxford Economics estimates that [20 million manufacturing jobs](#) will be automated by 2030. Given the industry's challenging history with employee retention and recruiting, some companies may be looking at automation as the silver bullet to all of their workforce challenges.

APPLICATIONS OF AUTOMATION

The Center for Economic Studies found that as many as 64% of US workers and 72% of manufacturing workers are [exposed to technologies](#) like AI, robotics, and specialized software, based on data from the US Census Bureau's 2019 Annual Business Survey. Adoption is concentrated in large firms. Common applications of these technologies include:

- **Maintenance:** Predictive maintenance software leverages a network of sensors on machinery to detect signs of wear so that servicing can be planned pre-emptively instead of in response to expensive breakdowns.
- **Quality control:** Companies are automating processes, often through a combination of sensor data and AI, to identify when a product fails a quality control check.
- **Dirty, dull, and dangerous work:** Machines are used to perform repetitive, specific manipulation tasks, such as processing components on an assembly line, and can be deployed in environments where temperatures or aerosols are unsafe for humans.
- **Streamlining human-computer interactions:** To speed up redundant computer interactions such as copy-pasting information across platforms, companies use digital rule-based programs called "robotic process automation" that replicate the interactions of a human navigating through computer interfaces.
- **Shift scheduling:** AI-driven tools are used for "smart scheduling" which can reduce unassigned time. Although these systems can be designed and used to give workers more control over their hours, they are frequently used as a form of worker surveillance, cited as a cause of high worker burnout and turnover.

IMPACTS OF AUTOMATION

Availability of Jobs

Research on the impact of AI adoption on the availability of jobs and wages is not clear-cut. Some groups predict that the impact will [depend on the specific use case and application](#) of the AI tool, while others say that there is a real chance that AI deployment will [ultimately lead to pervasive unemployment](#). Regardless of the net impact of AI adoption on jobs overall, it is clear that some jobs will be lost, leading to:

- **Fewer jobs focused on routine tasks:** Workers [without specialized skill sets](#) and workers performing [“routine or replaceable tasks”](#) may struggle to compete with automation.
- **Disproportionate displacement:** Women (nearly [30%](#) of the frontline manufacturing workforce), workers of color (nearly [30%](#)), and workers without a 4-year degree ([nearly 50%](#)) are more likely to [face disproportionate displacement](#).
- **Lower barriers to entry:** Automation that simplifies tasks can make a role accessible to a larger number of potential workers, but this can also result in greater competition for roles.
- **Training challenges:** AI benefits are greater for those with specific training and roles, disproportionately putting certain workers, [especially those over 40](#), at higher risk of job displacement due to automation.

Job Quality

People promoting AI as beneficial to the future of work have advocated that it can free up workers from dirty, dull, or dangerous tasks, allowing them to instead focus on higher-value activities that enable upward mobility internally within the organization. Commonly mentioned benefits include:

- **Making industrial work safer:** Minimizing direct contact between a human worker and dangerous machinery via robotics can [improve safety](#) in industrial workplaces.
- **Reducing physical labor requirements:** Manufacturing work has historically been physically demanding and taxing, limiting the number and tenure of workers in the field.
- **Freeing workers up from undesirable labor:** Automation can reduce the amount of necessary [tedious or repetitive work](#).

However, 2022 research from the Partnership on AI has indicated that, in fact, [the opposite is happening](#):

“Current implementations of AI in work are reducing workers’ opportunities for autonomy, judgment, empathy, and creativity...Workers in US warehouses with higher degrees of AI implementation often had less variety in their tasks and more technological guardrails to assist them in performing them correctly.”

According to these findings, which analyzed interviews with frontline workers in manufacturing, call centers, and data annotators who work with AI tools, the main threat of AI deployment lies not in reducing the number of available jobs for workers, but in decreasing the quality of work, by:

- **Placing harmful pressure on workers:** Algorithmic management tools are often used to push [intense, algorithmically-set productivity quotas](#).
- **Reducing skill requirements to do certain work:** Employers risk “deskilling” workers, where workers learn less about the processes they are contributing to, [disrupting pathways to higher-paying work](#) and reducing institutional wisdom.
- **Minimizing worker voice and agency:** Using tools to reduce worker autonomy leads to higher rates of attrition.

MAXIMIZING BENEFITS AND MINIMIZING HARMS OF AUTOMATION

Managerial decisions [play a substantial role](#) in shaping the impact of technology. Employers have an opportunity to lead and reap the benefits of implementing worker-centered processes when introducing these new tools. By doing so, companies not only foster a positive work environment but also enhance their competitive edge, ensuring sustainable growth and minimizing potential pitfalls associated with technology adoption.

[Aspen Digital](#), in consultation with experts from academia, civil society, and industry, has developed the following recommendations on how to integrate automation into the manufacturing frontline responsibly. At a high level, getting the most out of automation requires thinking of workers as an asset that must be leveraged and invested in. The following themes represent best practices that are further detailed in the recommendations below:

- **Upskilling:** Train the workforce to adapt to new skills automated tools require.
- **Human-in-the-loop:** Maintain human review and control of automated or AI-informed decisions.
- **Participatory design:** Use tools that incorporate feedback from and address pain points of the workers themselves—people who will actually be using the tools.
- **Human interaction:** Emphasize and support human-to-human interaction at work.

- **Supportive, not prescriptive, tools:** Use tools that are meant to increase the agency of workers.
- **Transparency:** Be transparent with workers about the benefits and risks of automated tools, both to the firm and to them.
- **Predictability:** Look for and evaluate tools in part based on whether they bring predictability into the frontline workplace (such as a scheduling tool that makes it easier for workers to plan their shifts).
- **HR foundations:** Attract and retain talent with competitive compensation and benefit packages.

The following recommendations may be more ambitious for smaller firms, so buy-in from leadership will be pivotal. Small firms should consider:

- **collaborating** on best practices with other firms in their region through industry-sector partnerships.
- **partnering** with local community colleges for training and upskilling
- **creating** a [registered apprenticeship program](#) with resources from the Department of Labor.
- **using** regional [Manufacturing Extension Partnership \(MEP\) resources](#).
- **tapping into** their local [workforce development boards](#).
- **consulting** organizations like the [Workforce & Organizational Research Center \(WORC\)](#), [America Works](#), the [Urban Manufacturing Alliance](#), and the [Institute for the Future of Work](#).

The recommendations below are tailored to meet three goals shared by leaders in manufacturing:

1 Reduce the risks of automated systems.

2 Upskill to get the most out of automation investments.

3 Retain workers and their valuable institutional knowledge.

To read about these goals and the recommendations to address them in more detail, please see the accompanying [Goal Spotlight](#) for each goal.

GOAL 1: REDUCE THE RISKS OF AUTOMATED SYSTEMS

- 1 Reinforce to managers that AI tools can (and do) make mistakes.

- 2 Maintain managerial decision-making and human oversight of automated systems.

- 3 Develop clear internal guidelines for identifying contexts in which AI should not be used, such as in hiring.

- 4 Evaluate the impacts of deploying automated systems on your workforce by identifying and tracking KPIs that measure employee satisfaction, health, and skill development, such as internal promotion rate, injury rate reduction, and employee satisfaction index.

- 5 Ensure that an AI tool was designed to meet your specific needs by consulting workers.

- 6 During and after deployment, set up real-time feedback loops using insights from the frontline. For more resources, see [Strategies for Worker Engagement](#).

- 7 Use a combination of quantitative KPIs and qualitative worker feedback via surveys or managerial check-ins to evaluate physical and mental health impacts of deployed automated systems.

- 8 Ask technology developers or vendors specific questions about their products including about your right to repair, the interoperability of their tools, and the ownership of data collected.

- 9 Prioritize informed consent prior to data collection.

GOAL 2: UPSKILL TO GET THE MOST OUT OF YOUR AUTOMATION INVESTMENTS

- 1 **Identify skill gaps and provide training in basic digital skills** based on what types of upskilling workers want.

- 2 **Use community college partnerships to develop high-value interpersonal skills** such as knowledge-sharing, conflict resolution, and negotiation.

- 3 **Make upskilling accessible** by making sure training opportunities are available on site, during work hours, in multiple languages, and with appropriate compensation for time spent.

- 4 **Provide training for a variety of skills and in a range of formats** based on what workers prefer such as cross-training workers on different technologies and mentoring programs and apprenticeships.

- 5 **Clearly outline economic and career mobility benefits** for workers who participate in an upskilling program.

- 6 **Designate a worker or small group of workers as subject matter experts** for new technology or specific functions of the new technology.

GOAL 3: RETAIN WORKERS AND VALUABLE INSTITUTIONAL KNOWLEDGE

- 1 **Be straightforward and communicate clearly** with workers about expected changes by providing comprehensible explanations of the AI system's function, talking plainly about staffing changes, and avoiding technology or business jargon.

- 2 **Provide adequate (at least 8 weeks) notice** to workers and unions before deploying new technologies.

- 3 **Get feedback and collaboratively define productivity goals** when adopting new technology both anonymously and through high-touch options like workshops.

- 4 **Seek worker input when creating policies for algorithmic management** and worker surveillance (e.g. wearable technology, sensors, and other monitoring systems), both of which can decrease job quality and impact retention.

- 5 **Provide a clear career growth plan** and allow workers to advance professionally by providing advancement training and opportunities on a yearly or more frequent cycle.

- 6 **Deploy automation in ways that provide equal opportunities to employees of all backgrounds**, regardless of race, age, gender, education, experience, native language, or other individual traits.

- 7 **Recognize and compensate workers** for their role in training peers and new hires through initiatives such as microcredentials, scholarships, or paid management trainings.

- 8 **Deploy technology that will complement or support your workers' professional identities.** Complementary technologies are much more easily accepted and adopted.

SPOTLIGHT

GOAL 1: REDUCE THE RISKS OF AUTOMATED SYSTEMS

[Aspen Digital](#), in consultation with experts from academia, civil society, and industry, developed the following recommendations for how to integrate automation into the manufacturing frontline responsibly.

Issue

AI tools and data-driven automation are becoming increasingly prevalent across sectors. McKinsey's 2022 Global Survey on AI found that [adoption had more than doubled](#) since 2017. While AI is rapidly providing efficiency gains, it also comes with risks due to the loss of human oversight and managerial decision-making control. These risks could lead to friction between technology capabilities and the needs of teams and individuals, potentially compromising efficiency, safety, and retention.

"Companies that put humans at the center of their transformations are 2½ times more likely to successfully deliver on their transformation objectives."

– [EY \(2023\)](#)

Why this matters

- **Overreliance on technology:** People have a tendency to trust machine output over human judgment even when the machine output is incorrect. This introduces risks, especially in complex, time-critical environments like manufacturing. Algorithmic error may result in increased downtime, and over-emphasis of technological decision-making may result in distrust and resistance to adoption.
- **Vendor lock-in:** The requirements for troubleshooting failures, training operators, and maintenance are fundamentally different with software than with a physical machine. Automated tools are not guaranteed to be interoperable with other vendors' products and a vendor's default contract may not permit you to repair issues in-house.

"Humans have a tendency to disregard or not search for contradictory information in light of a computer-generated solution that is ... exacerbated in time critical domains."

– [M.L. CUMMINGS \(2004\)](#)

- **Mismanaged investment:** Emerging technologies are often costly to implement. If systems are not properly evaluated (both pre- and post-deployment) it can lead to wasted resources, inefficiencies, and low uptake.

Opportunities

- **Buy-in for AI adoption:** Taking a human-first approach can help create buy-in for the adoption of emerging technologies and build knowledge and technical know-how for developing additional useful applications.
- **Avoid regulatory headaches:** As global regulators intensify oversight of technical systems, investing in transparency and proactive monitoring now will streamline compliance and yield long-term benefits down the road.

“Only 9% of surveyed manufacturing executives have implemented AI.”

– [PWC \(2020\)](#)

Actions

HUMAN OVERSIGHT

1. **Reinforce to managers that AI tools can (and do) make mistakes.** Make it clear that human design choices shape how these systems operate and how accuracy, efficiency, and success are defined.
 - AI capabilities do not necessarily surpass human experience. These tools are built for specific settings and may not work appropriately when applied to new contexts.
2. **Maintain managerial decision-making and human oversight** of automated systems. Define clear roles and processes for reviewing decisions, especially for safety-critical systems.
3. **Develop clear internal guidelines** for identifying contexts in which AI should not be used, such as in hiring.

“When it comes to the identification of candidates, there will always be a talent acquisition manager involved in the selection process. ... Whenever we know that there is inherent bias in the data, AI will not be used. And hiring is one of those areas.”

– [A. KANIOURA, PEPSICO \(2023\)](#)

4. Evaluate the impacts of deploying automated systems on your workforce by identifying and tracking KPIs that measure employee satisfaction, health, and skill development. Key KPIs to track include:

- Internal promotion rate
- Microcredentials achieved and certifications completed
- Injury rate reduction
- Number of days in advance workers know what days and hours they need to work
- Staff churn and worker absenteeism
- Employee satisfaction index or employee net promoter score (eNPS)
- Employee Assistance Program (EAP) utilization rate

5. Ensure that an AI tool was designed to meet your specific needs during the procurement process. Involve workers intended to use a tool on the factory floor in the technology procurement process, especially workers who have experience with the pain points the tool is meant to address.

6. During and after deployment, set up real-time feedback loops using insights from the frontline. This process will provide insight into where the technology is proving most helpful and where it is not delivering on intended benefits.

- Emphasize multiple pathways for worker feedback, not just reporting to a manager or to HR.
- Keep asking for feedback after deployment on at least a yearly basis.
- Play back a summary of feedback you've received to your workers on a regular basis and explain how you can or can't address that feedback.
- Regularly re-evaluate whether these systems are meeting the needs of the teams and people they serve.
- For more resources, see [Strategies for Worker Engagement](#).

7. Use a combination of quantitative KPIs and qualitative worker feedback via surveys or managerial check-ins to evaluate physical and mental health impacts of deployed automated systems.

8. **Prioritize informed consent prior to data collection.** Explain why you (or a vendor) are collecting data, how that worker-generated data will be used in a new technology, and how to opt-out of data collection, where possible.

9. **Ask technology developers or vendors** specific questions about their products. Consider asking:
 - **Right to repair:** Are you allowed to fix bugs or issues with the tool in-house? Does your vendor require that only they can to address issues?
 - **Prompt troubleshooting:** What options for troubleshooting and timely escalation will your vendor provide? If you have an urgent need for troubleshooting (e.g. a line goes down), how will your vendor quickly troubleshoot and address your issue?
 - **Intended use cases:** Ask your vendor to illustrate correct (and incorrect) application cases of their software. AI tools are often only built for specific use cases and are not guaranteed to generalize well to other uses.
 - **Interoperability:** Will your vendor commit to making sure their tools interface properly with other vendors' tools you may use?
 - **Operator training:** How will your vendor address training your workers to use their tool? How will they answer workers' questions? How long will they provide onboarding support?
 - **Data rights:** Who "owns" the data collected from your operations and equipment before, during, and after deployment of their tool? Can the vendor use that data to improve their products? Can the vendor sell that data to third parties?

SPOTLIGHT

GOAL 2: UPSKILL TO GET THE MOST OUT OF YOUR AUTOMATION INVESTMENTS

[Aspen Digital](#), in consultation with experts from academia, civil society, and industry, developed the following recommendations for how to integrate automation into the manufacturing frontline responsibly.

Issue

Hasty deployment of AI has the potential to “deskill” workers, leading to increased churn, but use of automated tools alone doesn't necessitate these negative impacts. Deskilling happens when automation is used in a way that limits workers’ agency and reduces the amount of knowledge it takes to perform a task, making workers less adaptable and knowledgeable about the larger processes to which they contribute. To avoid this issue, employers should focus on upskilling or reskilling their workforce. Upskilling benefits both employers (making them [more competitive](#) and maximizing returns on technology investments) and workers (promoting their skill development and professional growth).

Why this matters

- **Missing recruits:** While manufacturing was once an attractive career path, fewer people—especially young people—are entering this industry. This has led to staffing issues for employers that will likely worsen in the long term without intervention.
- **High industry turnover:** Turnover rates in the frontline manufacturing workforce are historically high. Hiring new talent to keep up with turnover is expensive for employers.

“Close to half (43 percent) of workers in the manufacturing industry have a high school education or less, a factor that is strongly correlated with limited digital skills. Yet a high percentage of job postings in manufacturing call for workers to have definitely digital (60 percent) or likely digital (93 percent) skills.”

– [NATIONAL SKILLS COALITION \(2022\)](#)

Only 28.34% of the manufacturing workforce in 2022 consisted of workers aged 20-34, where the median worker age was 44.3 years.

– [US BUREAU OF LABOR STATISTICS \(2023\)](#)

“In 2019-20, Nissan’s assembly plant suffered from a 38% turnover rate among its technicians; where the direct cost of replacing each technician was \$15,000”

– [THE CASE FOR GOOD JOBS \(2023\)](#)

- **Skills gap:** Not enough of the US workforce has the digital skills to meet employment demands, making it difficult for employers to fill positions.

Opportunities

- **Become an attractive employer:** Upskilling and reskilling initiatives capitalize on the aptitude and ambition of your workforce, which improves recruiting and worker motivation and productivity in the long term.
- **Improved worker retention:** Investing in reskilling your workforce improves retention, makes you more attractive to younger prospective employees (expanding the pool from which you can find talent), and saves you money in the long term.

"The skills gap may leave an estimated 2.4 million positions unfilled between 2018 and 2028, with a potential economic impact of 2.5 trillion."

– [DELOITTE \(2018\)](#)

"Two-thirds of companies expect to see a return on investment on skills training within a year of the investment, in the form of enhanced cross-role mobility, increased worker satisfaction or worker productivity."

– [WORLD ECONOMIC FORUM \(2023\)](#)

Actions

SKILL TYPES

1. **Identify skill gaps and provide training in basic digital skills** to prepare your workforce for working with automation in advance. Ask workers what types of trainings they want.
 - Common upskilling needs:
 - Familiarity with touchscreen interfaces
 - Machine diagnostics
 - Communication and team coordination skills

"A survey of more than 2,100 frontline employees found that more than 70% have applied to career advancement opportunities either with their current employers or with different companies."

– [MCKINSEY \(2022\)](#)

METHODOLOGY

3. **Make upskilling accessible** by making sure training opportunities are available on site, during work hours, in multiple languages, and with appropriate compensation for time spent.

"More than half of production employees want to participate in an upskilling program (52%)."

– [EY \(2022\)](#)

4. Provide training for a variety of skills and in a range of formats based on what workers prefer.

- Cross-train workers on different technologies to promote versatility and prevent production bottlenecks due to limited staff.
- Offer mentoring programs and apprenticeships (see the [Registered Apprenticeship Program](#)).
- Provide opportunities for workers to test out new technologies in low-stakes settings.
- Take advantage of vendor-provided trainings to teach interested workers how to use new technology.
- Provide trainings in peer and group learning formats.

"More than 60% of all [Swiss] firms find offering apprenticeships profitable, meaning that the average firm does not need to recoup training expenses after the end of an apprenticeship."

– [MUEHLEMANN & WOLTER \(2014\)](#)

5. Clearly outline economic and career mobility benefits for workers who participate in an upskilling program.

6. Designate a worker or small group of workers as subject matter experts for the new technology or specific functions of the new technology.

SPOTLIGHT

GOAL 3: RETAIN WORKERS AND VALUABLE INSTITUTIONAL KNOWLEDGE

[Aspen Digital](#), in consultation with experts from academia, civil society, and industry, developed the following recommendations for how to integrate automation into the manufacturing frontline responsibly.

Issue

The manufacturing sector faces a historic challenge in retaining skilled workers. Given that employee retention rate is a key metric of the firm's success, high turnover rates and the retirement of experienced workers threaten to deplete the industry's talent pool and erode essential institutional knowledge.

Why this matters

- **Institutional knowledge loss:** The departure of skilled workers and loss of on-the-ground knowledge can disrupt production, revenue, and industry reputation. Frontline workers' firsthand experience of the production process can lend key insights into opportunities for operational efficiencies. As they leave, they take that experience with them.
- **High costs of hiring:** Having to constantly recruit and train new workers due to high turnover rates is both costly and inefficient.

"The total cost of hiring one new employee could be as high as \$5,000, or more, in a professional or manufacturing industry."

– [MIRATECH \(2021\)](#)

Opportunities

- **Worker retention:** Workers are more likely to stay at companies where they feel trusted, valued, and included in the future growth of the organization.

- **Industry reputation:** The manufacturing sector has long been perceived as offering low job satisfaction and limited career growth. There is an opportunity to shift this negative perception by investing in the workforce and improving job quality.

"74% of manufacturing CEOs are concerned about the availability of key skills, highlighting the industry's urgent need for a better image to attract and retain talent."

– [PWC \(2020\)](#)

Actions

TRANSPARENCY

- 1. Be straightforward and communicate clearly** with workers about expected changes by taking the following steps:
 - Provide comprehensible explanations of the AI system's function, operation, goals, and benefits to workers overseeing, using, or otherwise affected by an AI tool.
 - Talk plainly to workers about any staffing changes and why those decisions are being made; if you are not replacing people, explicitly say that, and you will get better feedback from your workers on the new technology.
 - Make sure your communication doesn't include technology or business jargon. Explain all specialized terms if they must be used. Try and have a trusted leader on the frontline deliver these messages.
- 2. Provide adequate (at least 8 weeks) notice** to workers and unions before deploying new technologies and include timelines for providing training, piloting, testing, and implementing new technologies.

FEEDBACK

- 3. Get feedback and collaboratively define productivity goals** when adopting new technology. Develop strategies to meet those goals by:
 - Creating a system that encourages workers to anonymously ask questions (see the one-pager on [Strategies for Worker Engagement](#)), and

"Organizations that are the best in engaging their employees achieve earnings-per-share growth that is more than four times that of their competitors."

– [GALLUP \(2018\)](#)

- Providing a structure so that workers can develop their own systems for improving performance, such as team socialization activities (workshops, team retreats).

4. Seek worker input when creating policies for algorithmic management and worker surveillance (e.g. wearable technology, sensors, and other monitoring systems). If an algorithmic management tool is causing friction between the leadership and your workers, consider why there is pushback. Worker quantification initiated through surveillance systems typically decreases job quality which impacts retention.

5. Provide a clear career growth plan and allow workers to advance professionally by providing advancement training and opportunities on a yearly or more frequent cycle.

- Consider broadcasting metrics like internal hires, promotions, time to promotion, training participation, and retention rates on a leaderboard

6. Deploy automation in ways that provide equal opportunities to employees of all backgrounds, regardless of race, age, gender, education, experience, native language, or other individual traits, recognizing that some workers may face additional barriers due to legacies of discrimination.

7. Recognize and compensate workers for their role in training peers and new hires.

- Train team leads on new technology first before rolling out team-wide instruction.
- Offer paid quarterly management trainings for interested workers, creating opportunities for promotion from within and cost-savings in recruiting and hiring.
- Provide scholarships or subsidies for relevant certifications.

"Micro-credentials are flexible, portable and cost-effective to implement. They can help boost employee engagement and support employers by promoting a culture of lifelong learning while providing a map for an employee's career path."

– [FORBES \(2021\)](#)

- Offer awards, badges, or microcredentials for workers who oversee training and onboarding for their peers.

8. Deploy technology that will complement or support your workers' professional identities. Identify what your workers take pride in and what parts of their work they find most rewarding. Complementary technologies are much more easily accepted and adopted.

Case studies

GE's [leadership development programs](#) are designed for employees, especially those early in their careers or those identified as high-potential talents. These programs provide a structured path for participants to gain diverse experiences within the company, enhance their skill sets, and prepare for leadership roles.

The programs offer participants a mix of on-the-job learning, formal coursework, mentorship, and exposure to different facets of the company. While some participants might be hired directly into these programs from universities, others transition into them as current employees looking to accelerate their careers within GE.

Current popular programs include:

- [Edison Engineering Development Program](#): Aimed at those in engineering, this program includes rotational assignments in various business units, coupled with formal coursework.
- [Operations Management Leadership Program](#): Participants undergo rotations in different GE locations and functions, gaining a broad understanding of the company's operational practices.

PepsiCo has pioneered a comprehensive [approach to employee upskilling](#) to prepare its workforce for the digital age. Through its Digital Academy, PepsiCo offers a repository of over 11,000 learning assets, allowing employees across the spectrum—from digital novices to tech-savvy professionals—to enhance their digital competencies.

Within just a year of its 2022 launch, the Academy witnessed over 11,000 participants who engaged in 140,000 self-paced modules, securing 600 certifications in domains like Cloud Azure and Power BI for Data Analytics.

Other examples include:

- [myDevelopment platform](#): The platform connects incumbent employees to entry-level roles in new areas through short-term projects which only require a modest amount of time and commitment outside of regular hours. The project outcomes are logged internally through an employee profile which can be shared for internal job referrals and interviews.

CHEAT SHEET

FEEDBACK AND COMMON TERMS

The first part of this cheat sheet outlines concrete examples of how to solicit feedback from the frontline workforce. The second part defines both technical and job quality terms that we use throughout our work.

STRATEGIES FOR WORKER ENGAGEMENT

A variety (and frequently a combination) of different mechanisms for incorporating worker voice can be used to ensure that new technology is optimally deployed to solve production pain points. Bottom-up feedback from workers who will be using the tool in their day-to-day is a necessity, because only those workers (not office managers) will be aware of technical and practical nuances in their workflow that could dramatically impact AI performance.

The first step to building a culture of open feedback is having explicit management processes that encourage executives to “pull” improvement from the frontline versus “push” operational directives. High-touch models of feedback where corporate executives invest time in the frontline, can help management establish mutual trust and respect. This allows frontline workers to leverage their end-to-end perspective and offer concrete suggestions, without fear of losing their jobs.

HIGH-TOUCH OPTIONS

1. Town Halls
2. Small team meetings with an immediate supervisor or plant leadership
3. Hands-on feedback sessions with a vendor
4. Soliciting feedback through organized labor representatives, when applicable
 - *This process can be especially helpful for getting feedback at scale.*

LOW-TOUCH OPTIONS

1. Physical suggestion box or flip board
2. Digital surveys or feedback forms

Make sure to respond to feedback in some form, otherwise low-touch options may not produce constructive criticism!

Case study

Toyota’s unmatched quality can be attributed to its [focus on worker voice](#). Contributing to constant improvement is part of everyone’s job description. Toyota’s culture encourages front-line workers to suggest local improvements and streamline work without the fear of losing their jobs.

Managers actively seek out feedback through group bonding activities, and the firm rewards the team with the winning idea versus the individual. Senior managers are actively encouraged to “go to the front line and listen, which shows respect to those far from the executive suite.”

GLOSSARY OF TERMS

Job Quality Terms

FRONTLINE

Frontline workers are typically hourly workers, who aren’t managers, making [\\$22 per hour or less](#), employed in the manufacturing, retail, shipping, and logistics and transportation industries. Within the context of our work, “frontline worker” encompasses operators, mechanics, and other workers who directly interface with machinery in a factory.

UPSKILLING

A process of training a worker in skills intended to lead to career advancement, better pay, and greater systems knowledge and agency.

RESKILLING

Similar to upskilling. A process where a worker is trained to adopt a new skill set, frequently as part of a career transition.

DESKILLING

A process where automation is deployed in a way that limits workers’ agency and reduces the amount of knowledge it takes to perform a task, making workers less adaptable and knowledgeable about the larger processes to which they contribute. A deskilled worker gains fewer skills while working.

Technology Terms

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) has historically referred to a collection of technologies designed to emulate human intelligence. In recent years, the term has become synonymous with machine learning, a set of computer processes used to identify unintuitive patterns in data. Examples of AI today include speech recognition, autonomous vehicle navigation, and the generation of new content, such as text or images.

AUTOMATION

A process where a machine or computer program is used to complete a task instead of a person. While AI is a type of automation, many forms of automation do not use AI.

DATA

Data, like AI, is an umbrella term that covers more than just numbers. The term describes many types of information that are stored and processed on computers. Videos, images, temperature sensor readings, and the location information on your phone are all different kinds of data.

COMPUTER VISION

A field of computer science dedicated to figuring out how to process images and video with a computer in a way that mimics the human visual system. Some examples: inferring depth from a series of 2D images or isolating food on a line that doesn't visually meet quality assurance criteria.

ROBOTICS

Physical machines which are used to execute a variety of actions (such as object manipulation) either in an unsupervised or supervised way.

ALGORITHMIC MANAGEMENT

Use of software, instead of or in addition to a human manager, to set goals, track progress, and assign tasks to a worker.

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