Manufacturing Skills Report

Workforce Skills Division

August 2024

Introduction

Transformation in U.S. manufacturing

The U.S. manufacturing sector is seeing a strong resurgence after COVID-19. It's projected that this growth will lead to 3.8 million new jobs by 2033*. However, up to 50% of these jobs might not be filled due to a shortage of skills and qualified workers.

To maintain its strength, the U.S. manufacturing sector must embrace AI and prepare to capture the value it can create. Manufacturers need to understand the most relevant skills and how the skillset is being rapidly transformed by AI, as well as which roles and tasks will be transformed.

**Report "Taking charge: Manufacturers support growth with active workforce strategies", Deloitte and The Manufacturing Institute, 2024*

Introduction

Report Framework

This report has two parts, each focused on the units of analysis used by Pearson to deconstruct and analyze work:

1. Skills analysis: It examines the evolving skill demands in the U.S. manufacturing job market. Understanding the skills emerging or trending helps companies stay ahead of technological and industry shifts.
2. Task analysis: This section analyzes how AI impacts manufacturing roles and tasks, showcasing how AI could mitigate future labor shortages, increase capacity and reshape jobs.

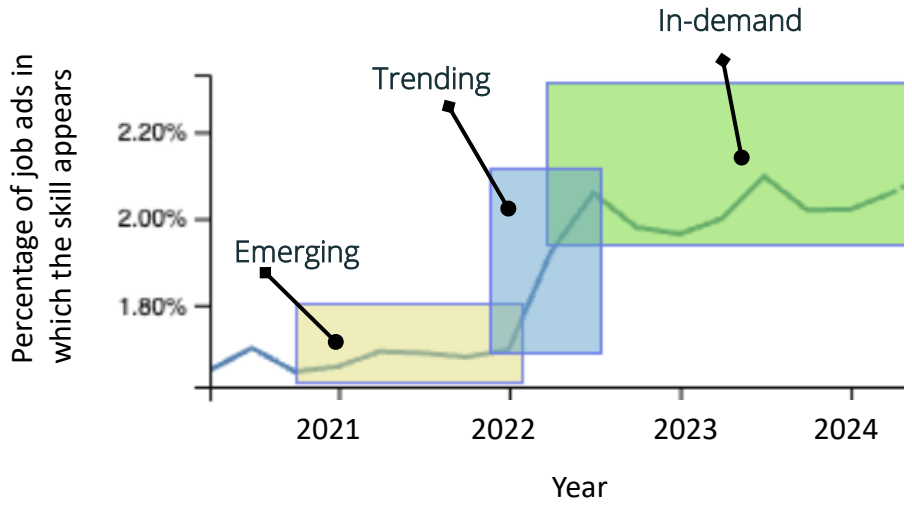
The report also provides manufacturing companies guidance for the various applications of skill and task data, including strategic workforce planning, talent planning, acquisition, and management.

It's time to move beyond theory and take action based on data and real-life applications. By leveraging the insights provided in this report, manufacturing organizations are better positioned to build a more resilient sector that will create meaningful careers for generations to come.

Executive Summary (Part 1)

Skills and tasks transformation in U.S. manufacturing

What skills should manufacturing professionals develop to stay competitive with the advent of AI?



Skill trends in the manufacturing job market in the U.S.

Emerging:

1. Collaboration
2. Safety Principles
3. Reading Comprehension

Trending:

1. Communication
2. Attention to Detail
3. Teamwork

In-demand:

1. Manufacturing
2. Leadership
3. Communication

Executive Summary (Part 2)

Skills and tasks transformation in U.S. manufacturing

How could AI help mitigate future labor shortages in U.S. manufacturing?

The manufacturing industry in the U.S. is facing a skilled worker shortage and a lack of applicants, with projections indicating that 1.9 million out of 3.8 million new jobs could remain unfilled by 2033*.

To address this, strategic implementation of technology, particularly Generative AI, can help streamline processes and free up workers' time, allowing them to focus on higher-value activities.

The top five task groups in manufacturing where AI can create the most capacity are:

1. Maintaining operational records
2. Reading documents to inform work processes
3. Measuring physical characteristics
4. Programming systems or equipment
5. Inspecting completed work or products

Technology types driving transformation in U.S. manufacturing:

- Advanced Robotics
- Predictive Analysis
- LLM Chatbot
- AI-Enhanced Imaging Analytics
- Smart Vision

Roles where AI has the largest potential for creating capacity:

1. Industrial Production Managers
2. Wind Energy Operations Managers
3. Chemical Plant Managers

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Part 1: Skills trends in the manufacturing job market

Pearson

Understanding Skills Classifications

This report presents information about the evolution of skills demanded in the U.S. manufacturing job market. The purpose of this analysis is to identify the skills that employers are actively seeking in the current marketplace.

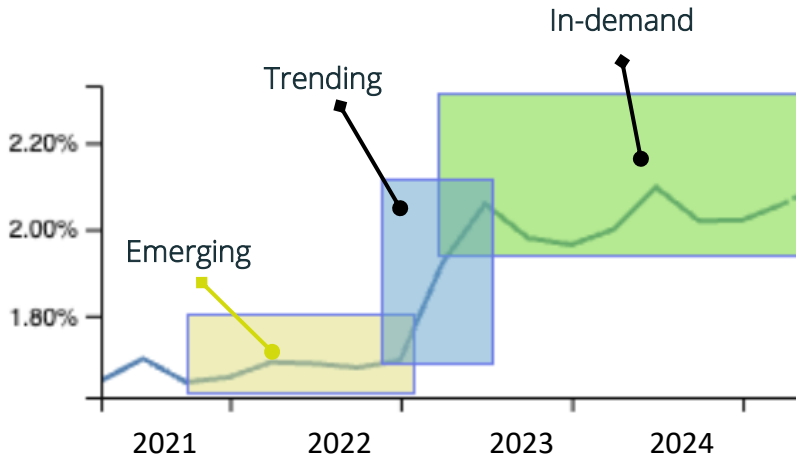
To compile the necessary data, the Pearson's taxonomy of tasks and technologies was used along with millions of monthly job advertisements from across the United States. The collected data was then analyzed to uncover trends and patterns in skill requirements over time.

By examining the frequency and rate of change in skill mentions, it becomes possible to understand the relative importance and growth of different skills. Then, skills are classified into three categories according to their frequency in job ads: emerging, trending, and in-demand.

Emerging Skills:
Previously low demand skills that are showing an early indication of a surge in the job market.

Trending Skills:
Those that have experienced a significant increase in frequency within job advertisements over the last six months, as measured by the gradient of their occurrence.

In-Demand Skills:
The top 5% of skills based on their frequency in job ads.



From insight to action:

- Emerging skills allows to anticipate future requirements and adapt proactively, investing in development to stay ahead.
- Trending skills reflect current market demands, guiding talent acquisition and development efforts.
- Popular skills represent core competencies sought after in the job market.

Collaboration and safety skills are emerging in manufacturing

In today's rapidly evolving manufacturing landscape, identifying and harnessing emerging skills is crucial to stay competitive.

Collaboration is the most frequently mentioned emerging skill in the U.S. manufacturing industry. This trend highlights the growing emphasis on teamwork and interpersonal skills due to the increasing complexity of manufacturing operations.

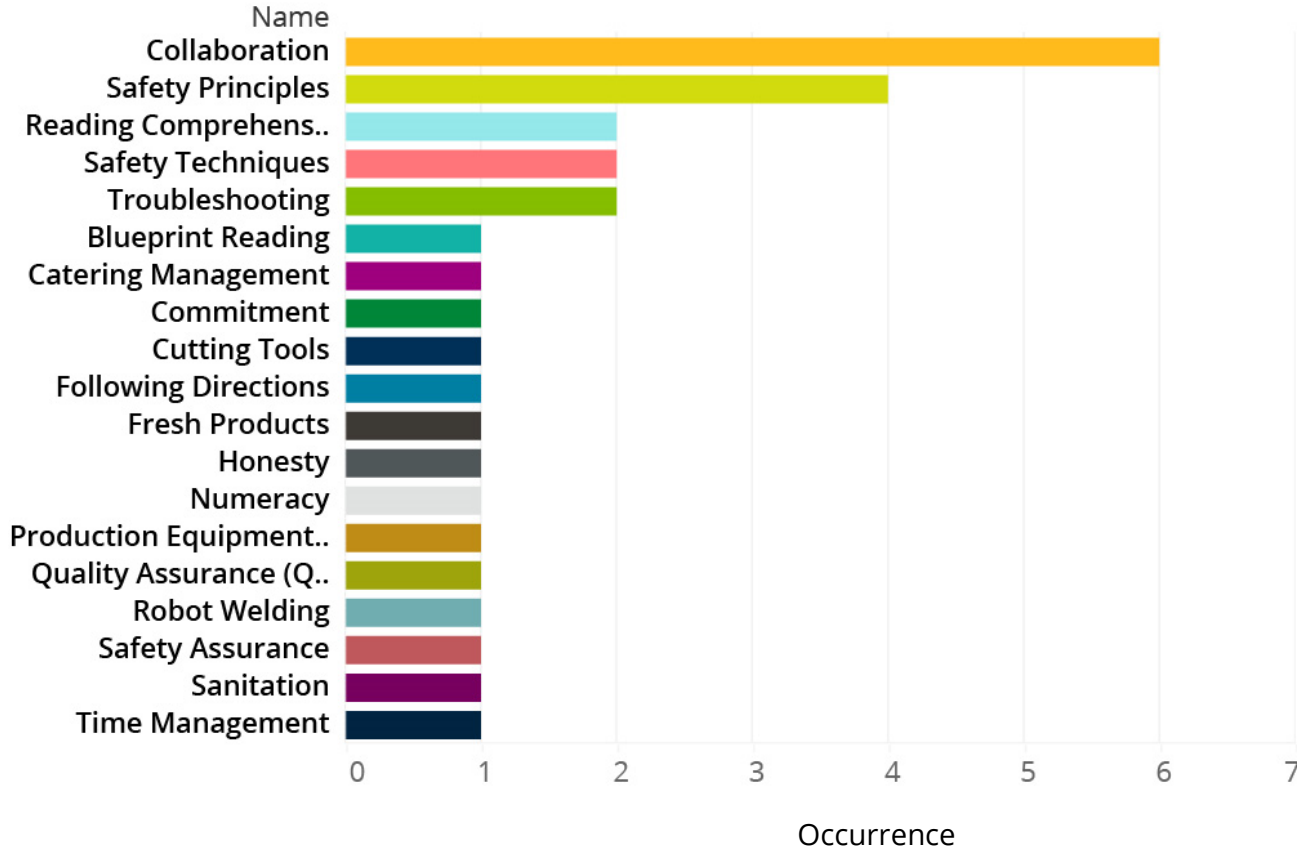
A cluster of skills related to S**afety Assurance** indicate that as manufacturing environments are subject to stringent safety regulations, the demand for professionals who can develop and oversee comprehensive safety programs has heightened.

From insight to action:

- By identifying emerging skills early, companies can target niche talent pools before these skills become highly competitive, securing innovative talent ahead of market trends.
- Training programs can be designed to include these emerging skills, preparing the workforce for future demands and ensuring adaptability to new technologies or processes.

Skills emerging in the U.S. manufacturing industry

*(*Previously low demand skills that are showing an early indication of a surge in the job market*, 2019 to date)*



Skills that enhance collaboration and safety have gained importance

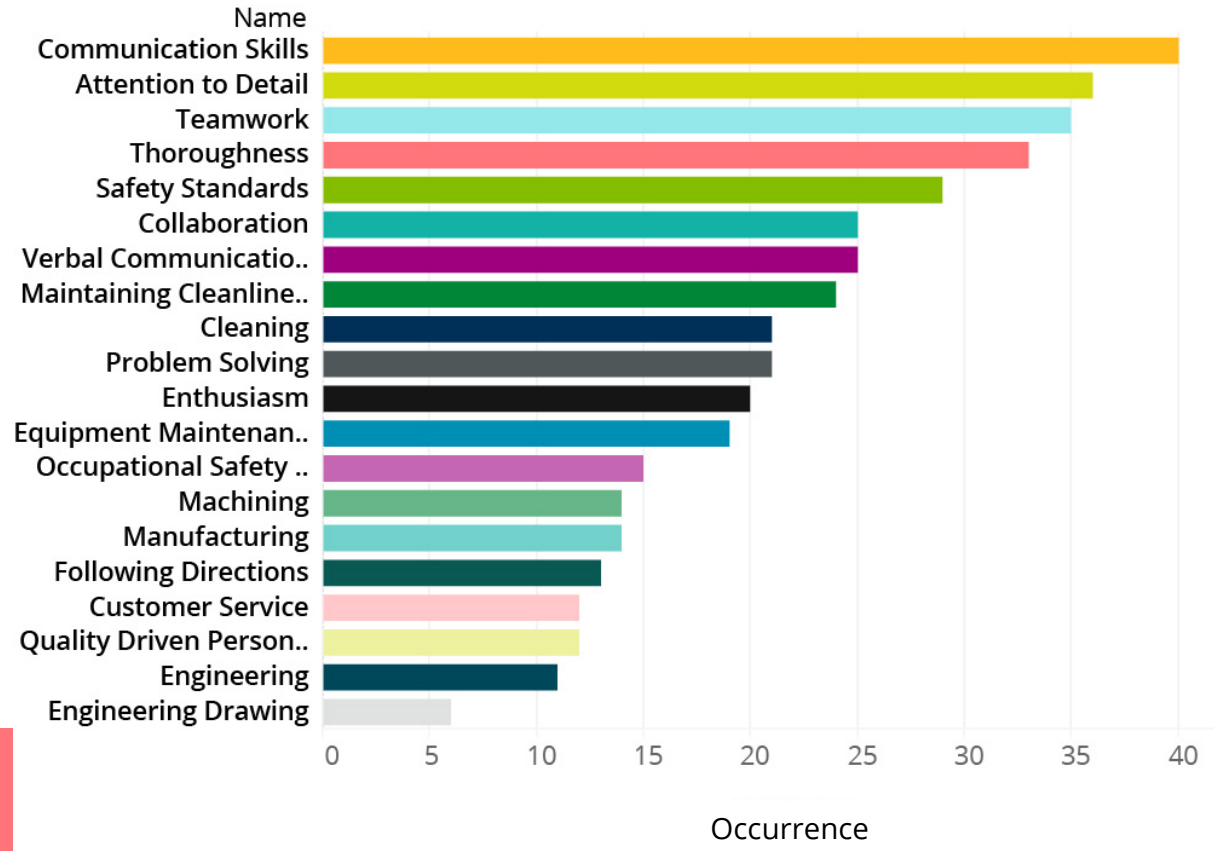
Understanding the skills trending in the jobs market is essential to ensure the right talent is in place to meet the evolving demands of the manufacturing industry.

The chart on the right displays the skills that have experienced a significant increase in demand over the last six months in the U.S. manufacturing industry.

Communication skills lead the list, and core manufacturing skills remain highly valued.

The rise in demand for safety, quality awareness, and detail-oriented skills highlights the industry's focus on compliance, quality control, precision, and high-quality outputs in complex modern manufacturing processes.

Trending skills for the U.S. manufacturing industry
(skills showing a surge in the job market over the last six months)



From insight to action:

- By identifying trending skills, organizations can proactively spot potential future skills gaps before they become acute. This allows to put training, hiring, or upskilling plans in place to close those gaps.
- If certain skills start trending unexpectedly, it could signal a shift in industry practices or technological advancements, prompting strategic pivots or enhancements in service offerings.

Core manufacturing skills stay in-demand despite increase in automation

Knowing which skills are most requested across the manufacturing industry allows companies to focus on sourcing and retaining talent with these capabilities.

The skill Manufacturing* itself is the most frequently mentioned, despite the increasing adoption of automation and new technologies, core manufacturing skills remain indispensable.

Occupational Safety and Attention to Detail rank high on the list of essential skills. This suggests that even with technological advancements, human oversight is crucial in maintaining safety standards and ensuring precision in manufacturing processes.

Leadership and Team Management skills are highly sought after. As the industry faces complex operational and workforce management challenges, strong leadership and effective team management are vital for success.

From insight to action:

- Role-level data of skills in-demand serve as a benchmark for what is considered standard proficiency in the industry.
- Understanding in-demand skills refines recruitment, sets industry benchmarks, and informs retention strategies like targeted bonuses and career development, ensuring alignment with top market competencies.

Skills in-demand in the U.S. manufacturing industry

(highest occurring skills, 2019 to date)

**Manufacturing is defined as the creation or production of goods with the help of equipment, labor, machines, tools, and chemical or biological processing or formulation. We will explore this skill in greater detail later in this report.*

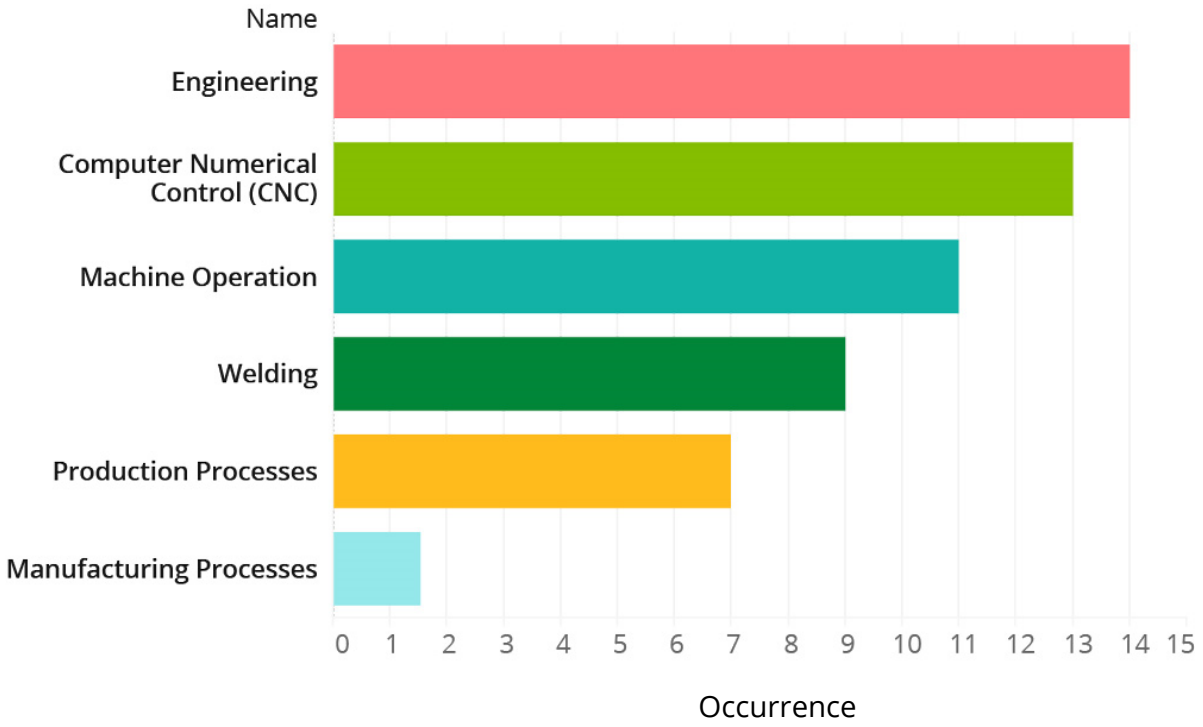
Deep dive into Manufacturing

Manufacturing is the most mentioned skill in job ads within the manufacturing industry because it encompasses a wide range of sub-skills.

Pearson's Skill Adjacency Model reveals the skills that frequently co-occur with Manufacturing in job listings. The model implies that jobs requiring a specific skill, like Manufacturing, are likely to also require the co-occurring skills, and vice versa. This relationship helps us understand the broader skill set associated with manufacturing roles.

By applying the model to the skill “Manufacturing”, we identify the specific skills under the manufacturing umbrella. The graph on the right shows that Engineering stands out as the most common related skill, appearing in 14 job roles that also require manufacturing expertise.

Skills that frequently coincide with the skill “Manufacturing” in job listings



**Occurrence indicates the total number of roles for which the skill appears*

Manufacturing organizations seek managers with operational and quality expertise

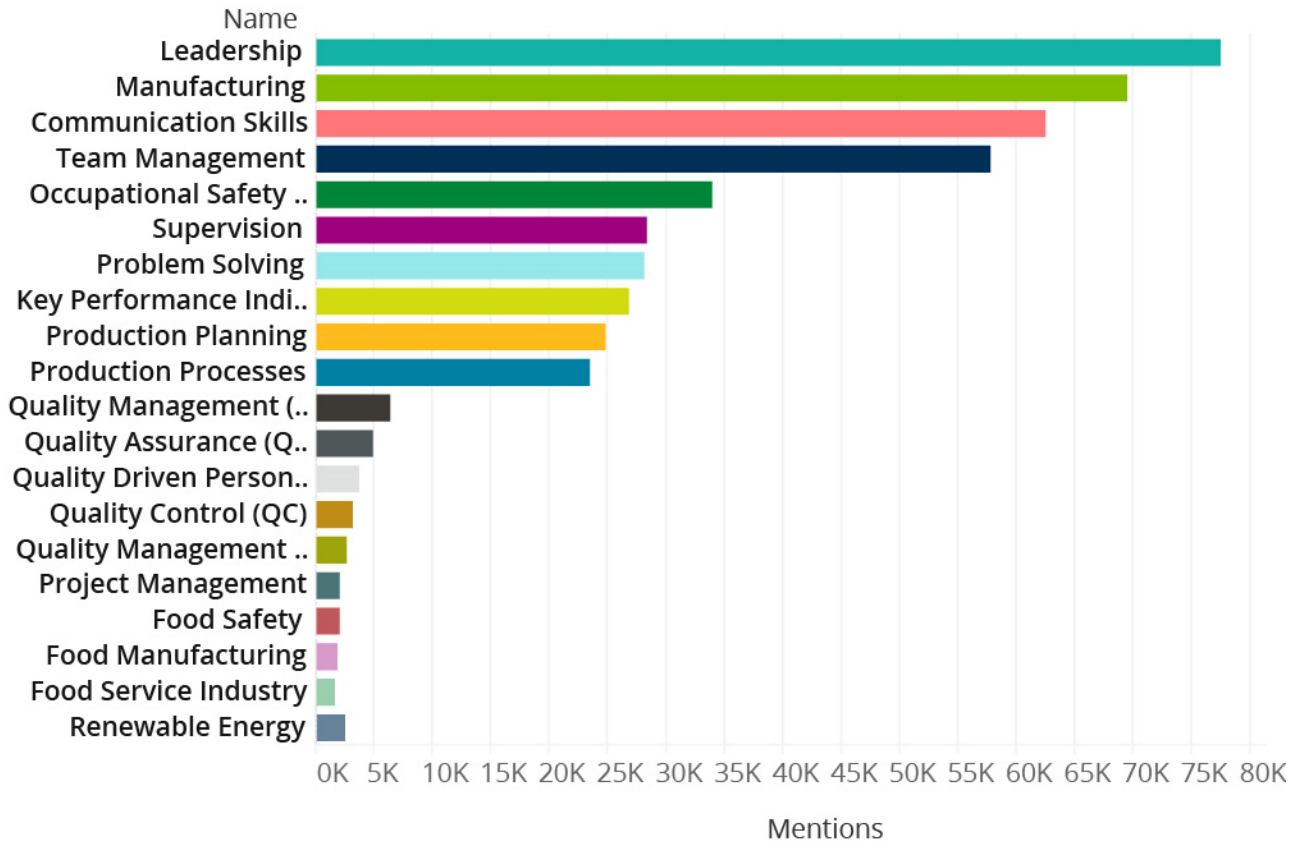
Leadership emerges as the most sought-after skill for managerial roles in the manufacturing industry, which comes as no surprise. However, the high demand for two other skill sets is noteworthy:

- **Production Planning and Processes.** Managerial roles require a strong grasp of technical and strategic skills, such as Production Planning and Production Processes. These skills are crucial for optimizing manufacturing operations and ensuring efficient oversight.
- **Quality Management.** Includes aspects like Quality Assurance, Quality Control, and Quality Management Systems. In the manufacturing sector, managers play a central role in maintaining and improving product standards.

The emphasis on these skill sets highlights the importance of managers possessing a comprehensive understanding of both operational and quality-related aspects to effectively lead and drive success in manufacturing organizations.

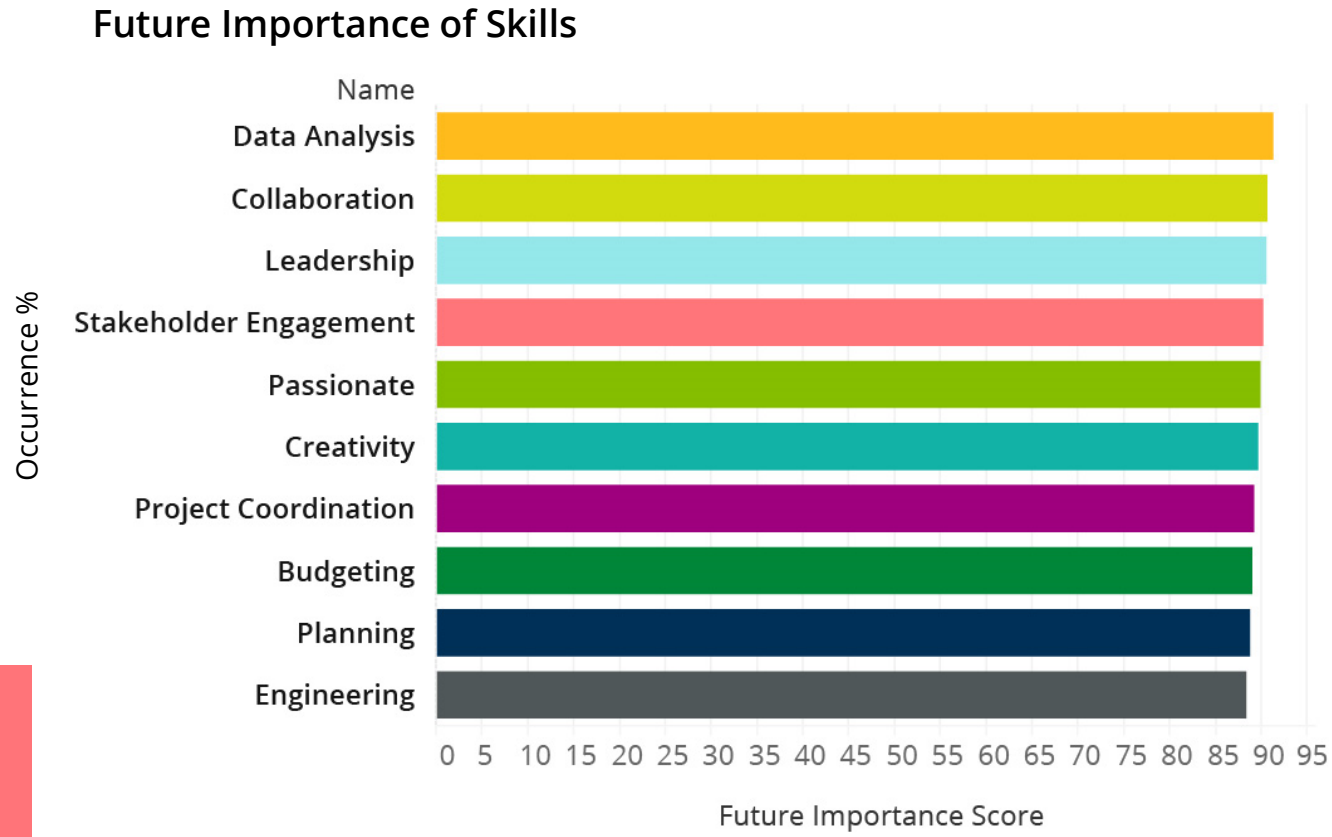
Skills in-demand among Manager Roles in the U.S. manufacturing industry

(highest occurring skills, 2019 to date)



Blend analytics and human skills for manufacturing career longevity

Data Analysis emerges as the skill with the highest future importance*, reflecting the increasing digitization and automation of manufacturing processes. However, the importance of human skills such as Collaboration, Leadership, Creativity, and Stakeholder Engagement remains critical.



From insight to action:
To prepare for the future of manufacturing, organizations should:

- Review and update job descriptions to include skills with high future importance scores, particularly in data-related skills, while nurturing the human skills that enable the effective application of technical capabilities.
- Modify competency models to emphasize critical future skills.
- Prioritize these skills in hiring, performance management, and development, advocating for their value to the organization.

** The future importance score considers factors like automation risk, short-term skill and occupation trends, and long-term projections. Skills with higher scores are likely to be more valuable and in-demand in the future job market.*

Part 2: Impact of AI on manufacturing tasks

Pearson

Generative AI has greater potential to create additional capacity on white collar roles

From insight to action:

Develop targeted training programs for the roles that will be more transformed by technology. Focus on:

a) Enhancing power skills (Creativity, Communication, Leadership) that AI can't easily replicate.

b) Upskilling for more complex tasks.

c) Training for new technologies.

Use role-level insights to identify positions needing redesign, combining tasks or eliminating unnecessary procedures. This prepares employees for future job requirements and streamlines processes as AI advances.

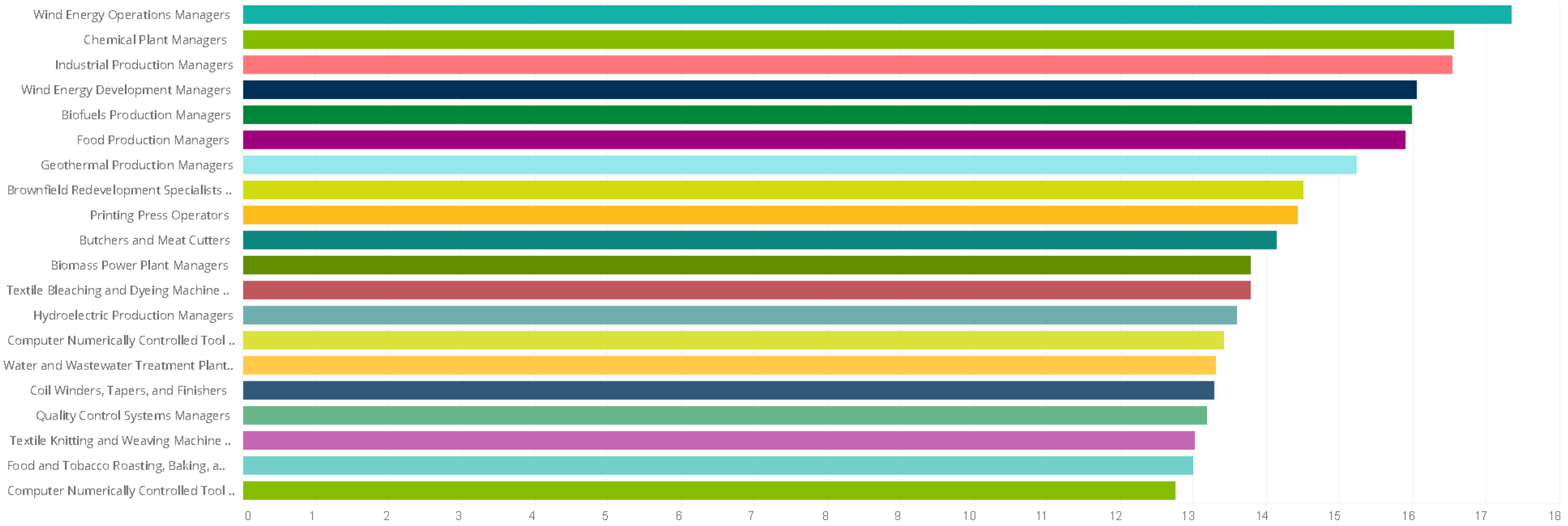
Pearson uses predictive analytics to forecast changes in jobs and industries over the next 1 to 15 years. The model analyzes the current time spent on tasks within jobs and identifies how emerging technologies can assist or complete these tasks, enabling humans to concentrate on higher-value responsibilities.

Pearson's ontology, consisting of 76,000 tasks, assigns the most likely emerging technology to each task, with varying impact based on role, seniority, industry, and country. This model provides insights at the task, job, and industry levels, enabling advanced task analysis.

As illustrated in the chart, Generative AI is expected to have a greater impact on white-collar roles (typically performed in an office or other administrative setting) than blue-collar roles in the U.S. manufacturing industry over the next 5 years, with managerial roles being particularly transformed.

AI has great potential to create additional capacity on white collar roles

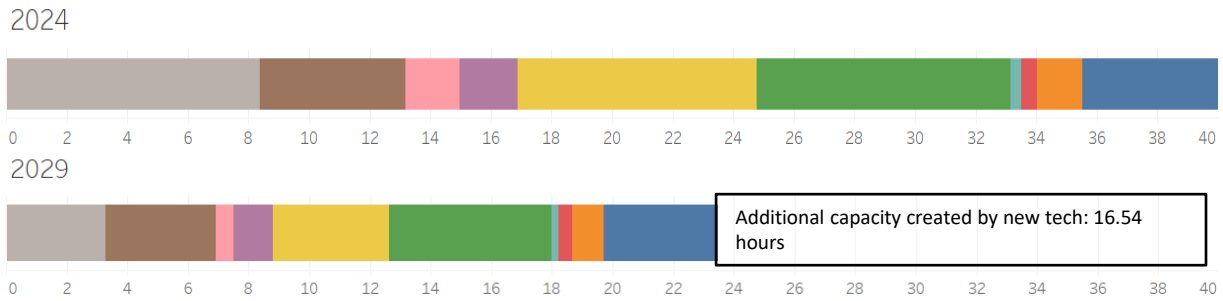
Top 20 U.S. manufacturing jobs with the greatest time savings from new technologies *(hours saved per week, by 2029)*



Deep dive into the Industrial Production Manager role

AI-enabled tools can significantly impact Industrial Production Managers, the most transformed occupation in U.S. manufacturing, potentially creating 16.54 additional hours of capacity per week by 2029.

Distribution of weekly work hours for Industrial Production Managers in 2024 and projected for 2029



Tech Name
- AI-Autonomous Decision Making
- AI-Enhanced Imaging Analytics
- AI-Enhanced Innovation
- Empathetic Chatbot
- LLM Chatbot
- Predictive Analytics (General)
- Predictive Inventory Analytics
- RPA for internal processes
- Smart Asset Performance Management
- Virtual Communication Systems

From insight to action:

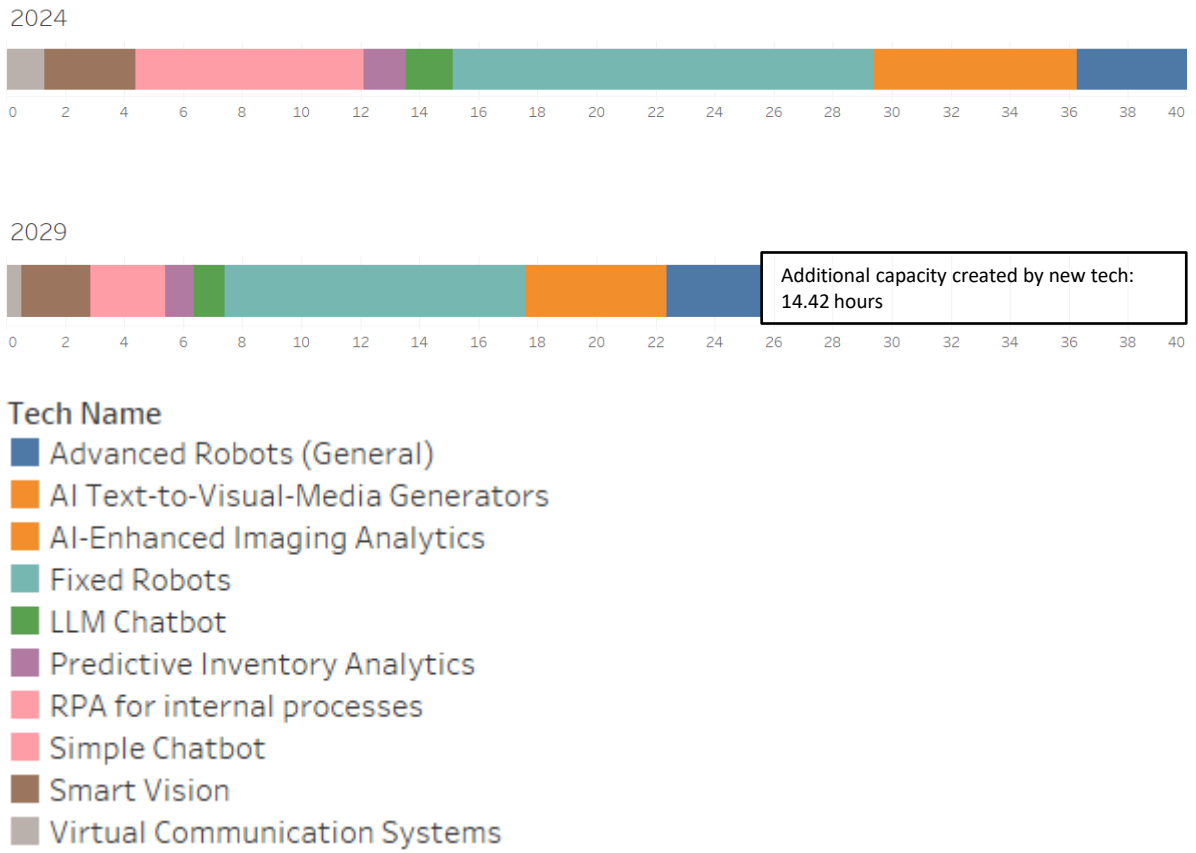
This detailed task information can guide a comprehensive role analysis to inform both the implementation of technology and the redesign of roles to better match the changes in job functions following AI implementation.

Additionally, this data can help understand how key roles and critical talent segments will evolve with the introduction of Gen AI. It's important to take this transformation into account when making decisions about retention, talent acquisition, and talent development.

AI enables role consolidation, restructuring, and shifting to high-value tasks

AI applications in printing could profoundly transform the role of Printing Press Operators, potentially freeing up to 14.42 hours per week.

Distribution of weekly work hours for Printing Press Operators in 2024 and projected for 2029



From insight to action:

Organizations need to strategically decide how to leverage the additional capacity created by the use of AI.

For instance, merging similar roles or consolidating responsibilities across different positions, which could lead to a redesign of team structures or the entire organizational architecture.

This strategy allows the redirection of employee time to higher-value tasks that demand human skills such as Problem-solving, Innovation, and Building Relationships.

AI could mitigate future labor shortages in U.S. manufacturing

The U.S. manufacturing industry faces two challenges: a shortage of skilled workers and a lack of applicants.

It is projected that between 2024 and 2033, the industry will need to fill nearly 3.8 million new jobs. Without significant changes to address these workforce challenges, it is likely that around 1.9 million of these jobs could remain unfilled by 2033.*

Strategically implementing technology to enhance tasks and streamline processes can help address labor shortages by freeing up workers time, enabling them to focus on higher-value activities and boosting overall productivity.

From insight to action:

To address labor shortages, it is crucial to pinpoint the task groups within an organization that offer the greatest potential for capacity creation.

In the manufacturing industry, we have identified five task groups where Generative AI can significantly free up workers time. This task-level data is essential for informing the strategic implementation of technology and prioritizing the redesign of jobs or processes.

By focusing on these key areas, manufacturers can allow their employees to concentrate on more human-centric aspects of their work, such as Problem-solving, Creativity, and Interpersonal Communication.

Top five group tasks in the manufacturing industry where AI can create more capacity (release more time)

We categorized the 76,000 tasks from Pearson's ontology into 300 task groups to identify the top 5 areas where Generative AI can most effectively create additional capacity in manufacturing

Task Group	Impacting Technologies
1. Maintain operational records	Advanced Robotics, Predictive Inventory Analysis, Predictive Analysis, Simple Chatbot, LLM Chatbot, AI Text-to-Visual-Media Generation
2. Read documents or materials to inform work processes	AI-Enhanced Imaging Analytics, Smart Vision, LLM Chatbot, Advanced Robotics, Predictive Analysis, AI-Autonomous Decision Making
3. Measure physical characteristics of materials, products, or equipment	Smart Vision, Advanced Robotics, AI-Enhanced Imaging Analytics, Drones
4. Program computer systems or production equipment	AI Text-to-Visual-Media Generation, LLM chatbot, Predictive Analytics, AI-Autonomous Decision Making, Advanced Robotics, AI-Enhanced Imaging Analytics
5. Inspect completed work or finished products	Smart Vision, AI-Enhanced Imaging Analytics, Drones, Predictive Analysis

**Report "Taking charge: Manufacturers support growth with active workforce strategies", Deloitte and The Manufacturing Institute, 2024*

KEY TAKEAWAYS

Develop Targeted Training Programs: Design training programs tailored to roles that will be significantly impacted by technology. Emphasize enhancing power skills even in a technically driven industry like manufacturing. Soft skills such as Collaboration, Leadership, Communication, and Teamwork are increasingly important especially for managerial roles.

Invest in Safety and Quality Training: Skills related to safety and quality are consistently in demand. Implementing regular training programs that focus on these areas can help meet compliance standards and improve overall productivity and product quality.

Align Recruitment with Skill Trends: Understanding which skills are emerging, trending, and most in-demand can guide recruitment efforts to focus on candidates who possess these current and future capabilities, ensuring the organization stays competitive.

KEY TAKEAWAYS

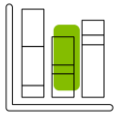
Redesign Roles Based on Role-Level Insights: Utilize role-level insights to identify positions that require redesigning, combining tasks, or eliminating unnecessary procedures. This proactive approach prepares employees for future job requirements and optimizes processes in line with AI advancements.

Strategically Leverage AI-Created Capacity: Make strategic decisions on how to utilize the additional capacity generated by AI, such as merging similar roles or consolidating responsibilities across positions. This may lead to redesigning team structures or the entire organizational architecture.

Prioritize Capacity Creation to Address Labor Shortages: Identify processes and task groups within the organization that have the highest potential for capacity creation to tackle labor shortages effectively.

Data Sources

Data Sources



Pearson's Labor Market Data

Using Natural Language Processing (NLP), Faethm by Pearson collates millions of job ads every month throughout the U.S. to determine the skills that are being sought in the marketplace. This data is then analyzed to find trends and patterns.

Pearson's Tech Impact Model

The task analysis is based on Pearson's Tech Impact model. This model is comprised of 33 technologies and 76,000 tasks and predicts the impact of each technology on the work tasks over the next fifteen years.

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