

# Building the Future of Work in the Age of AI: How New Jobs and Technologies Will Transform Manufacturing

MAPI ManufacturED

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# About the Research

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In 2019, the MAPI Foundation collaborated with ITIF to study how AI will transform manufacturing and the workforce of the future.

- The MAPI Foundation is MAPI's sister organization that focuses on manufacturing's impact on the global economy and how to keep the industry vibrant.
- This research was underwritten by leading manufacturing companies committed to supporting future workforce initiatives and strengthening U.S. communities.
- ITIF is the world's leading science and technology policy think tank. It supports policies driving global, innovation-based economic growth.
- ITIF focuses on a host of issues at the intersection of technology innovation and public policy across several sectors:
  - Innovation and competitiveness
  - IT and data
  - Telecommunications
  - Trade and globalization
  - Life sciences, agricultural biotech, and energy

# Today's Presentation

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- 1 Digitalization Transforming Manufacturing
- 2 How AI Will Transform the Manufacturing Workforce
- 3 Developing and Acquiring AI Talent
- 4 Business and Policy Recommendations

# Increasingly Digitalized Global Economy

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- Digital economy accounts for 25% of global GDP.
- Value of international data flows has surpassed the value of international merchandise trade.
- 50% of all value created in the global economy will be created digitally over the next decade.



Sources: Accenture, "Digital Disruption: The Growth Multiplier"; McKinsey Global Institute, "Digital Globalization: The New Era of Global Flows"

# Digitalization and AI Transforming Manufacturing

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- “Digital services” now account for 25% of manufacturing inputs.
- Services responsible for 25% of manufacturing revenues, but 46% of manufacturing profits.
- AI applications expected to contribute one-third of output growth in Germany’s manufacturing sector over next five years.



Sources: Sherry Stephenson, “The Linkage Between Services and Manufacturing in the U.S. Economy”; IDC, “IDC FutureScape: Worldwide IT Industry 2018 Predictions”

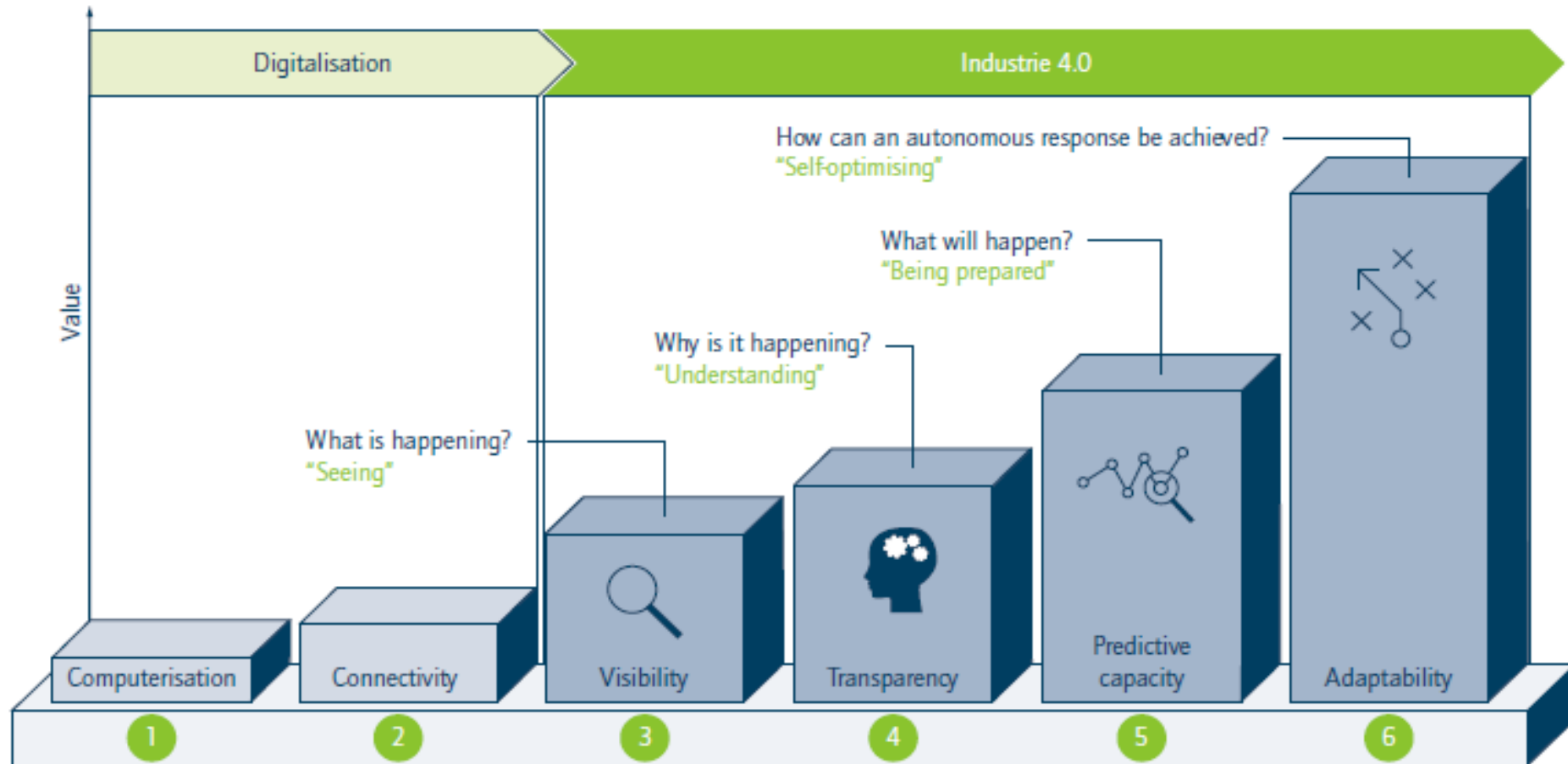
# Digital Tools Transforming Every Facet of Manufacturing

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1. Product Design
2. Fabrication and Assembly
3. Factory Operation
4. Supply Chain Integration
5. Product Use and Consumption

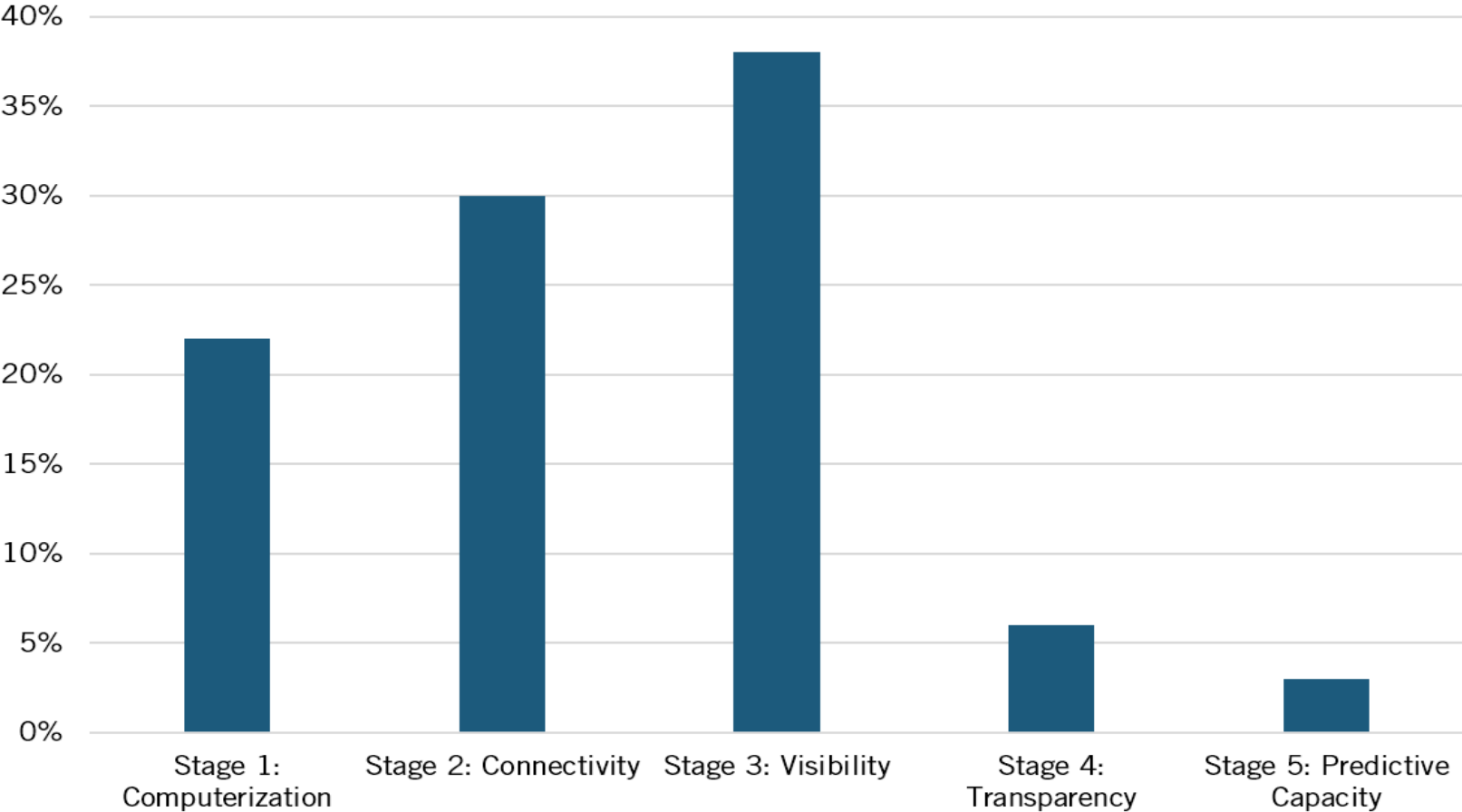


# The Manufacturing Digitalization Maturity Journey



Source: Acatech (German National Academy of Science and Engineering) "Industrie 4.0 Maturity Index"

# Yet Most Manufacturers Still in Early Stages of Digitalization



Source: ITIF/MAPI, “The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future”



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# ITIF/MAPI “The Manufacturing Evolution” Report

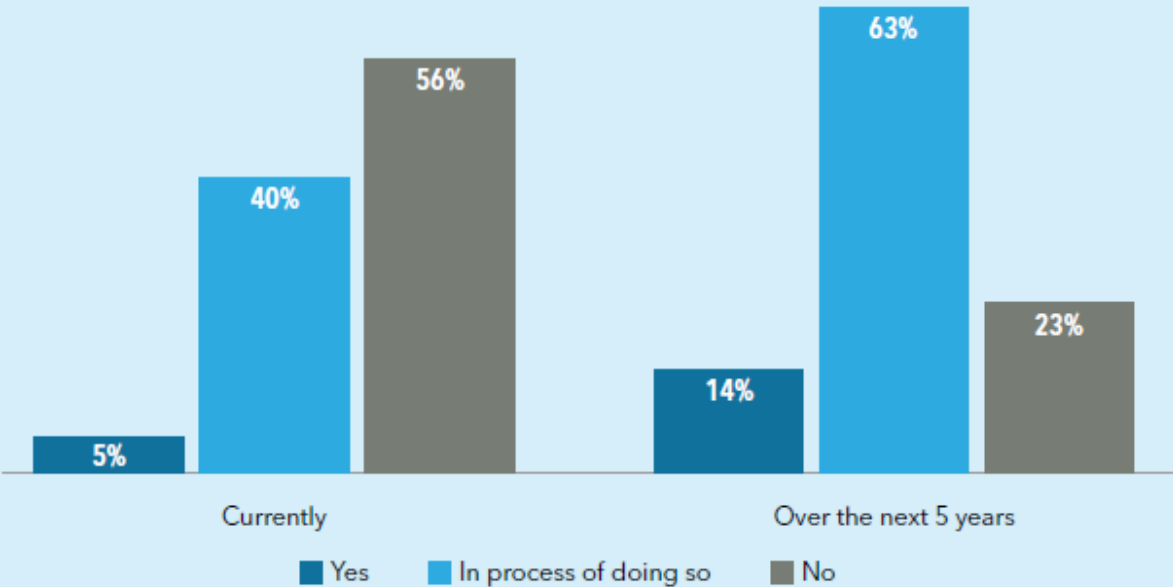
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- Surveyed AI adoption/workforce implications for 70 MAPI members.

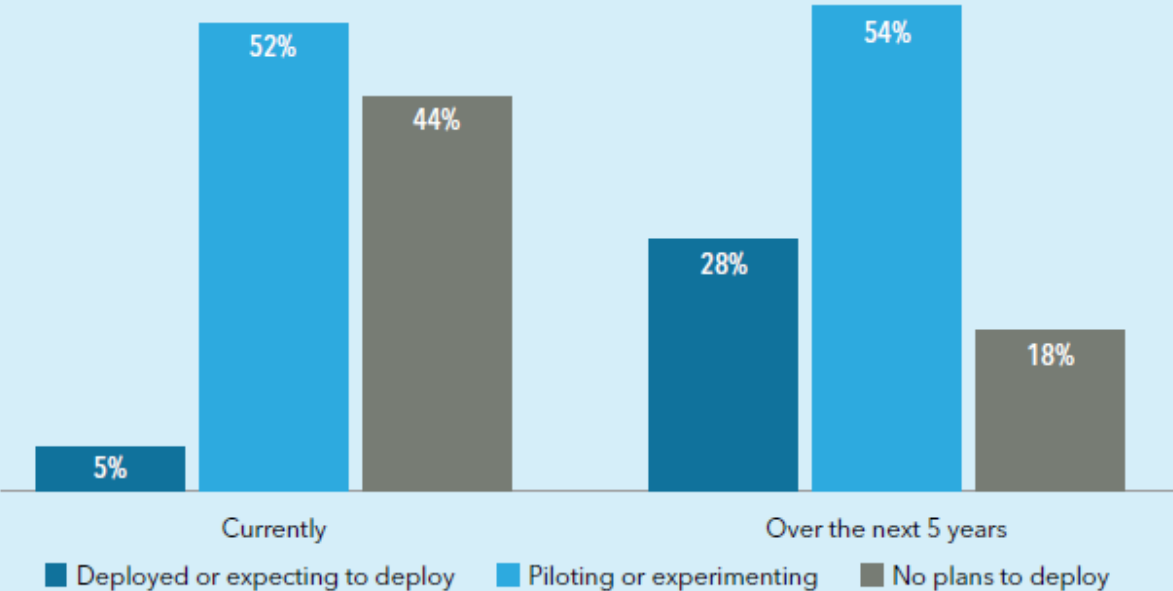


# AI Deployment Lagging But Expected to Surge Quickly

### Expectations Rising for Mapping AI Opportunities and Data Requirements



### AI Deployment Expected to Surge

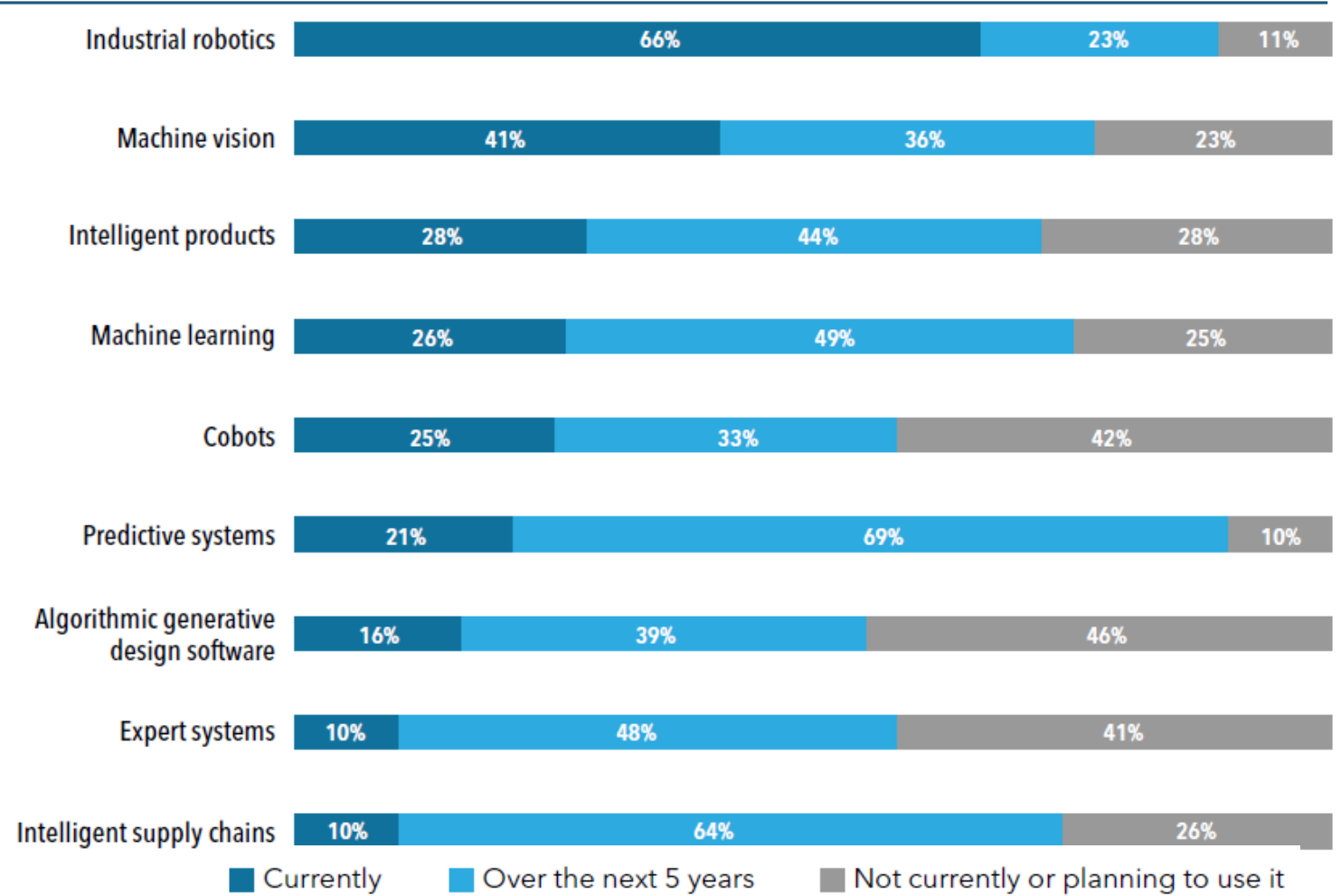


Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

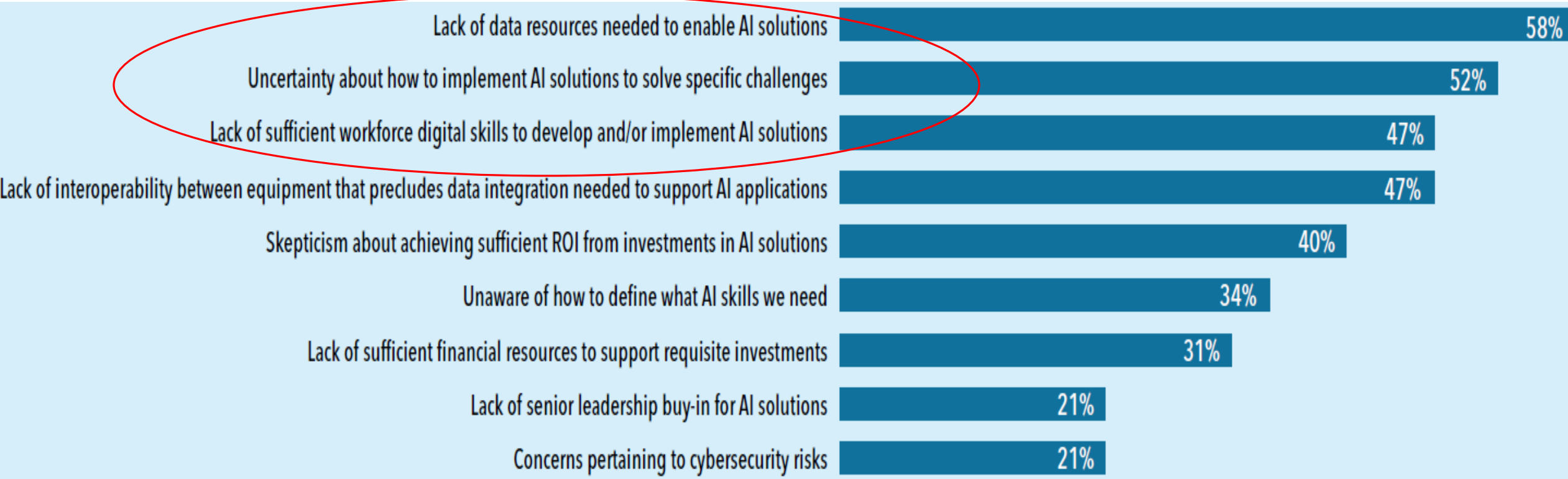
# AI Deployment Levels Vary By Application

Most common apps in 5 years:

- Industrial robotics
- Predictive systems
- Machine vision/learning
- Intelligent products
- Intelligent supply chains



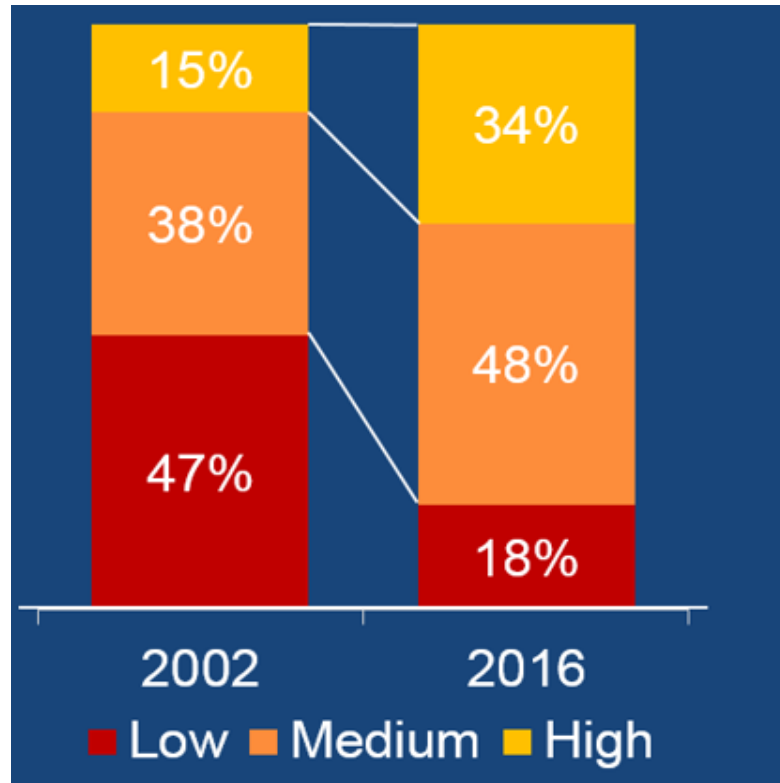
# Leading Barriers to AI Adoption Among Manufacturers



Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

# Manufacturing Jobs Increasingly Demand Digital Skills

Employment in Advanced Manufacturing  
by Digital Skill Level

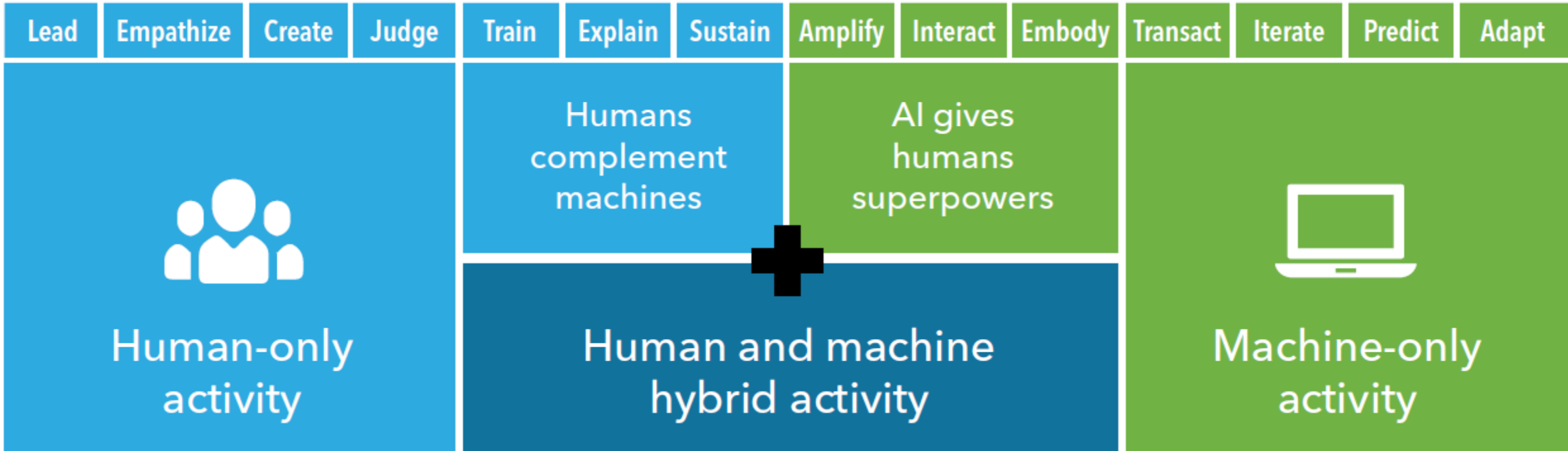


“82% of U.S. manufacturing jobs require a medium to high digital skill level today.”



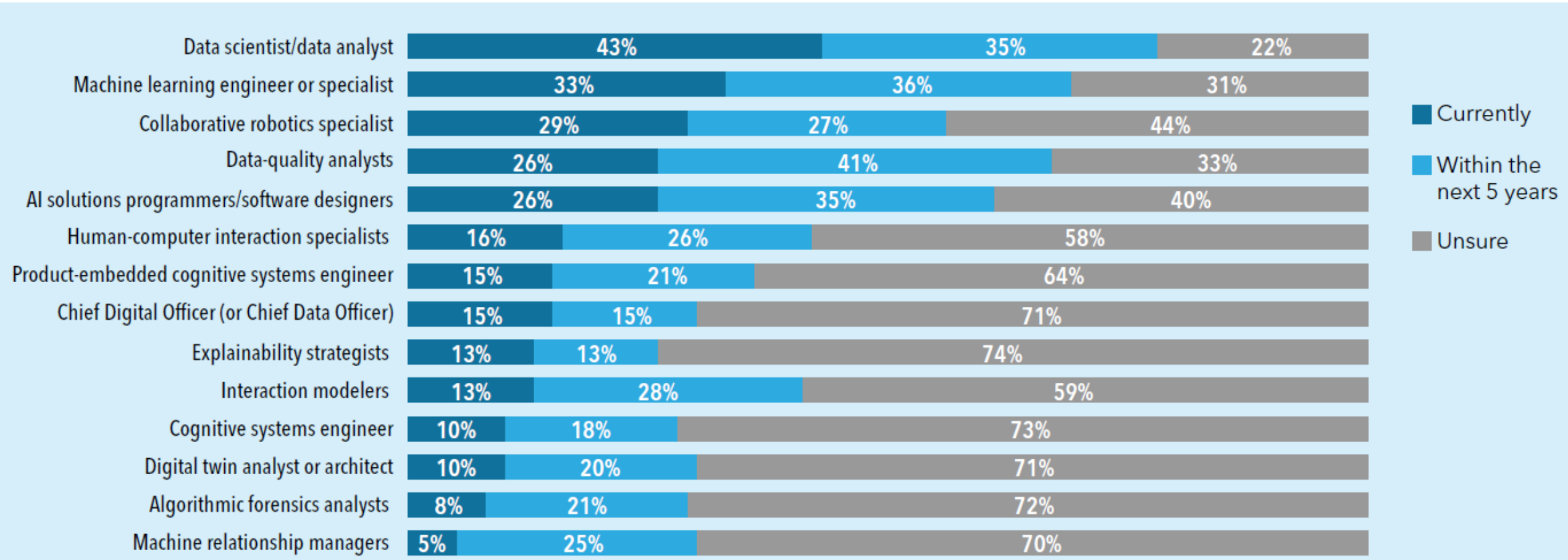
Source: Mark Muro, Sifan Liu, Jacob Whiton, and Siddharth Kulkarni, Brookings Metropolitan Policy Program, “Digitalization and the American Workforce”

# Role of Humans and Machines in the AI Era



Graphic based on diagram from Daugherty and Wilson, *Human + Machine: Reimagining Work in the Age of AI*

# Manufacturers Expecting to Create New AI-Specific Jobs



Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

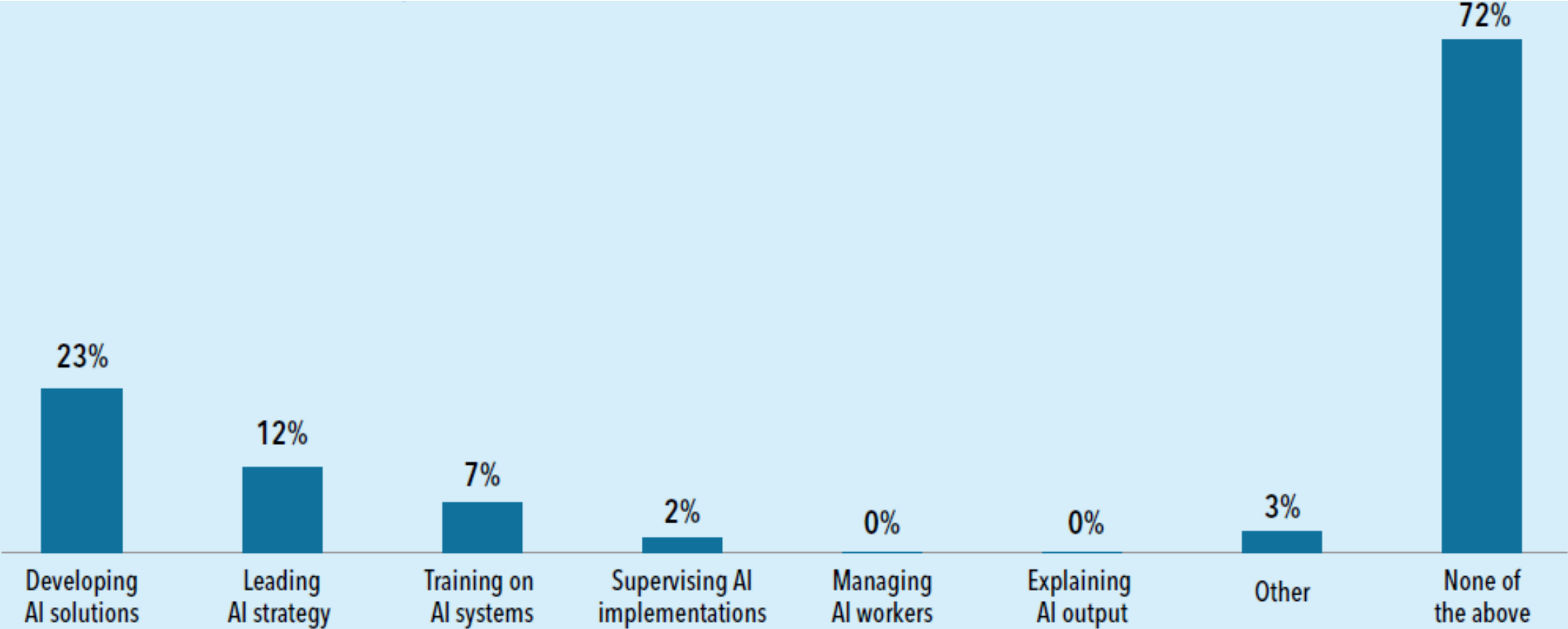


# “Fusion Skills” Reflect Human and Machine Hybrid Activities

Human and machine hybrid activities					
Humans complement machines			AI gives humans superpowers		
TRAIN	EXPLAIN	SUSTAIN	AMPLIFY	INTERACT	EMBODY
Rehumanizing time			Intelligent interrogation		
Responsible normalizing			Bot-based empowerment		
Judgement integration			Holistic melding		
Reciprocal apprenticing					
Relentless reimagining					

Graphic based on diagram from Daugherty and Wilson, *Human + Machine: Reimagining Work in the Age of AI*

# Yet Still Early Days For New Types of AI-Related Mfg. Jobs



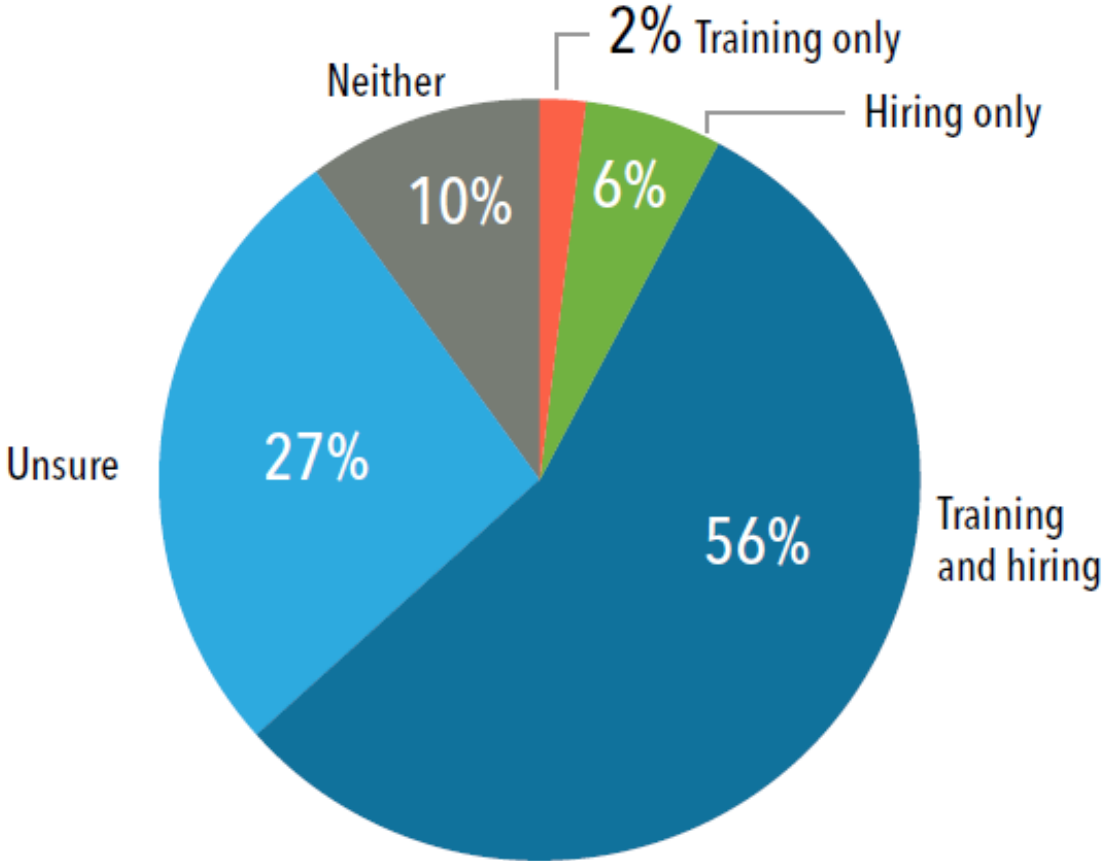
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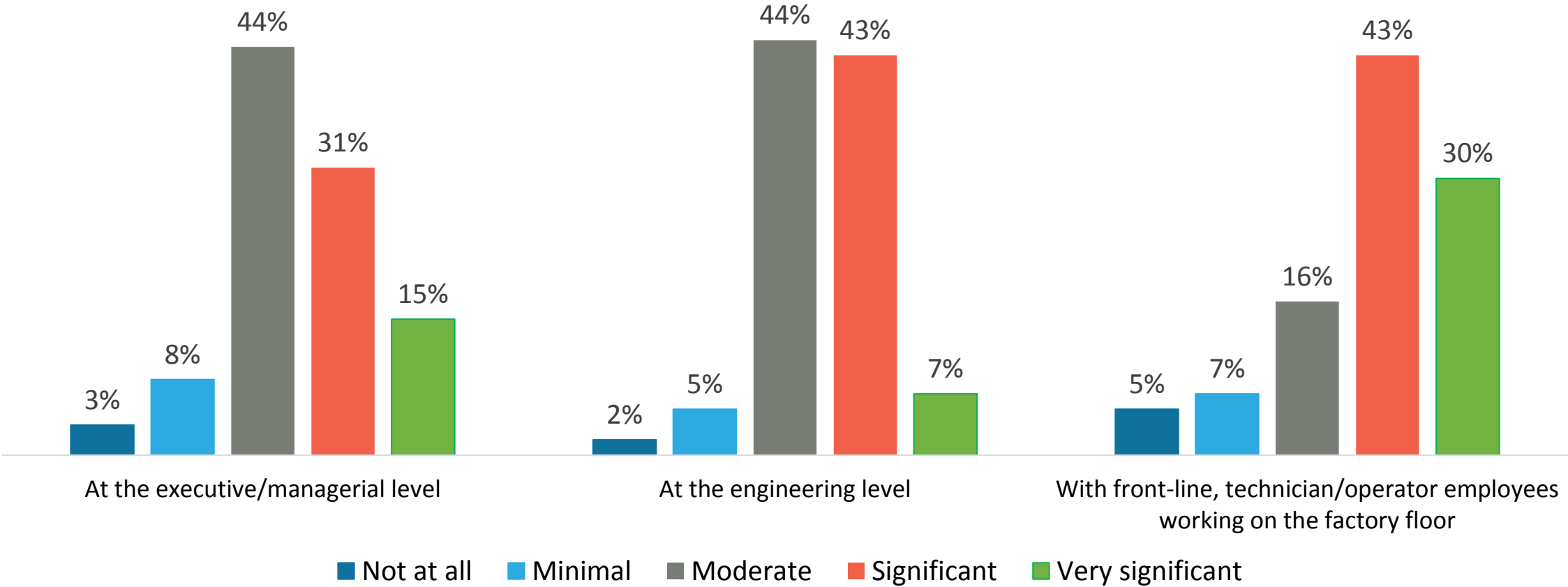
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# Companies Both Hiring and Training to Source AI Talent



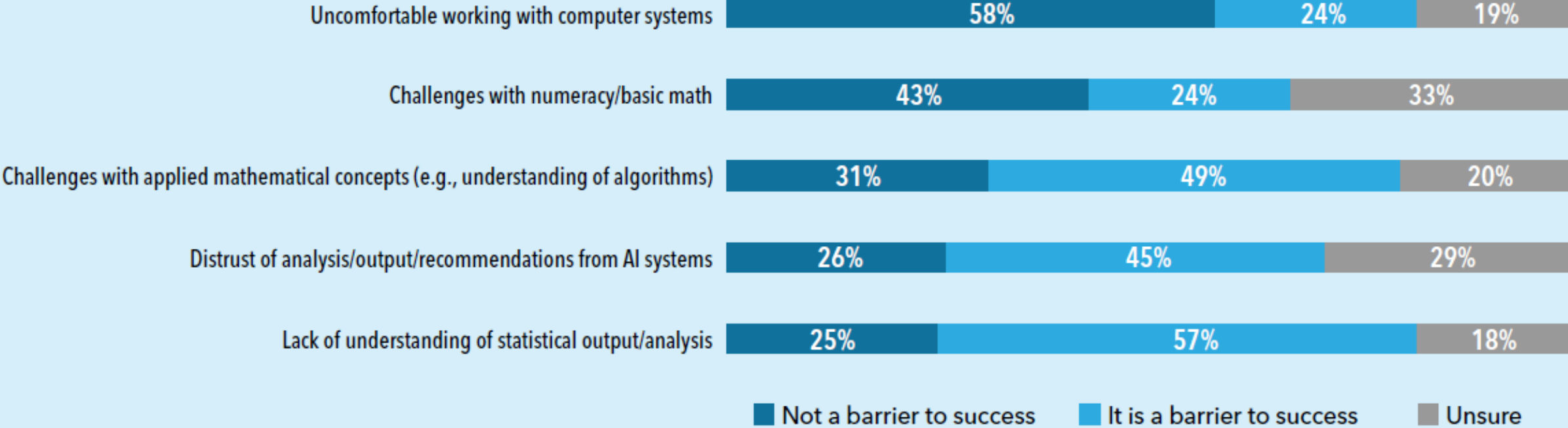
Source: ITIF/MAPI, “The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future”

# AI Skill Gaps Appear Across All Levels of Mfg. Workforce



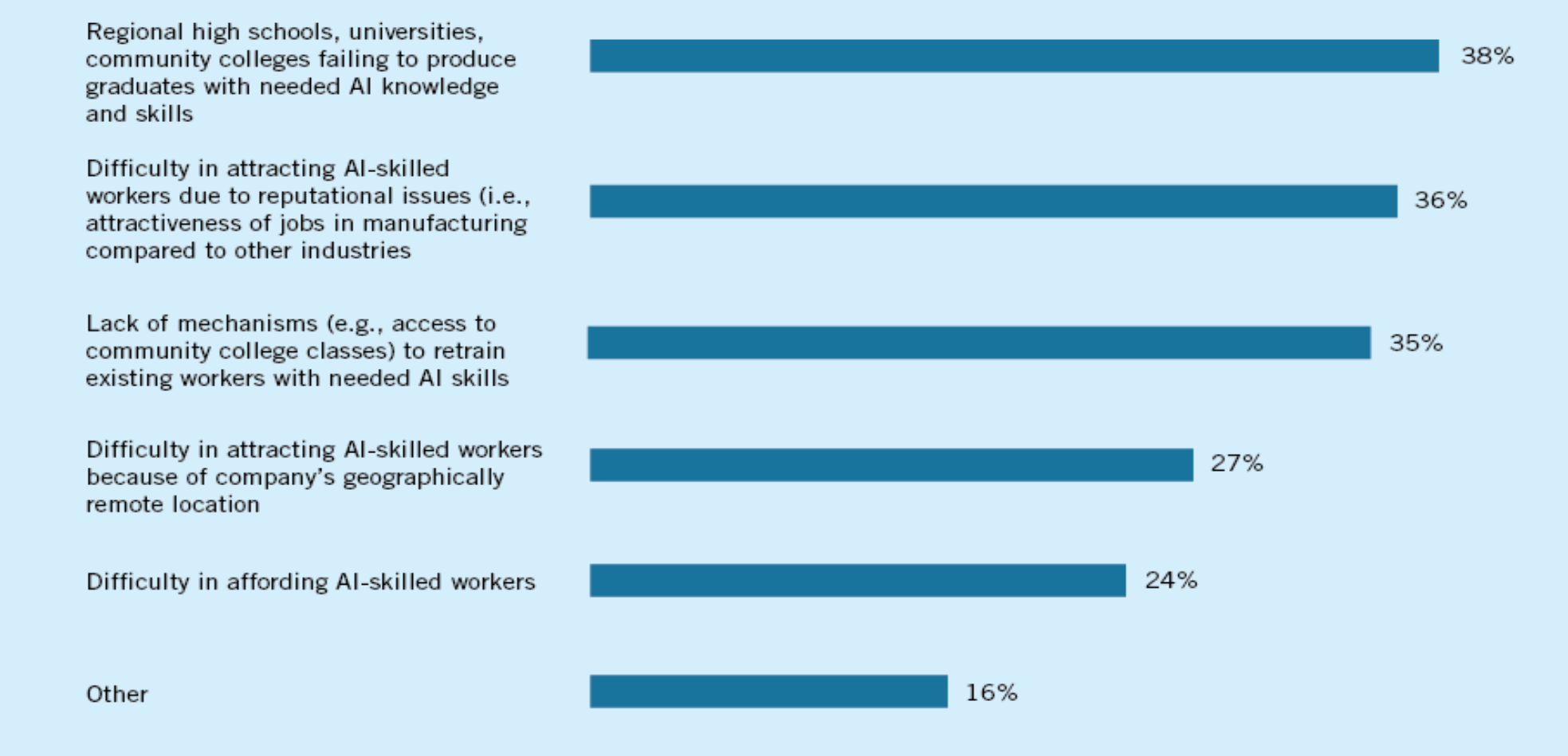
Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

# Key AI Skills Gap Among Front-Line Mfg. Workers



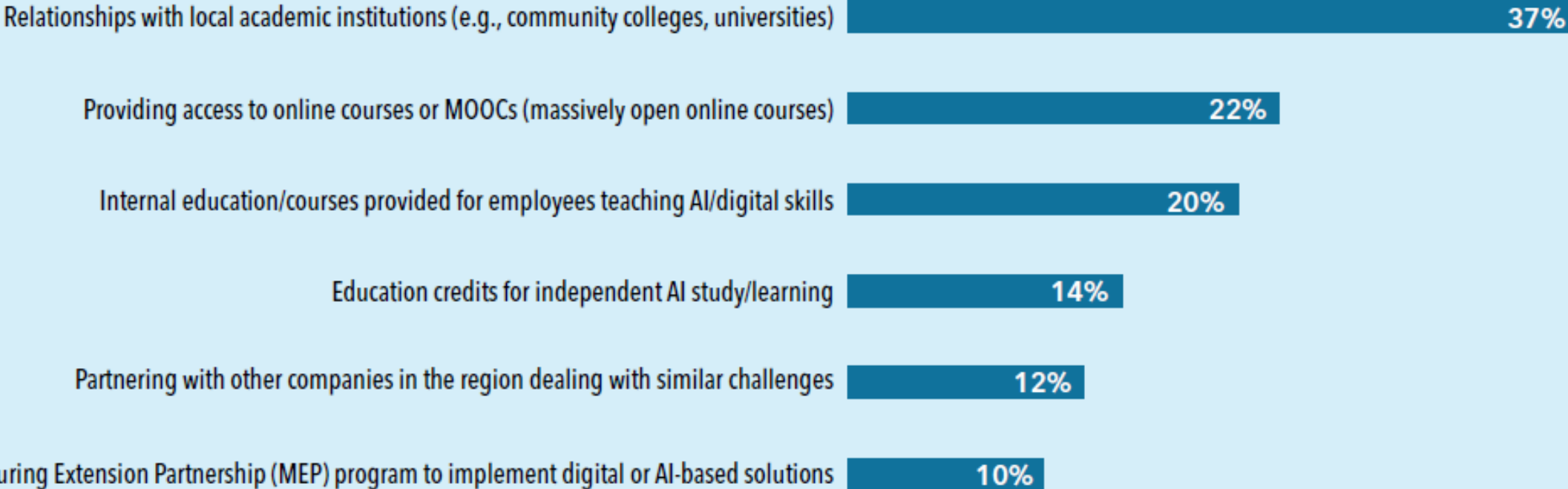
Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

# Barriers In Finding Employees with Requisite AI Skills



Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

# How Companies Are Cultivating AI Workforce Skills



Source: ITIF/MAPI, “The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future”



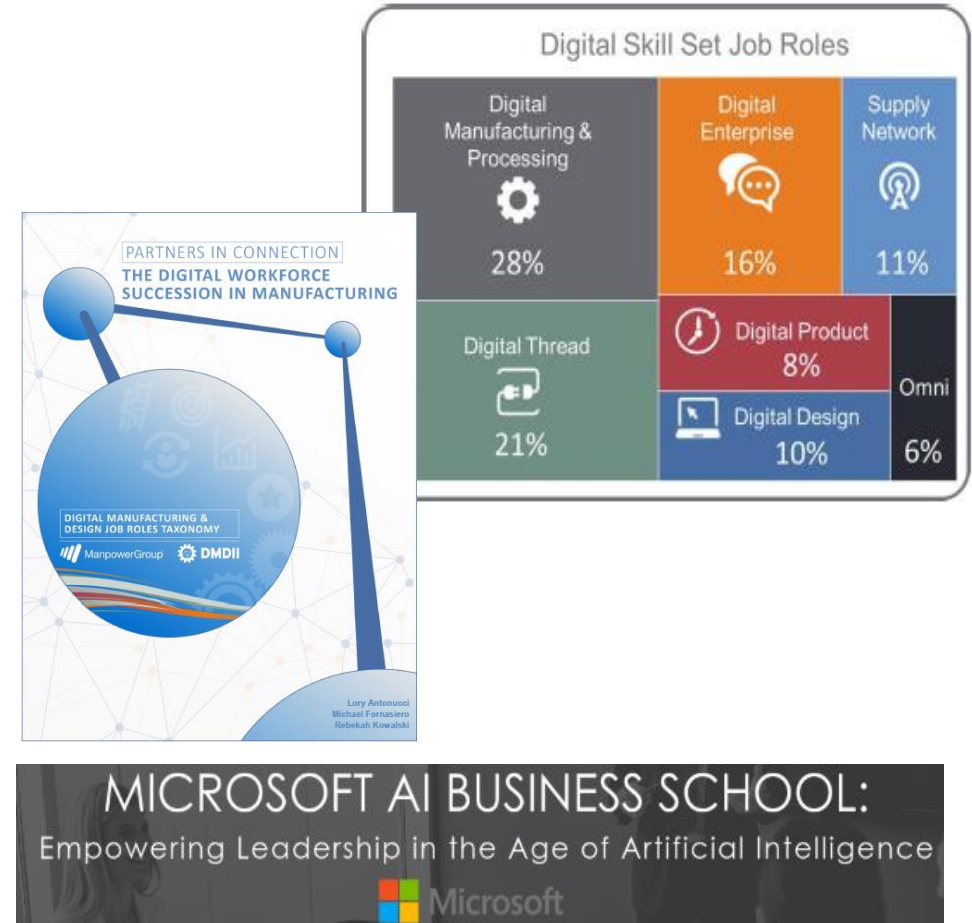
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# Leverage Resources for AI/Digital Mfg. Skills Development

- SME's "Tooling U" MOOC provides 500+ manufacturing technology classes online.
- MxD's "Digital Manufacturing and Design Roles Taxonomy" identifies 165 distinct digital manufacturing and design roles.
- For AI, the Microsoft AI Business School offers education for executives while a Professional Program offers certifications in data science and AI apps development.



Source: MxD and Manpower Group, "The Digital Workforce Succession in Manufacturing"

# Recommendations for Manufacturers to Spur AI Adoption

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- ✓ Set clear objectives for digital and AI transformation.  
Microsoft: “Get Connected; Become Predictive; Grow to Be Cognitive.”
- ✓ Establish an AI Governing Coalition for the enterprise.
- ✓ Develop an AI workforce transformation strategy, recognizing that employees are more welcoming of AI transformation than most believe.
- ✓ Recognize that AI’s greatest benefit comes from thoroughly reimagining existing business processes and operations.

Source: ITIF/MAPI, “The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future”

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# AI Policy Recommendations for the United States

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- Congress should pass the Artificial Intelligence Initiative Act.
- U.S. should commit to a massive expansion of U.S. AI talent.
  - E.g., Create NSF AI fellowship program with 1K CS graduates annually.
- Recast R&D tax credit to an “Innovation/Investment Tax Credit.”
- Smooth workforce transitions (e.g., expand Section 127 tax credit).
- Don’t resist AI/automation due to employment concerns.

# Thank You!

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