How Digitalization Is Transforming Manufacturing

Maryland Manufacturing Innovation Conference 2019

Stephen Ezell
VP, Global Innovation Policy
ITIF

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- The world's leading science and technology policy think tank.
- Supports policies driving global, innovation-based economic growth.
- 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
  - Manufacturing, life sciences, ag biotech, and energy


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1-2019

2018 Global Go To Think Tank Index Report

James G. McGann
University of Pennsylvania, jmcgann@sas.upenn.edu

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All requests, questions and comments should be sent to:
James G. McGann, Ph.D.
Senior Lecturer, International Studies
Director, Think Tanks and Civil Societies Program
The Lauder Institute University of Pennsylvania
Email: jmcgann@wharton.upenn.edu

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ITIF Mfg. Reports

Today's Presentation

1 Manufacturing Digitalization and Why It Matters

2 How Businesses Can Spur Manufacturing Digitalization

3 State of U.S. Manufacturing and Policy Recommendations

Increasingly Digitalized Global Economy

- 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 Transforming Modern Manufacturing

- "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.

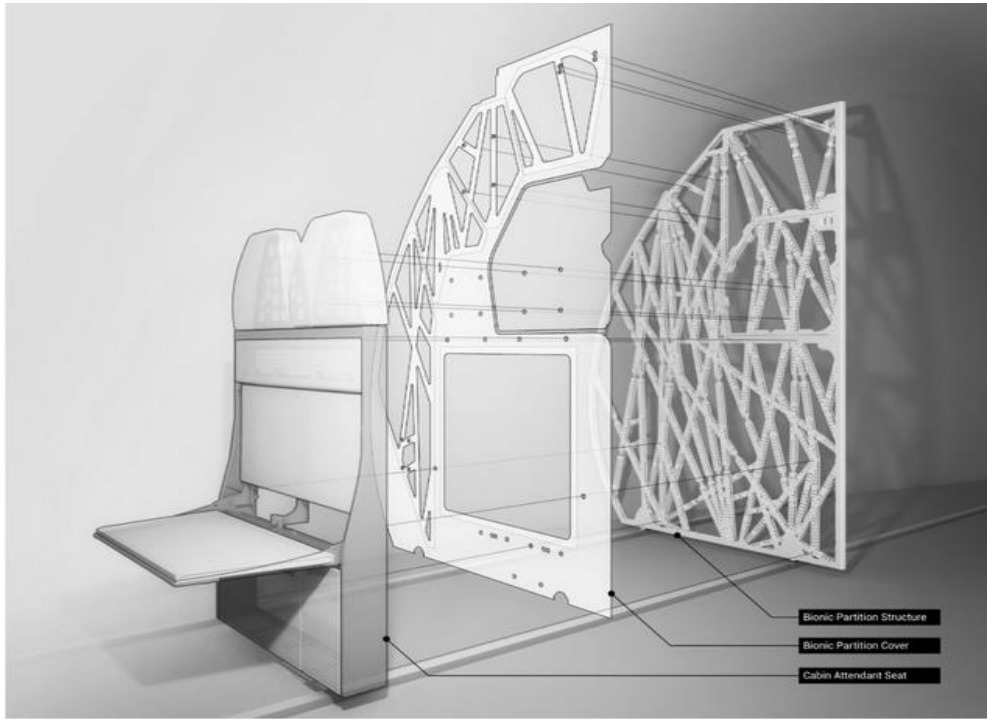
Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

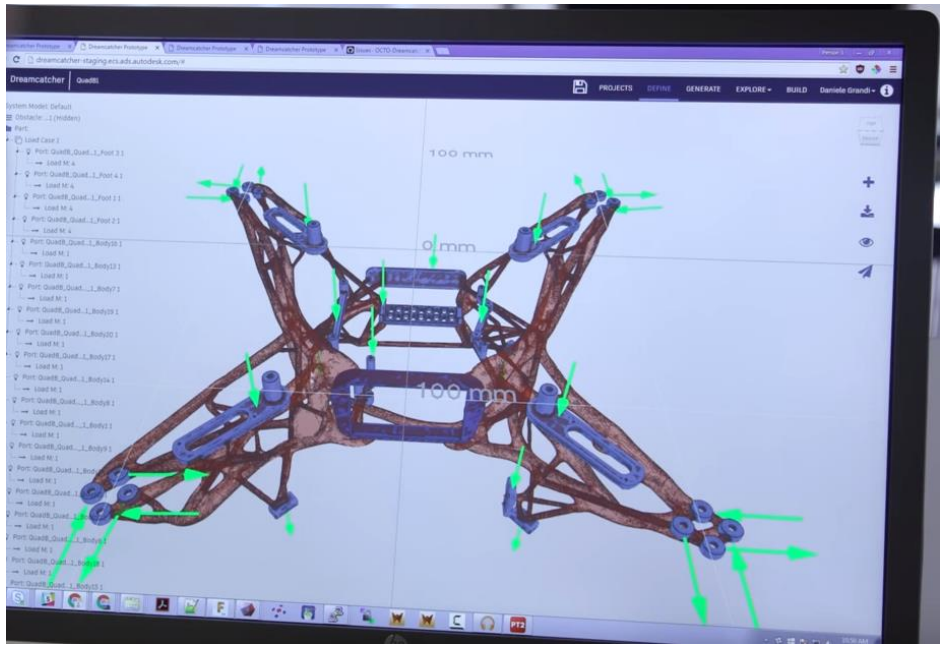
“Digitally Enabled” at Each Step of Manufacturing

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

Product Design

- Modern CAD software leverages generative design techniques to herald a new era of how products get designed.





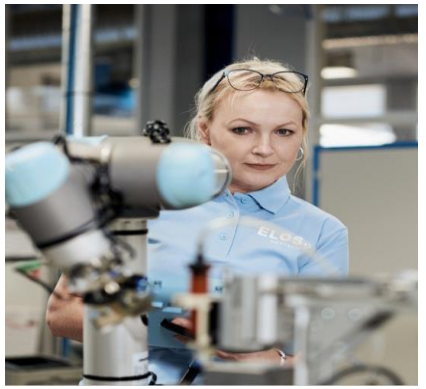
https://www.youtube.com/watch?v=CtYRfMzmWFU

Fabrication and Assembly: 3D Printing & Robotics

- 3D printing expected to impact up to 42% of production in U.S. aerospace, auto, and medical devices sectors.

- 2 million industrial robots at work in the world's factories; responsible for 10% U.S. GDP growth over last 15 years.

- Human-robot collaborations are 85% more productive than either humans or robots working on their own.



THE COBOT DIFFERENCE

VS

- Large, fixed equipment
- Typically requires safety cage
- High-volume, high-speed production
- Complex integration and programming
- Difficult to change/redeploy
- High deployment costs

- Small & flexible
- Similar speed as human
- Fast set-up
- Easy to use
- Safe alongside workers
- Low upfront costs and fast ROI

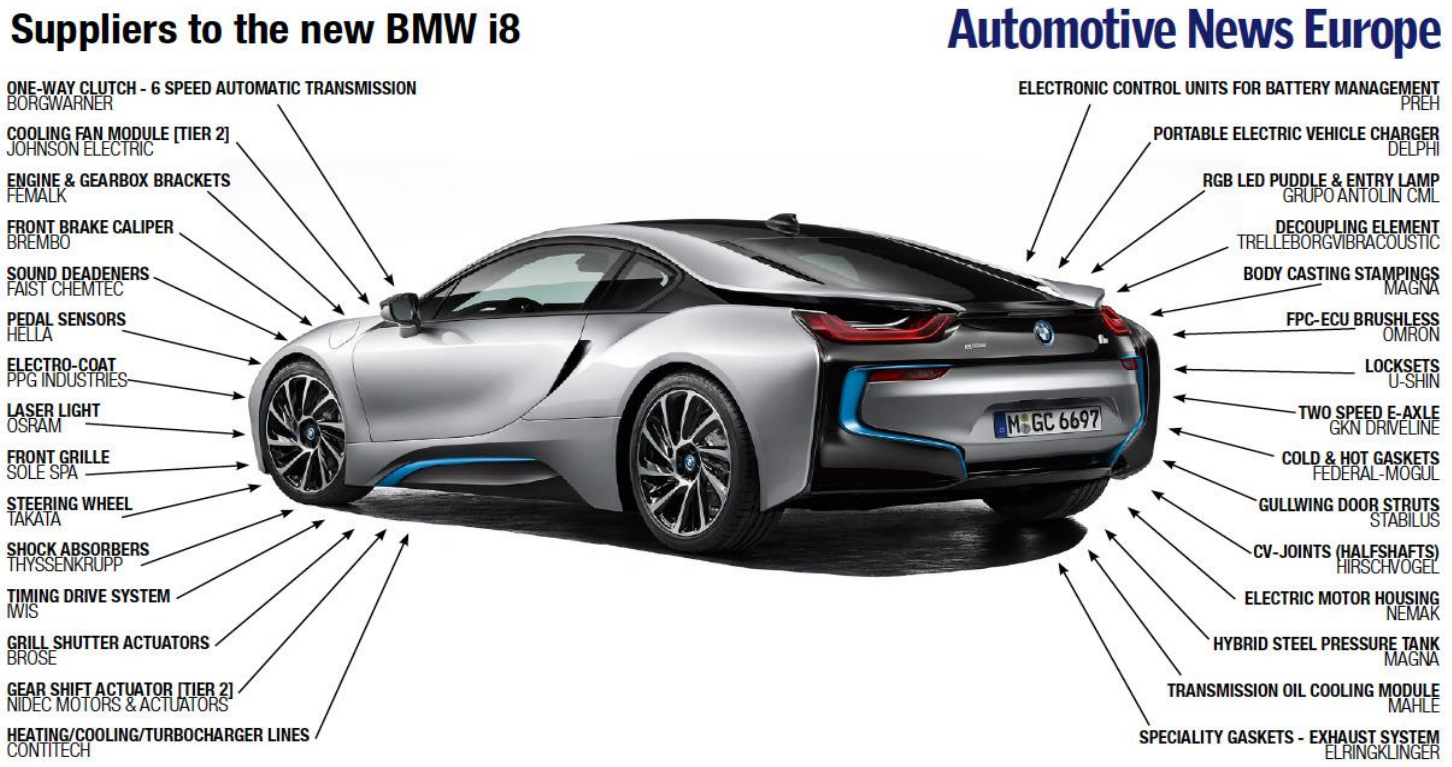
Source: Universal Robotics

Factory Operations

- Sensor-enabling equipment generates a comprehensive, real-time view of the status of machines, work cells, and systems.

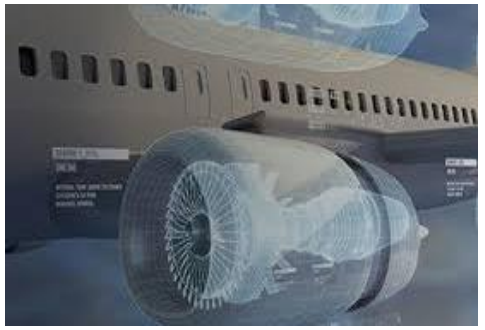
Supply Chain Management and Integration

- Real-time visibility and synchronization of every machine making every component across supply chains.



Digitally Enabled Product Use and Consumption

- Digitalization enables new business models such as product servitization, mass customization, low-cost variability, and evergreen design.
  - E.g., Rolls Royce's "Power by the Hour" model.
  - John Deere tractors with variable engine horsepower.



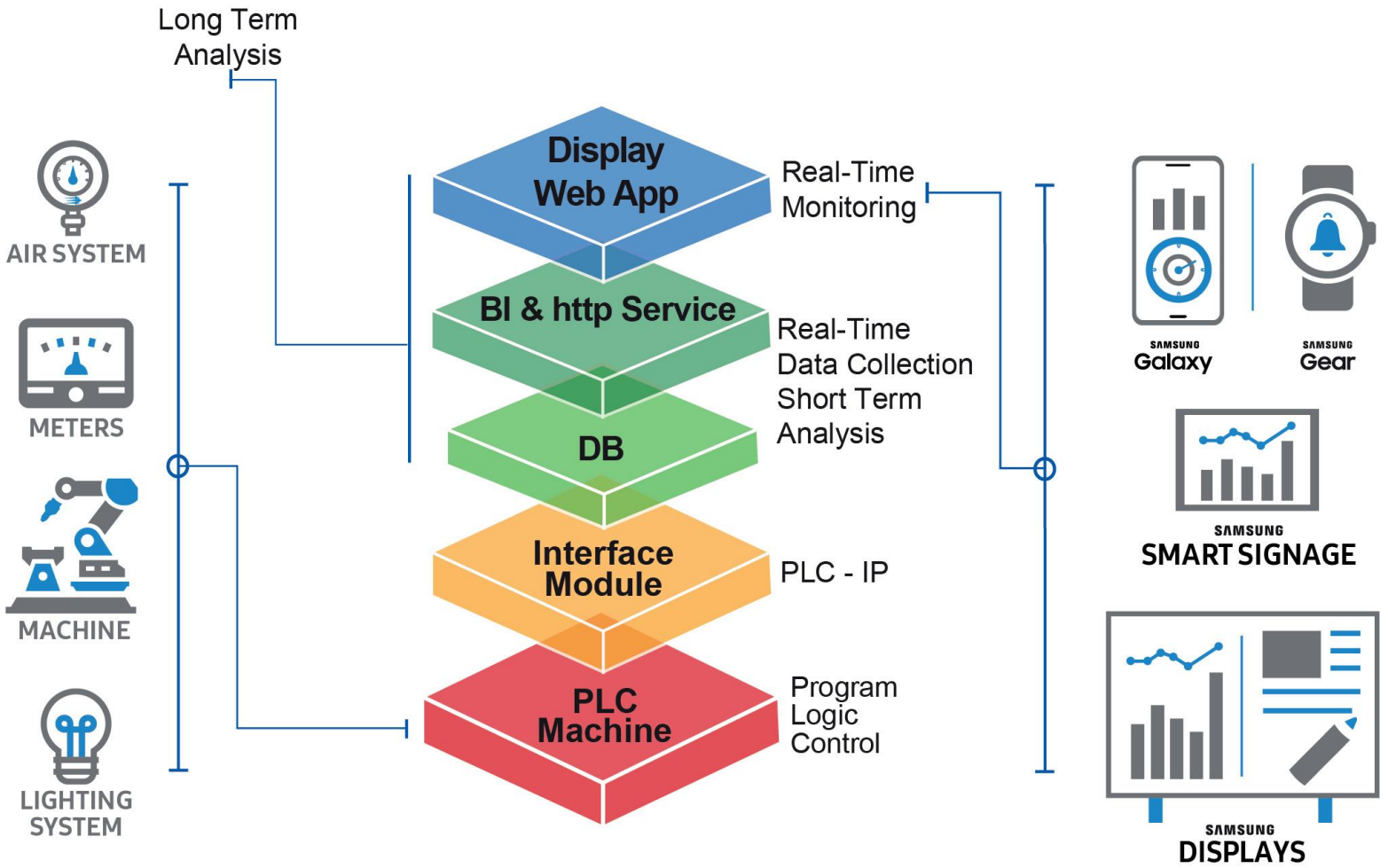
Source: Harvard Business Review, "How Smart, Connected Products Are Transforming Companies"

Rold

Roldsmartfab

Roldappliance **Rold**lighting **Rold**industrial

RoLD



Roldsmartfab

- **Digital Manufacturing Platform**
- **Monitoring**

  Machines | Sensors | Energy | Air
- **Real-Time Data and Alerts**
- **Data on touch-screen displays**
- **Mobile & wearable devices**

All the data and factory alerts in real-time and ready-to-use

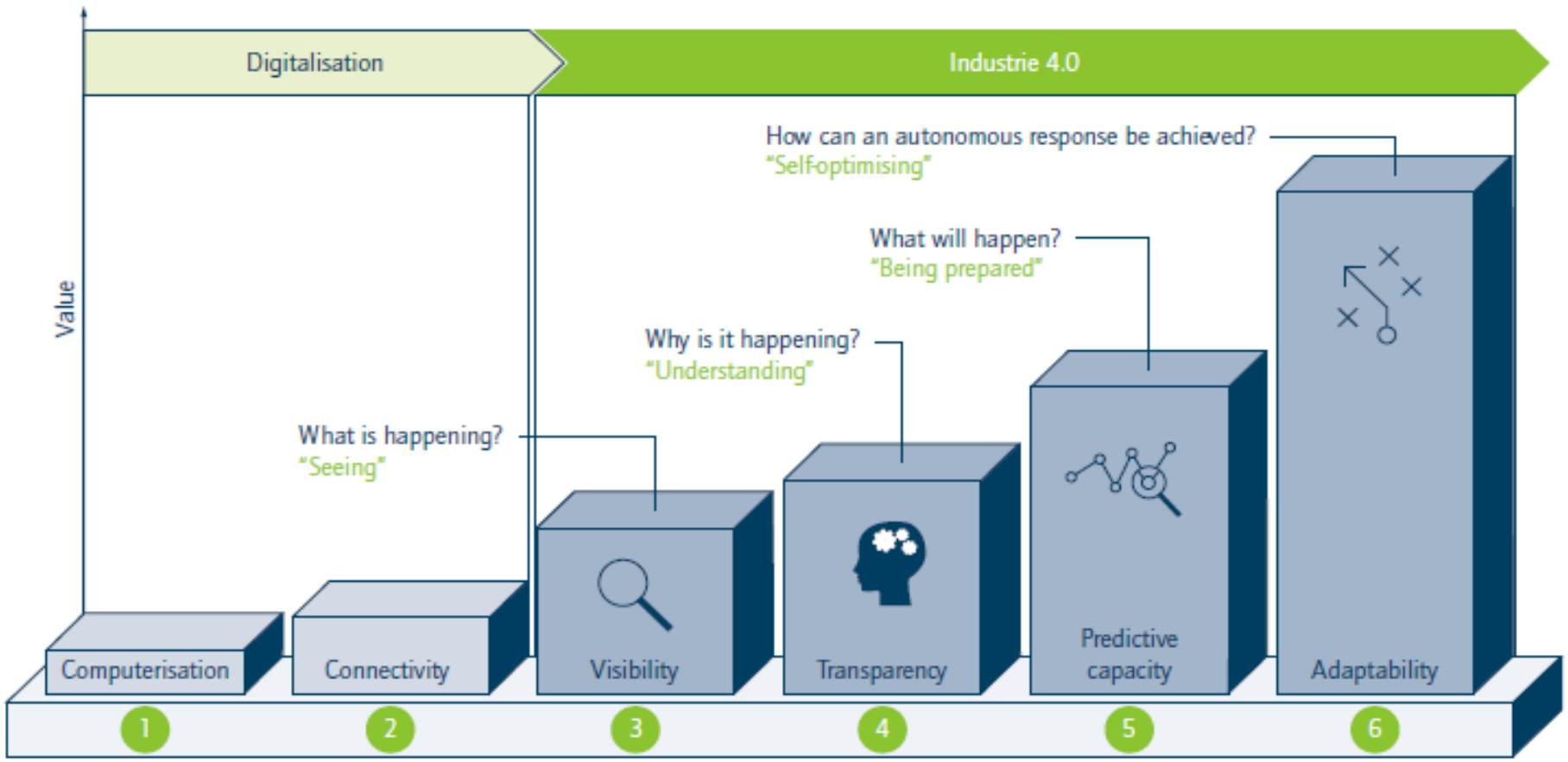
Real-Time Notification to the Operator

Timely Problem Solving

Instant Feedback to the Manager

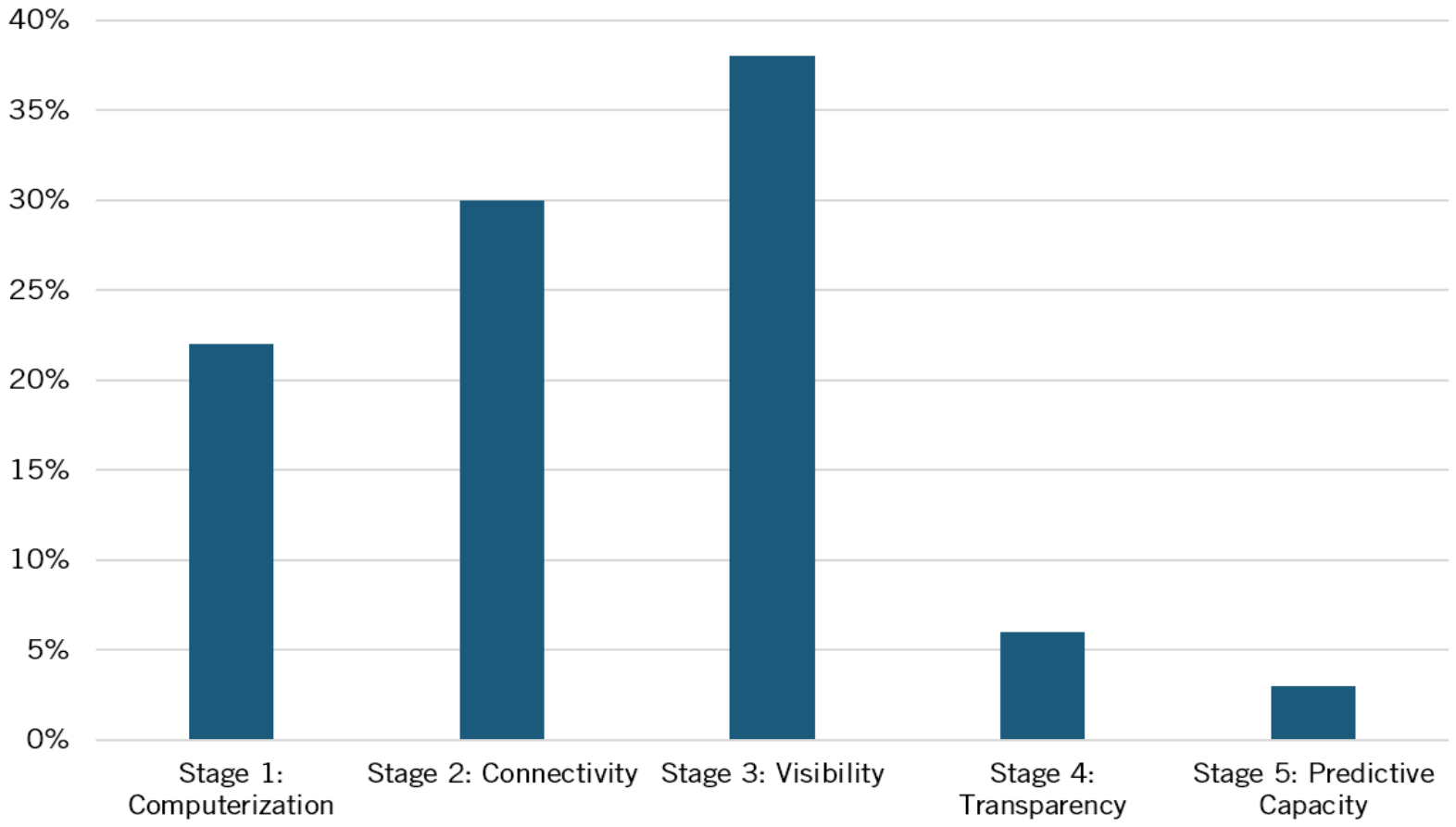
Roldappliance Roldlighting Roldindustrial ROLD

The Manufacturing Digitalization Maturity Journey



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

Most Manufacturers in Early Stages of Digitalization Journey



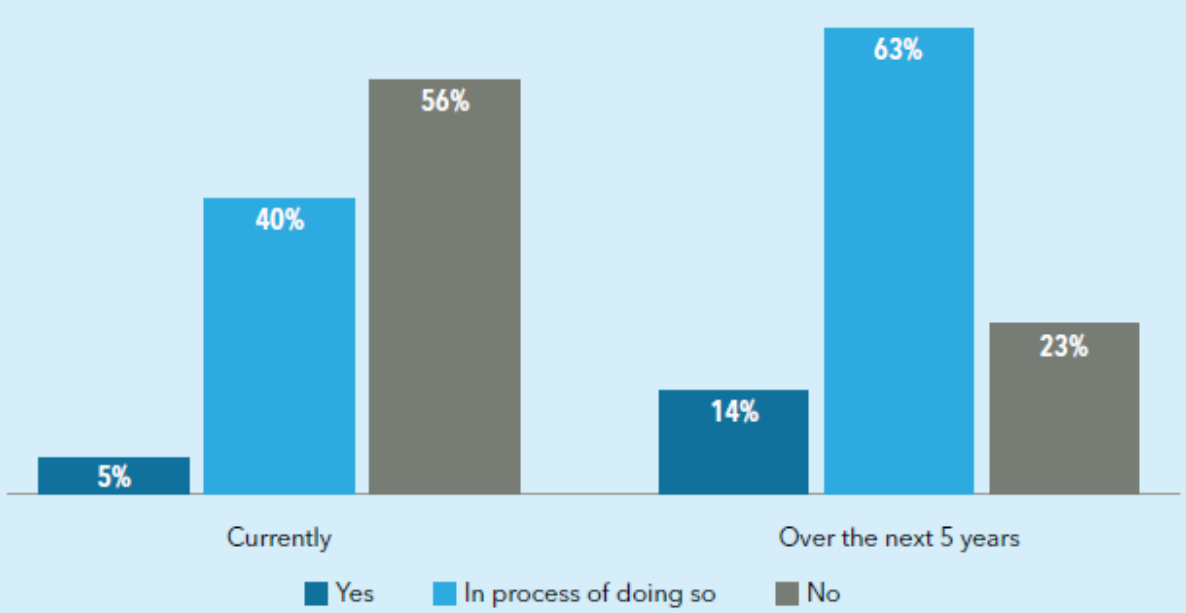
Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

AI Becoming Increasing Driver of Manufacturing Innovation

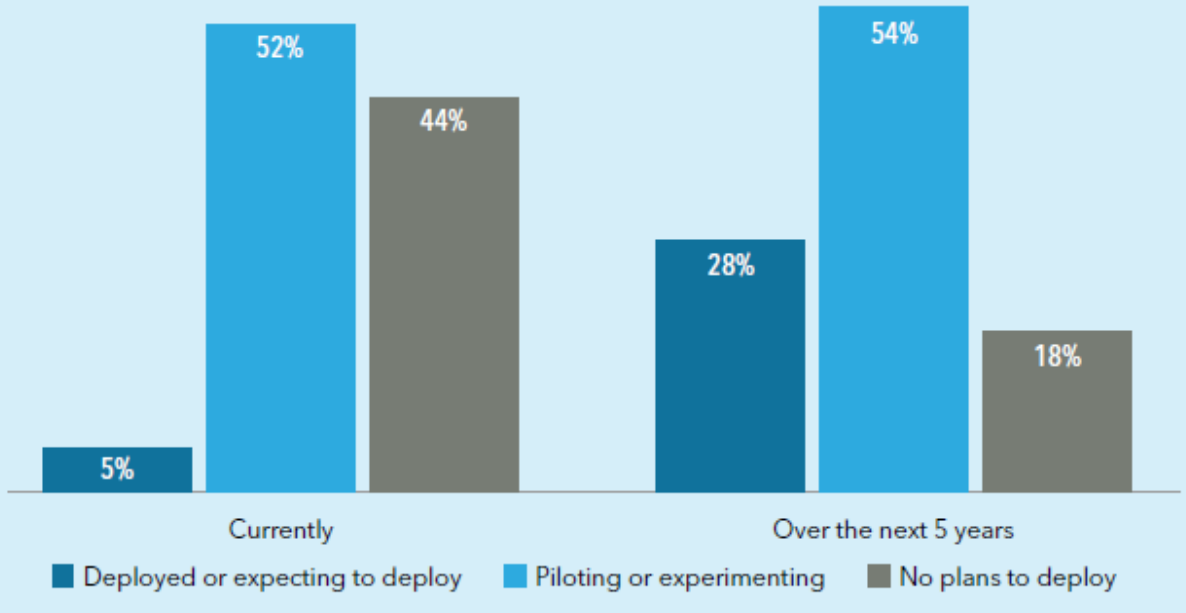
- Surveyed AI adoption/challenges among 70 $1-10B manufacturers.

AI Deployment Lagging But Expected to Surge Quickly

Expectations Rising for Mapping AI Opportunities and Data Requirements



AI Deployment Expected to Surge

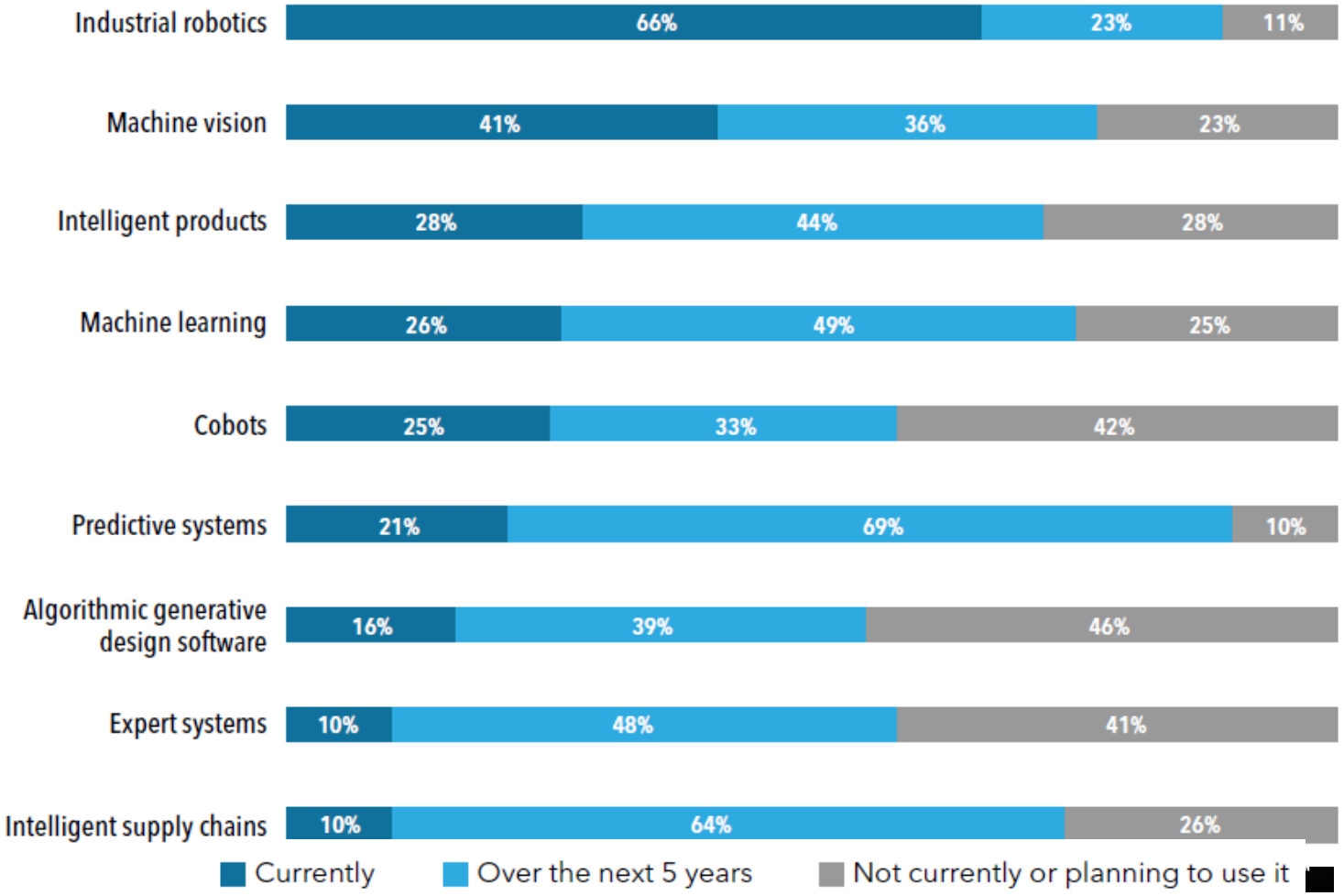


Source: ITIF/MAPI, "The Manufacturing Evolution: How AI Will Transform Manufacturing & The Workforce of the Future"

AI A Key Driver of Manufacturing Transformation

Most common apps in 5 years:

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



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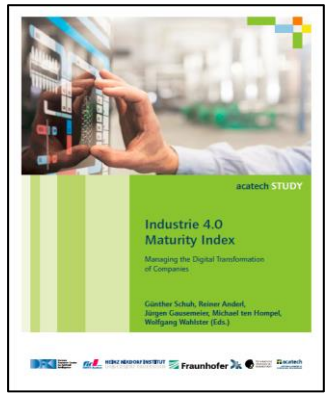
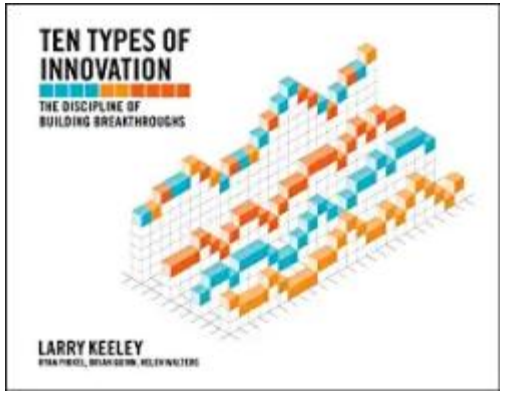
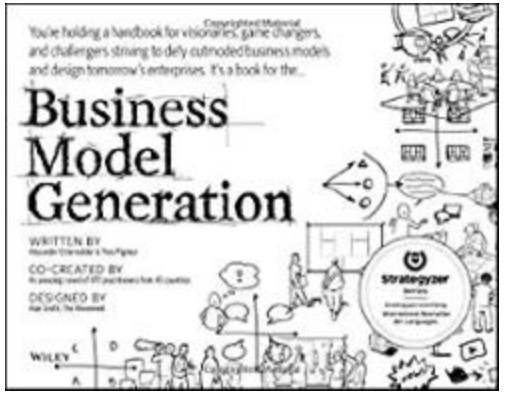
Recommendations for Manufacturers to Spur Digitalization

- Create a digital team tasked with leading manufacturing digitalization (e.g., an "AI Governing Coalition" for the enterprise).
- Join MxD – Tier 3 Memberships for SMEs are just $500.
- Leverage existing literature on mfg. digitalization/innovation methods.



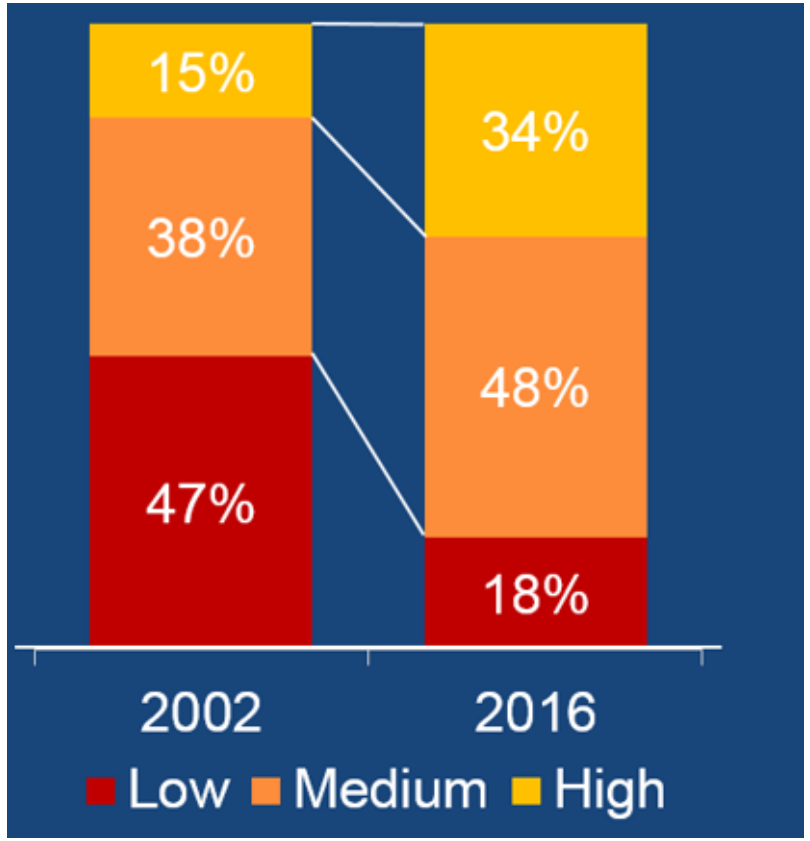




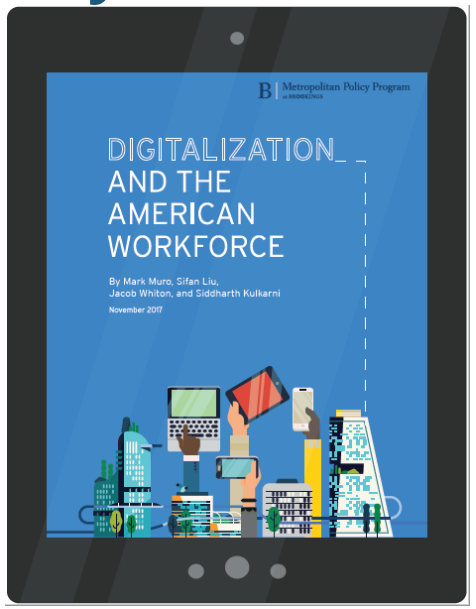
- Develop a digital workforce/skills transformation strategy.

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."

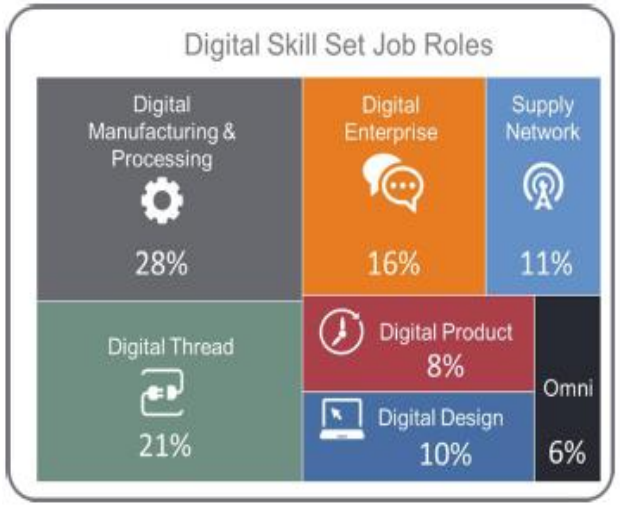


Source: Mark Muro, Sifan Liu, Jacob Whiton, and Siddharth Kulkarni, Brookings Metropolitan Policy Program, "Digitalization and the American Workforce"

Public/Private Initiatives Tackling Mfg. Skills Challenges

- 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. (Taxonomy 2.0 on cybersecurity coming.)
- For AI, the Microsoft AI Business School offers education for executives while a Professional Program offers certifications in data science and AI apps development.

TOOLINGU | sme



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

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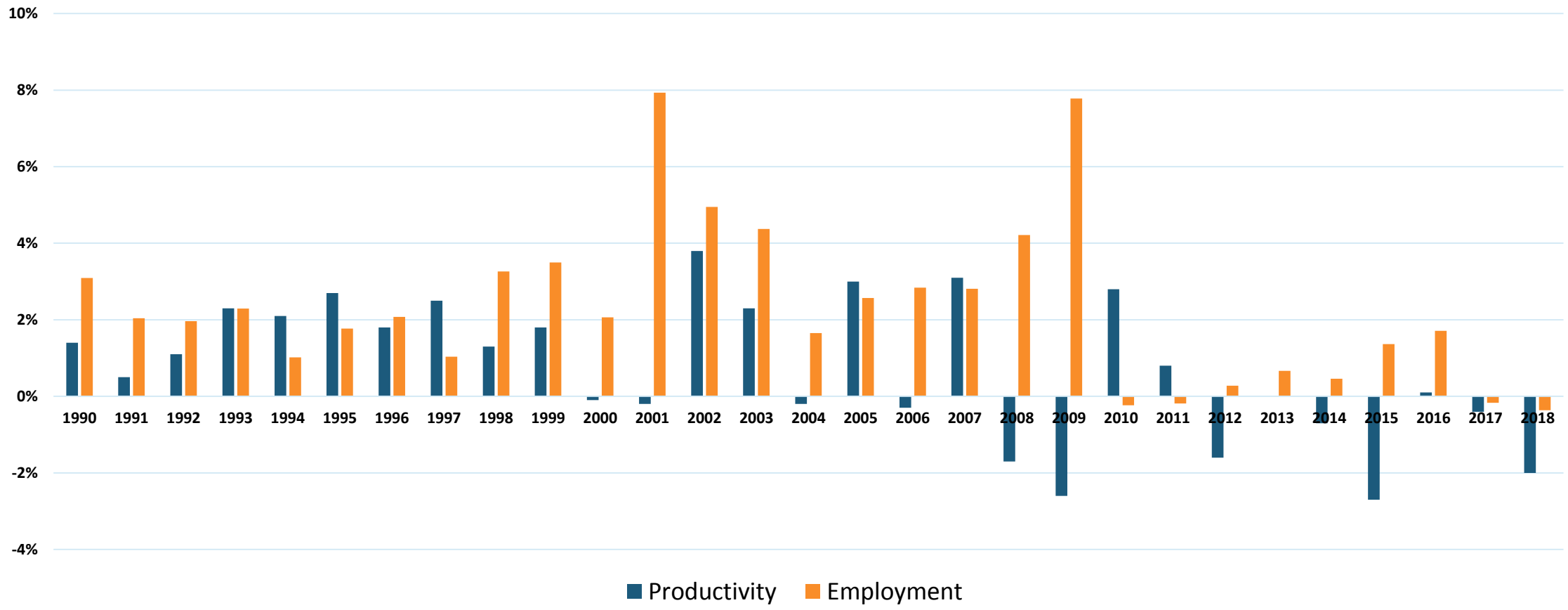
U.S. Manufacturing Productivity Faltering

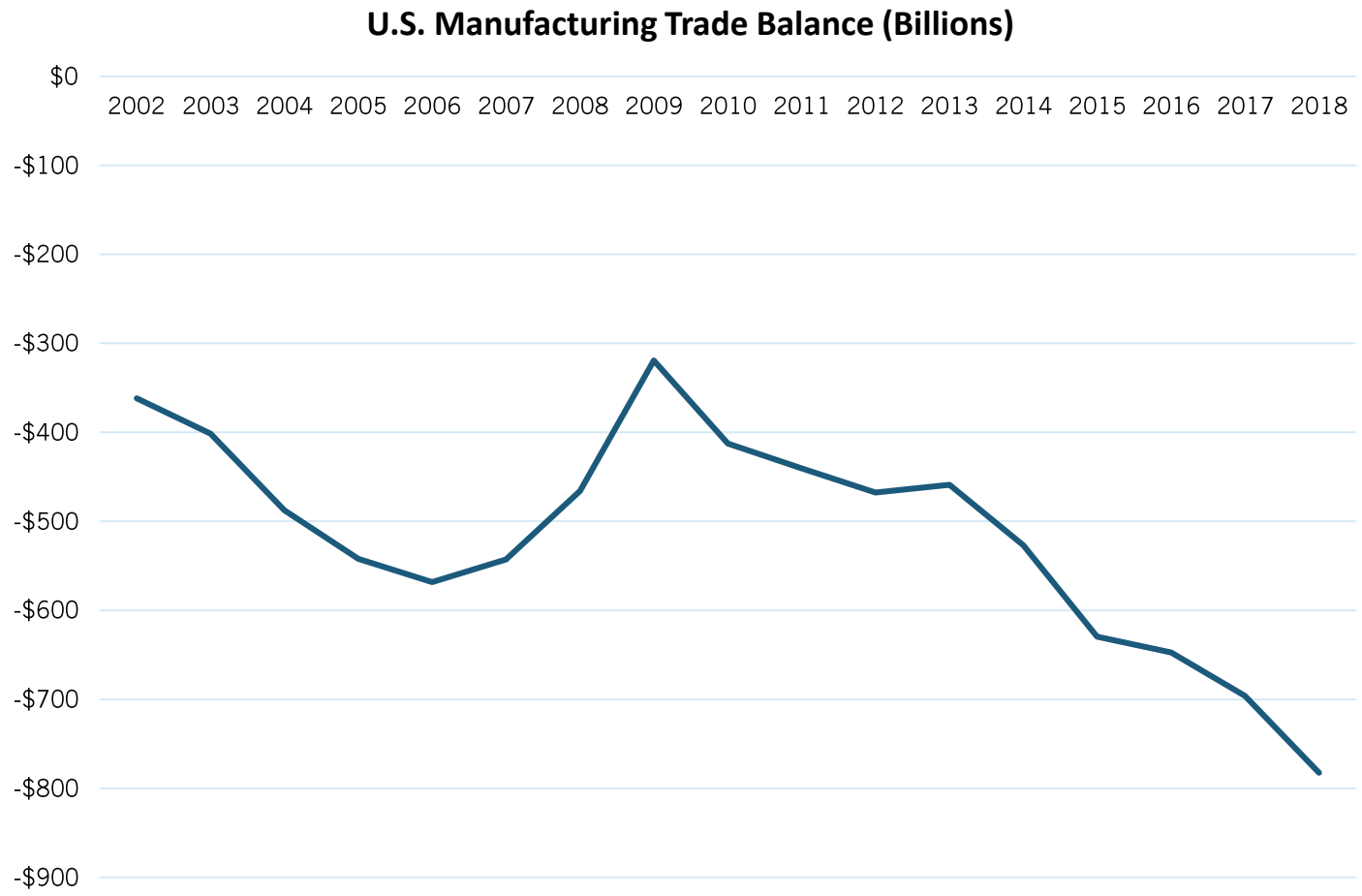
Source: U.S. Bureau of Labor Statistics

Productivity and Job Growth in the U.S. Economy (Employment Growth In Total Economy Relative to Manufacturing; Productivity Growth in Manufacturing Relative to Total Economy)



Source: Bureau of Labor Statistics, Major Sector Productivity, Costs, and Employment

U.S. Manufacturing Trade Balance Worsening



Source: U.S. Census Bureau, Exports & Imports by NAICS Commodities

Manufacturing Digitalization Becoming a Priority Worldwide

- Netherlands: Smart Industry
- Belgium: Made Different
- Portugal: Industria 4.0
- Denmark: M.A.D.E.
- Mexico: Industry 4.0 Roadmap
- Slovakia: Smart Industry
- Wallonia: Marshall 4.0

Courtesy: Dave Vasko, Rockwell Automation

Top 5 Things Countries' "Industry 4.0" Policies Are Doing

1. **Recognizing that effective public/private partnerships are critical if countries, or U.S. states, are to take advantage of the digital manufacturing revolution.**
2. Developing "Digital Manufacturing Maturity Indices" and providing "Self-Benchmarking Assessment Tools" for SMEs.
3. Inventorying and describing discrete, specific manufacturing digitalization use cases and processes. (E.g., Germany has documented over 300 specific use cases/sample instantiations of SME manufacturing digitalization).
4. Launching "pilot fabs" that demonstrate smart manufacturing techniques on active production lines. (Iowa/Austria/Germany/Japan/Korea)
5. Providing financial support ($ and tax credits) for manufacturing digitalization and helping industry address manufacturing workforce challenges.

State-Level Policy Ideas to Spur Manufacturing Digitalization

- ✓ Articulate a state-wide manufacturing digitalization strategy.
- ✓ Consider creating a 401(k) for manufacturers or implementing manufacturing innovation vouchers.
- ✓ Match investment SMEs make to become Tier 3 MxD members.
- ✓ Begin a state-wide roadshow going into the field to demonstrate how rural manufacturers could effectively deploy cobots/AI techs.
- ✓ Task Maryland community colleges with developing a comprehensive digital manufacturing curriculum through two-year degree programs.

Thank You!

Stephen Ezell | sezell@itif.org | 202.465.2984

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