How Digitalization Is Transforming Manufacturing

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About ITIF

- 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
Today’s Presentation

1. Manufacturing Digitalization and Why It Matters
2. How Businesses Can Spur Manufacturing Digitalization
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.

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.

“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

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

VS

• 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"
- 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
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

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

- Currently: 40% Yes, 56% In process of doing so, 5% No
- Over the next 5 years: 63% Yes, 23% In process of doing so, 14% No

AI Deployment Expected to Surge

- Currently: 5% Deployed or expecting to deploy, 28% Piloting or experimenting, 54% No plans to deploy
- Over the next 5 years: 52% Deployed or expecting to deploy, 44% Piloting or experimenting, 18% No plans to deploy

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

Source: MxD and Manpower Group, “The Digital Workforce Succession in Manufacturing”
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U.S. Manufacturing Productivity Faltering

U.S. Manufacturing Productivity Growth (Change from prior year)

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

U.S. Manufacturing Trade Balance (Billions)

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

Manufacturing USA
Industrie 4.0
Produktion 2030
Průmysl Industry 4.0
IPAR 4.0
Industrie 4.0
Made in China 2025
Made Smarter
Industria Conectada 4.0
Industrie du Futur
Piano Industria 4.0
Make in India
ABII - Associação Brasileira de Internet Industrial
Prime Minister’s Industry 4.0 Taskforce
Industrial Value Chain Initiative (IVI) in China 2025

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!

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