Smart Manufacturing: A National Imperative

Requiring Local Mobilization and Engagement
Jeannine Kunz
Chief Workforce Development Officer
SME

- 23 years in workforce development and training
- Lead the Tooling U-SME and WFD efforts at SME
- Co-Chair of the National Smart Manufacturing Executive Council with CESMII
- Appointed Committee Member – National Academies
  - Options for a National Smart Manufacturing Plan
- Advisory Board Member - THINKER graduate program at Clemson University
- Board Member – Coalition for Career Development
- Chair of NDIA's Manufacturing Division's Workforce Committee
- Education & Workforce Advisory Committee Member of ARM
Our Purpose
Advance manufacturing to drive competitiveness, resiliency, and national security

Our Vision
Manufacturing is a diverse, thriving, and valued ecosystem

Our Mission
Accelerate widespread adoption of manufacturing technologies and build North America's talent and capabilities

SME is a nonprofit organization that supports manufacturing based on our core belief: Manufacturing is key to economic growth and prosperity.
Today

1. What is SMART Manufacturing?
2. Why SMART Manufacturing?
3. State of Adopting SMART Manufacturing
4. National Efforts - Smart Manufacturing
5. Impact on Roles
What is SMART Manufacturing?

It is all in the name
Manufacturing USA is a national network of 16 manufacturing innovation institutes created to secure U.S. global leadership in advanced manufacturing through large-scale public-private collaboration on technology, supply chain, and education and workforce development. The institutes, sponsored by the U.S. Departments of Defense, Energy and Commerce, partner with six additional federal agencies.
Smart Manufacturing – Elevator Definition

- Right Information
  At the
- Right Time
  With the
- Right Form
  In the
- Right Place
  At the
- Right Technology
  For the
- Right People
  To enable
- Smart Decisions
  (or machines)

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Industrial Revolutions
The Smart Manufacturing Revolution

INDUSTRY 1.0
Mechanization, steam power, weaving loom

INDUSTRY 2.0
Mass production, assembly line, electrical energy

INDUSTRY 3.0
Automation, computers and electronics

INDUSTRY 4.0
Cyber Physical Systems, internet of things, networks

End of the 18th Century
Start of the 20th Century
Late 20th Century
Today
EXHIBIT 2 | Industry 4.0 Is Changing Traditional Manufacturing Relationships

From isolated, optimized cells...

Integrated communication along the entire value chain reduces work-in-progress inventory

Greater automation will displace some of the least-skilled labor but will require higher-skilled labor for monitoring and managing the factory of the future

...to fully integrated data and product flows across borders

Machine-to-machine and machine-to-human interaction enables customization and small batches

Source: BCG.
SMART Transformational Technologies

- Industrial Internet of Things (IIoT)
- Big Data
- Cloud Computing
- Cybersecurity
- Automation
- Robotics
- Artificial Intelligence and Machine Learning
- Simulation & Visualization
  - Digital Twin
  - AR/VR
Why SMART Manufacturing?
Value of Manufacturing Digitization

Why SMART Manufacturing?

Societal Benefits
• National security
• Supply chain resiliency
• Sustainability
• Decarbonization

Business Drivers
• Customer satisfaction
• Energy efficiency
• Productivity
• Data integrity
• Time to market
• Supply chain
• Workforce and resource optimization
• Responsive, decentralized decisions
National Imperative

• Pandemic showed us the power of supply chain, connectivity, data

• Manufacturing productivity as a nation declined for first time in 50 years

• Other parts of the world are surpassing
Not without Risks

- This new digital thread ecosystems create opportunities to increase U.S. global competitiveness and enhance supply chain network resilience.

- With this exponential increase in connectivity, there is an exponential increase in exploitable weaknesses, leaving manufacturers vulnerable to massive consequences if their operational technology boundary detection systems fail.
State of Adoption – SMART Manufacturing
Manufacturers Lacking a Plan for SMART

- Respondents fall into the 1/3 rule for their company’s smart manufacturing strategy, where 1/3 have no formal strategy, another 1/3 are preparing their strategy and the final 1/3 are implementing/testing a strategy.

- 31% have no formal strategy
- 32% preparing a strategy
- 36% implementing/testing a strategy

Q5. How far along is your company in terms of adopting a smart manufacturing strategy?

Source: 2022 Research Study, CESMII and SME
Lack of Talent #1 Challenge to SMART Manufacturing

Top Challenges:
- Need for Skilled Talent
- Cost and Complexity to Implement and Integrate
- Lack of connection between technology and business strategy

Source: 2022 Research Study, CESMII and SME
Current Challenges and Barriers

• We can’t get the data out contextually & at the right resolution
• We don’t know how to use the data to build a model
• We can’t operationalize the insights
• We can’t staff the implementation of the solution

(From Large National Employer)
National Efforts and Programs for SMART Manufacturing
Champion Smart Manufacturing First Principles and Thought Leadership Topics

Educate the Current and Future Workforce

Accelerate and Amplify the Adoption of Smart Manufacturing
Our Charter: The Smart Manufacturing Executive Council was formed to engage business and technology executives, thought leaders and visionaries advocating for the transformation of the U.S. manufacturing ecosystem.

Our Objective: To develop practical guidance and policy recommendations that will help this ecosystem across this digital divide.
• Leverage admired Manufacturing Businesses, demonstrating their leadership on this journey, and showing others the way

• Inspire this ecosystem to evolve their strategies and business models to truly support the democratization of manufacturing technologies and ensure that SMMs can engage in Smart Manufacturing as well

• Provide guidance for each of the 8 stakeholder groups in our manufacturing ecosystem, helping them understand their role in this evolution, and invest in the knowledge and skills required for this transformation

• Inform US policy makers on the transformative actions and policies that will accelerate US adoption of Smart Manufacturing
A National ‘Think Tank’ of Smart Manufacturing Leaders, Advocating for the Transformation of the Ecosystem
What are the Guiding Principles – the behaviors & strategies – for each SM stakeholder group that the SMEC would establish as essential for Smart Manufacturing success?
Developing a Smart Manufacturing Mindset...

The Smart Manufacturing Playbook

The basis for building a sustainable culture of digitally enabled operational and organizational excellence...

- Corporate Manufacturing & Supply Chain Leadership
- Plant Leadership Team
- Strategy Consultants
- Technology Providers

- System Integrators
- Machine Builders
- Learning & Training Ecosystem
- Operator
Options for National SMART Manufacturing Plan

Statement of Task: A National Academies of Sciences, Engineering, and Medicine-appointed ad hoc committee will develop options for a national plan for smart manufacturing technology development and deployment.

- Congressional request, Dept of Energy sponsored
- Committee to develop report and recommendations to:
  - inform legislation, policy, funding
  - improve the productivity and energy efficiency of the manufacturing sector
  - ensure U.S. competitiveness
- Last nine months - workshops, input sessions and report writing
- Release late 2023
Options for National SMART Manufacturing Plan

Recommendations to Congress and broader ecosystem address:

1. state of the art smart manufacturing and future directions and needs;

2. potential broader impacts of smart manufacturing; and

3. education, training, and workforce needs for smart manufacturing.

Input was gathered from representatives of the manufacturing institutes, developers of past cross-agency national plans, and experts from smart manufacturing research communities in academia, industry, nonprofits and government.
National Academy Study Committee

- **Thomas Kurfess** (*Chair*), Georgia Institute of Technology
- **Billy Bardin**, Global Digitalization Director, Dow Inc.
- **Richard Braatz**, Massachusetts Institute of Technology
- **Jian Cao**, Northwestern University.
- **Krystel Castillo-Villar**, Energy VP, CYMAII
- **Lili Cheng**, Cooperate Vice President, Microsoft
- **Jim Davis**, Vice Provost IT, UCLA
- **Robert Gao**, Case Western Reserve University
- **SK Gupta**, University of Southern California
- **Susan Houseman**, Upjohn Institute for Employment Research
- **Jeannine Kunz**, SME
- **Stuart Lawrence, III**, CEO and President of Titan Robotics
- **Blake Moret**, Chairman and CEO of Rockwell Automation
- **Chinedum Okwudire**, University of Michigan
- **Melissa Orme**, Vice President, The Boeing Company
- **William Spriggs**, Howard University
- **John Sutherland**, Purdue University
- **Karen Thole**, Penn State University
Impact on Jobs and Educators
TECHNOLOGY ADOPTION

WORKFORCE COMPETENCY

Competitive Manufacturing Industry

Economic Prosperity National Security Supply Chain Resiliency
Confluence of People and Technology

Disruption of How we Work
Reskilling needs

40%

of current workers’ core skills are expected to change in the next 5 years.

Digital Skills
Impacting All Jobs

• Being tech-and data-literate will be an integral part of the job description for everyone
• 78% of middle skilled jobs required digital skills
• Digitally intensive jobs are growing twice as fast in middle skilled jobs than those not digitally intensive.
• OT meets IT….Electrical meets Mechanical
• AI, ML, Data Analytics, Robots, Automation, Cyber, Cloud Computing have all seen dramatic demand increases in the last 5 years
  • It is not just manufacturing – expands into healthcare, finance, etc.
• 72% of executives reporting that they have or can source the AI talent they need.
Jobs are **paying premium** for Smart Manufacturing skills

- **> 25,000** Job Postings
- **6.4%** Projected Growth in Employment
- **$77,000** Median Salary
- **46 days** Days to fill

**Manufacturing / Process Engineer**

**Necessary Skills**
- Data Analysis, Statistics, Business Intelligence
- Lean Manufacturing
- Complex Problem Solving

+ **Smart Manufacturing Skills**
  + $10,000
  
  Skills include:
  - Smart Manufacturing Concepts
  - Automation, IIoT, Big Data, Cybersecurity
  - IT-OT Integration, Information Models
  - Optimization, Simulation

+ **Advanced Smart Manufacturing Skills**
  ++ $10,000
  
  Skills include:
  - AI, Machine Learning
  - Programming in Python, C#
  - Edge, Cloud Computing
  - Connected Augmented Worker

Data Source: Labor Insights, Burning Glass, 2021 June
The Critical Role of Higher Education

“Education is the most powerful weapon which you can use to change the world.”

Nelson Mandela
Take Aways

1. Keep an eye on the national program outputs

2. Opportunity to lead

3. Roles and lines not as clear
   • Multi-disciplinary (mechanical/electrical, OT/IT)

4. Stay close to industry for insights

5. Participate in grants or consortiums

6. Leverage opportunity to diversify enrollment and marketing – data, AI, analytics
Thank you

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