



NSF/NIST Sponsored Symposium

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# Strategy for Resilient Manufacturing Ecosystems through Artificial Intelligence

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# 2020-2022 Workshops

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## Workshop 1

**Aligning AI and U.S. Advanced Manufacturing Competitiveness**  
December 2020

## Workshop 2

**R&D Strategies to Scale the Adoption of AI  
for Manufacturing Competitiveness**  
June-July 2021

## Workshop 3

**National Priorities for Adoption of AI in Advanced Manufacturing**  
February 2022

# Bringing AI and Manufacturing Together

**Industry: 26**

Boeing, Cargill, Corning, Dow, GE Aviation, GE Power, GM, GMI  
JPL, Lockheed, Merck, Mazak, MSC, Procter & Gamble, Raytheon

**AI Providers: 17**

Amazon Robotics, Autodesk, C3.ai, Google Cloud, IBM, Intel,  
Microsoft, PTC, Rockwell, Siemens, Ready Robotics

**Government: 22**

DoA, DoD, DoE, FDA, NIOSH, NSF, NIST, NITRD, ONR, USDA,  
White House

**Academia: 16**

CMU, Clemson, FIT, Georgia Tech, MIT, MSU, NCSU, PSU, Dartmouth,  
UCLA, UM, UNC Charlotte, USC, Malaysia Inst. Supply Chain

**Manufacturing Institutes/  
National Labs: 8**

CESMII, LIFT, MxD, NIMBL, MTDG, ORNL

**MEP: 1**

California Manufacturing Technology Consulting

**Manufacturing  
Associations/Consultants : 4**

Advanced Manufacturing International, AMT, Kearney,  
Manufacturing Leadership Council

# Important Definitions

**Artificial Intelligence (AI)** in manufacturing refers to software systems that can recognize, simulate, predict, and optimize situations, operating conditions, and material properties for **human and machine** action.

**Machine Learning** (generally seen as a subset of AI) refers to algorithms that use prior data to accurately identify current state and predict future state, with the goal of improving productivity, precision, and performance.

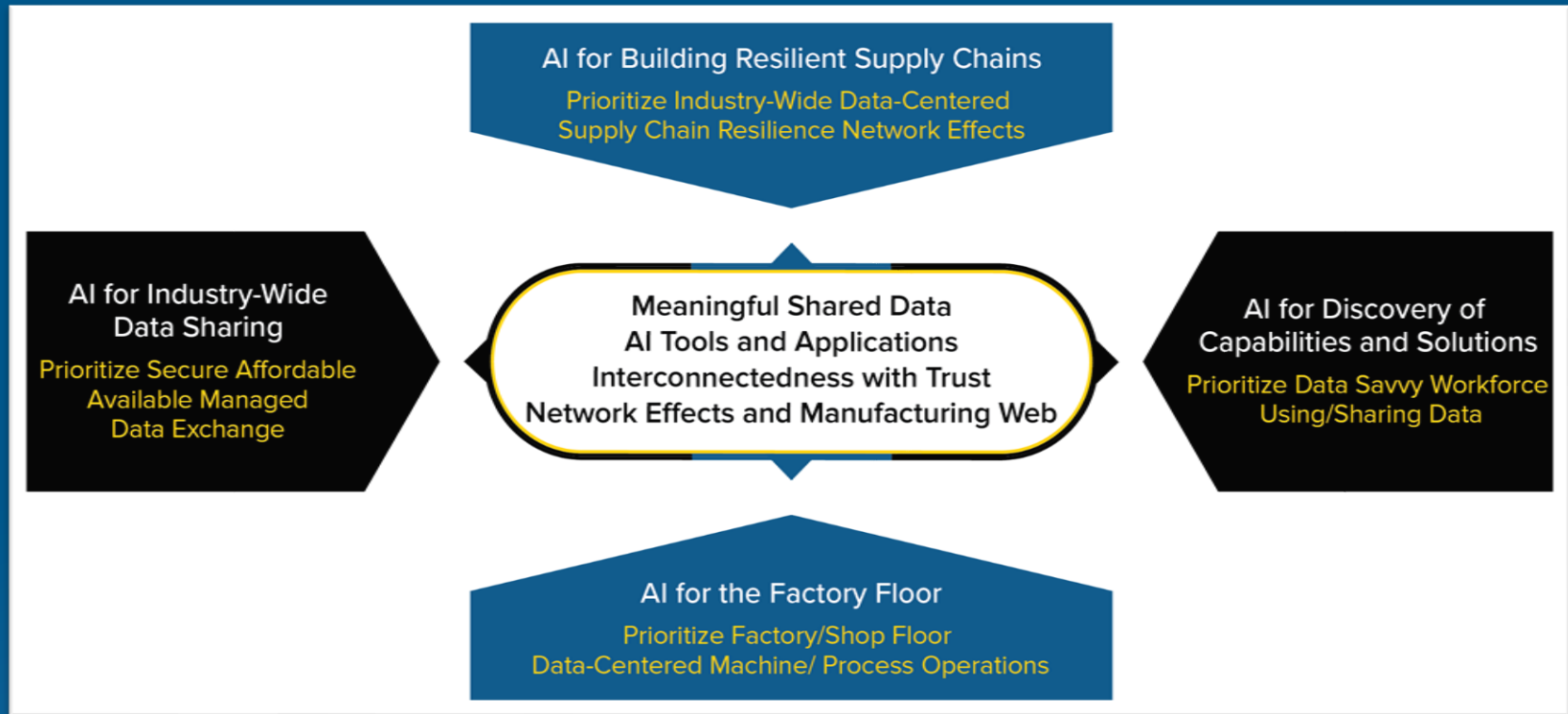
**Scale** means readily accessible, easy to use, and cost effective for manufacturers of all sizes.

**Models** are digital, software representations (quantitative, qualitative, pattern, causal, inference, etc.) of real-world events, systems, or behavior, which can use data to simulate or predict future results.

**Standard Data Format** refers to the organization of information (protocol) according to agreements on preset specifications that describe how data should be stored or shared for consistent collection and processing across different systems and users.

**Tools** refer to software platforms that support the availability of **data, knowhow, and models** for use in **business and operations**.

# Workshop 1: Industry-Wide Strategies for the Adoption of AI in Manufacturing





# Workshop 2: Path to a Networked/ Interconnected Manufacturing Industry

Digitalization and Predictive Modeling

AI Monetization Layers

Layer 1  
Asset  
Management

Layer 2  
Interoperability

Layer 3  
Supply Chain  
Resilience

Concurrent Activities & Integrated Implementation

Goal 1  
Digitalize SMMs  
Skills &  
Capabilities

Goal 2  
Apply AI Methods in  
Large Company  
Supply Chains

Goal 3  
Enable New  
Business Models

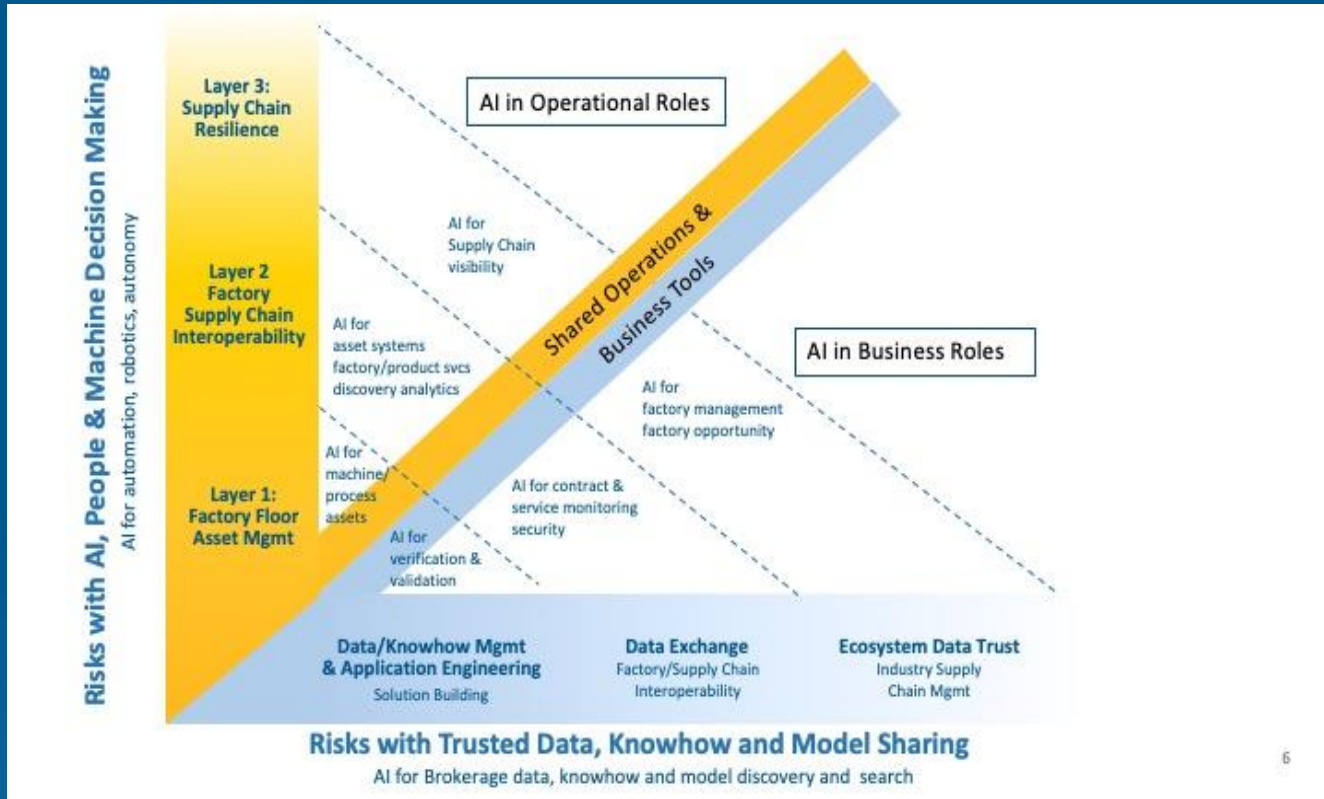
Scaled AI Adoption

Industry Data, Knowhow and Model Sharing

Industry Connectedness and Network Effects



# Workshop 2: Relationship of Risks



# Workshop 3: Roadmap for Manufacturing Program Strategies and AI Adoption

**Goal 1:**  
Enable Digital Capabilities at Small and Medium-Sized Manufacturers (SMMs)

*Overcome lack of resources, infrastructure, data, expertise, and administrative capacity*

*Enable SMMs to share data and knowhow for AI applications*

*Provide SMMs with tools to easily adopt AI solutions*

**Goal 2:**  
Incentivize AI Adoption Throughout Established Supply Chains

*Develop partnerships to define data, applications, and tools for supplier network interoperation*

*Enable companies to conduct demonstrations that define the value of scaled AI projects*

*Establish partnerships to converge on common AI applications and associated software tools and infrastructure*

**Goal 3:**  
Enable New Business Models for AI Adoption

*Develop scalable data sharing, applications, software tools, and educational tools to enable benefits of collaboration*

*Develop AI data sharing and software tools to enhance supply chain discovery and ecosystem resiliency*

*Adapt AI business models to manufacturing*

*Address Industry Constraints*

*Identify New Sources of Revenue*

*Scale Success*

Time



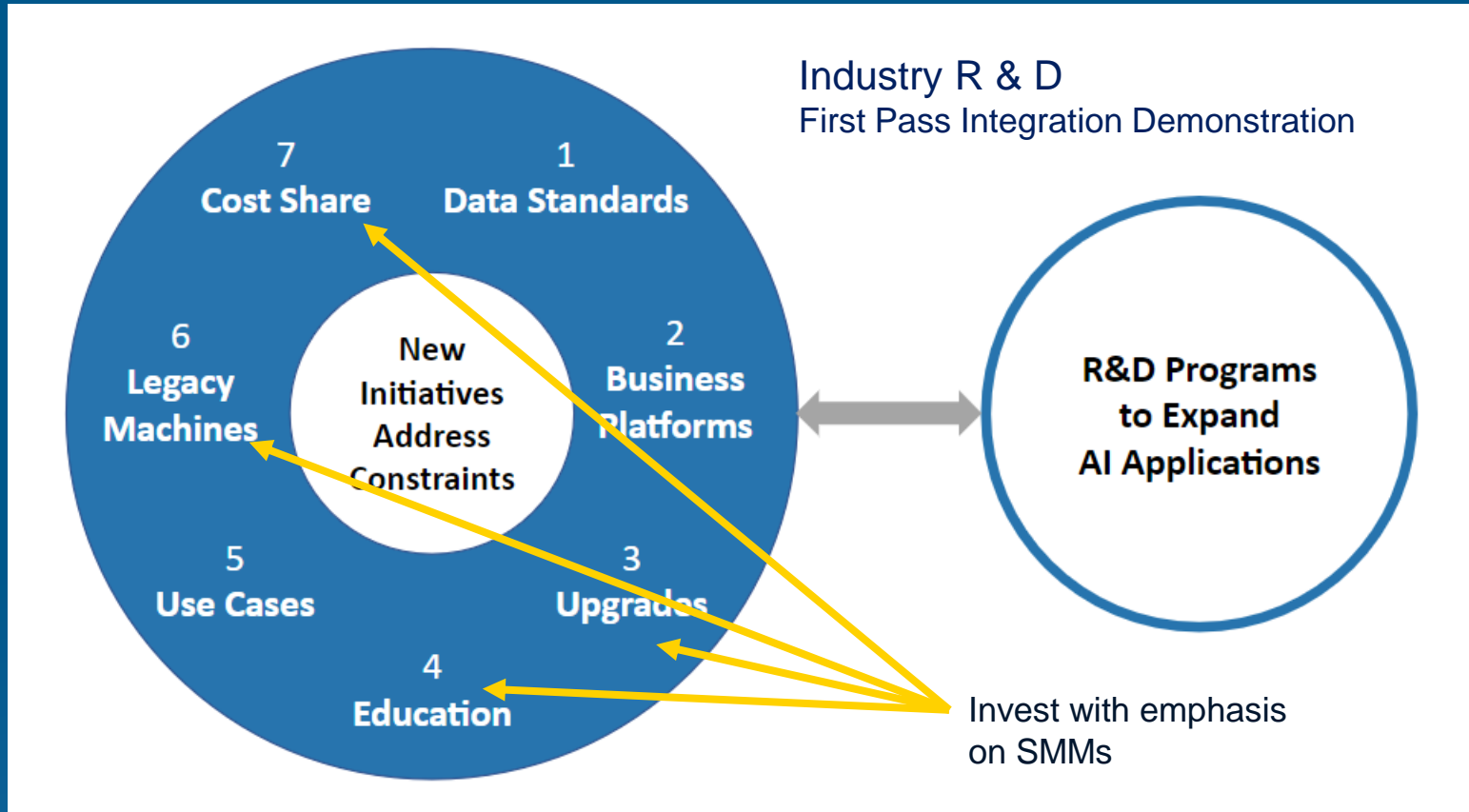
## Workshop 3: R&D Areas

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1. AI methods, tools and data aggregation for manufacturing's time centered data types
2. Data to automate algorithm building and continuous tuning
3. Going beyond incremental change
4. Scaling data and operation interoperability

*Technologies required for robust, scaled, unbiased access, and trustworthy AI in manufacturing are largely at a nascent stage and require continued R&D investment*

# Workshop 3: Interrelated Structural Constraints Inhibiting AI Adoption



## Recommendations for Roadmap Execution

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- Explore opportunities to expand existing and/or establish new PPPs
- Focus initial implementations (s) on currently available technologies and tools
- Initiate research on highest priority manufacturing-relevant machine learning methods
- Precede the Roadmap execution with a program that demonstrates industry collaboration on an integrated set of “first pass” actions on the seven constraints
- Guided by industry use cases, expand into the execution of the Roadmap with phased development and demonstration of advanced software tools, models, and infrastructure for scaling



# Thank You & Written Comments

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**Please send your written comments  
to the organizing committee:**

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