Annual Member Meeting 2020

A New Decade.
A New Outlook on Manufacturing.

Conrad Leiva
CESMII Anti-Trust Statement

As participants in this meeting, we need to be mindful of the constraints of antitrust laws. There shall be no discussions of, agreements or concerted actions that may restrain competition. This prohibition includes the exchange of information concerning individual prices, or any other competitive aspect of an individual company’s operation. Each participant is obligated to speak up immediately for the purpose of preventing any discussion falling outside these bounds.
"In the times of rapid change, learners inherit the Earth, while the learned find themselves beautifully equipped to deal with a world that no longer exists."

- Eric Hoffer

*Image Source: washingtonrebel.typepad.com, online*
AGENDA

Ecosystem and Workforce Development

STRATEGY
EXECUTION TO-DATE
ROADMAP
ENGAGEMENT

Conrad Leiva
Director Ecosystem and Workforce Development

Accelerating manufacturing innovation through a knowledge-building ecosystem
From surviving to thriving: Reimagining the post-COVID-19 return

**Purpose-driven customer playbook.** Companies need to understand what customers will value, post-COVID-19, and develop new use cases and tailored experiences based on those insights.

**Acceleration of digital, tech, and analytics.** It’s already a cliché: the COVID-19 crisis has accelerated the shift to digital. But the best companies are going further, by enhancing and expanding their digital channels. They’re successfully using advanced analytics to combine new sources of data, such as satellite imaging, with their own insights to make better and faster decisions and strengthen their links to customers.

**Human at the core.** Companies will need to rethink their operating model based on how their people work best. Sixty percent of businesses surveyed by McKinsey in early April said that their new remote sales models were proving as much (29 percent) or more effective (31 percent) than traditional channels.

**Ecosystems and adaptability.** Given crisis related disruptions in supply chains and channels, adaptability is essential. That will mean changing the ecosystem and considering nontraditional collaborations with partners up and down the supply chain.

May 2020
Industry 4.0
USD 3.7 trillion
value creation potential in 2025

While Industry 4.0 is a strategic priority, value capture at scale is lagging behind

How much of a priority is Industry 4.0 on your company’s strategic agenda?°

Status of Industry 4.0 solutions°

<table>
<thead>
<tr>
<th>Percent</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Top priority</td>
<td>68%</td>
</tr>
<tr>
<td>Average</td>
<td>22%</td>
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<tr>
<td>Low priority</td>
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Deploying at scale | 29%
Still piloting     | 41%
Not piloted        | 30%

To unleash the power of Industry 4.0, key roadblocks need to be overcome

Top 5 roadblocks preventing the move from pilot to rollout°

<table>
<thead>
<tr>
<th>Percentage of respondents choosing the reason as 1 of their top 3</th>
<th>Underlying questions</th>
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<tbody>
<tr>
<td>Lack of resources/knowledge to scale</td>
<td>How should we scale?</td>
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<tr>
<td>High cost of scaling</td>
<td></td>
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<tr>
<td>Pilots demonstrate unclear business value</td>
<td>Where should we focus?</td>
</tr>
<tr>
<td>Too many use cases to prove</td>
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</tbody>
</table>

However, we lack knowledgeable resources
Skills in existing workforce are not keeping up…
We need an SM Workforce that bridges across disciplines and cultures

- SM Savvy Business Leader
- Citizen Technologist
- Innovation Integrator
- SM Data Scientist
- SM Predictive Analysis Modeler
- Enterprise SM Architect
- SM Profile Developer
- SM Professional
- Augmented Worker
SM Curriculum Opportunities

**High variability** in SM definition and education programs

**Gaps in skills taught** in current curriculum

Lack of **upskilling capability** for existing workforce

Curriculum **lags the needs** of industry

Computer/data science and manufacturing skills **taught in separate silos**

Need more **hands-on labs** for educators

Not enough **on-the-job learning** to get experience on resume wanted by manufacturers

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**Example of variability in data science skills taught at different institutions**

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Excerpt Source: BHEF Business Higher Education Forum presentation, 2019
Ecosystem and Workforce Development

STRATEGY
Democratizing Smart Manufacturing

Via strategies that enhance the business models for each of the stakeholders in this ecosystem

1. Enabling SM Technology Platform and Marketplace
2. SM Innovation Ecosystem for vendor-neutral agile innovation collaboration
3. National SM Learning Infrastructure for the entire SM ecosystem
4. National SM Presence and engagement for ALL manufacturers

Manufacturer, Machine Builder, System Integrator, SW App Vendor, Academia, Labs

Direct, broad and significant impact on Manufacturing & Energy Productivity
Enabling Technology – The SM Innovation Platform

Standardized infrastructure that drives OT/IT CONVERGENCE and enables repeatable Innovation and R&D

Openness, Interoperability, Standards Based

Smart manufacturing API - Streaming & Historical Data via Model

Data store - time series, relational, blob, data lake…

Detect SM Edge systems, federate all profiles & fragments & assemble data model

Edge - connect, monitor, manage

Smart Manufacturing Marketplace

SM Profiles (Device, Machine, Process)

Member Apps

SM Innovation Platform

Profile Designer

SM Services – IT/OT

SM Tools

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The SM Journey is an Ecosystem Journey

**TECHNOLOGY VENDORS**
- Design
- Develop
- Deploy
  - IoT, Edge Connectors
  - Data Models, Profiles
  - Predictive Models
  - Analytic, Workflow
  - Smart Solutions

**EDUCATORS**
- Develop Curriculum
- Educate Workforce
  - Innovation Champions
  - Business Leaders
  - Innovation Integrators
  - Citizen Technologists
  - Augmented Workforce

**MANUFACTURER**
- Strategize
- Implement
- Operate
- Sustain

**VALUE CHAIN**
- Establish Partnerships
- Develop Rules, Exchanges
- Connect, Sustain Ecosystem

The big **transformational value** achieved at the value chain level

**Skilled people** needed to operate, sustain, and scale
3 Education and Workforce Development

Create a national learning infrastructure & drive competitiveness through broad-scale adoption of Smart Manufacturing and development of SM Workforce and SM Professionals

- **Engage** at scale
  - Virtual – regional – national
- **Deliver** formal and informal education
  - Social, expert networks, collaboration, crowdsourced experiences and knowledge bases
  - SM curriculum and SM learning centers
- **Address** entire SM ecosystem
  - Students, integrators, manufacturers, practitioners and business leaders
- **Offer** open-source access to education, best practices, tools, methodologies, benchmarks…
- **Scale** national pool of SM Workforce and SM Professionals
- **Empower** and engage executives
- **Breakthrough** Transformational Thinking!
National Presence – Smart Manufacturing Innovation Centers

Engage Manufacturing & Supply Chains where they are - local presence, test beds, training...

- Aligned around Industry Segments or Technology Verticals
- A World-Class Network of Manufacturing Assets Connected to our SM Innovation Platform
- Academia or Industry Partners

HQ & SM Innovation Center
SM Innovation Centers
SMIC Satellites
SMIC Satellites
Other SMICs or Satellites (directional)
**NCSU-SMIC**: Building the Smart Manufacturing Community

Powerful Educational Platforms to Promote Active and Immersive Learning for Workforce Development

**SMIC-Nonwovens**: Polymeric Materials

**SMIC-BTEC**: Biopharmaceuticals

**SMIC-Paper**: Pulp & Paper

**SMIC-AM**: Advanced Mfg
NCSU-SMIC: Building the Smart Manufacturing Community
Powerful Educational Platforms to Promote Active and Immersive Learning for Workforce Development

Hands-on Automation Training
Visual learning on process control and monitoring

Smart Manufacturing Training
OT/IT Principles, IIoT, AI/ML, Modeling, Analytics, AR, etc.

SM Innovation Platform - Interoperability, Open, Scalable, Secure

Material Flow & Genealogy  Workflow  ERP & EAM  Predictive Maintenance  Visualization & ProfitAdvisor  Power BI, TSM Trend

SM API  GraphQL

BTEC - Bio Manufacturing  NWI - Nonwovens Factory  Forest Biomaterials - Pulp & Paper  Advanced Manufacturing
National Manufacturing Competitiveness

I. Framing the Smart Manufacturing Journey and Business Strategy
   Exec, Enterprise, Plant Leaders

II. Smart Manufacturing Cultural & Technological Transformation
    Practitioners, 4-yr Engineers

III. Smart Manufacturing Orchestration, Automation & Connectivity
     Digital Skills – Operators, Technicians, Welders, etc...
     Community Colleges

IV. Smart Manufacturing Secured Infrastructure & Technologies
SM Ecosystem and Workforce Development - **Framework**

**Educational Areas of Focus**

I. Framing the Smart Manufacturing Journey and Business Strategy
   - SM trends, SM overview and concepts,
   - SM ecosystem readiness, competitiveness

II. Smart Manufacturing Cultural & Technological Transformation
   - The SM Landscape, SM benchmarks, SM Readiness, SM Roadmaps,
   - SM Business Impact, Value and Justification,
   - SM Mfg Process Overview,
   - SM and Manufacturing Functional Disciplines

III. Smart Manufacturing Orchestration, Automation & Connectivity
   - OT/IT Fundamentals, Factory Apps and Enterprise Systems,
   - Augmented Connected Workforce, Analytics/Metrics, Data Lakes,
   - ML/AI at the Edge, Platform Infrastructure, Data Exchange Stds,
   - Workflow, Control, Process Modeling, Sensing, Ingestion,
   - Data Profiles, Data Modeling, Industrial Security Practices

IV. Smart Manufacturing Secured Infrastructure & Technologies
   - Advanced Manufacturing, Additive/Subtractive, Smart Machines,
   - Robotics, Cloud and Edge Computing, Cyber-Security Infrastructure

**Audiences**

- Exec, Enterprise & Plants Leaders
- Analysts & Consultants
- Plants Functional & IT Leaders
- Practitioners, Engineers, Colleges
- Ecosystem Partners, Hardware, Software, Vendors, Integrators

Copyright © 2020 CESMII - All Rights Reserved.
I. Framing the Smart Manufacturing Journey and Business Strategy
SM trends, SM overview and concepts, SM ecosystem readiness, competitiveness

II. Smart Manufacturing Cultural & Technological Transformation
The SM Landscape, SM benchmarks, SM Readiness, SM Roadmaps, SM Business Impact, Value and Justification, SM Mfg Process Overview, SM and Manufacturing Functional Disciplines

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Educational Areas of Focus

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CESMII Produced + CESMII Recognized

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CESMII Recognized – SM Principles, Imperatives

**SM Business Outcomes**
- Cash Generation
  - Cash Generation
  - Reduced Inventory
  - Higher Return on Assets
- Revenue Improvements
  - Improved Cash Flow
  - Reduced Costs
  - Higher Return on Investment
- Cost Improvements
  - Decreased Labor Costs
  - Increased Labor Productivity
  - Lower Plant Expenses
- Revenue Improvements
  - Improved Cash Flow
  - Reduced Costs
  - Higher Return on Investment

**SM Strategies**
- Quality
- Compliance
- Throughput/Yield
- New Capabilities
- Agility / NPI
- Costs
- Risk
- Safety

**SM Imperatives**
- Secure
- Scalable
- Interoperable
- Standards-Based
- Data-Driven
- Open
- Sustainable

**SM Technologies**
- IIoT
- AI/ML
- Digital Twin
- Connected Worker
- Augmented Reality
- Big Data
- Cloud, Edge
- Modeling
- 5G

**SM Solutions**
- Asset Performance Management
- Tool Monitoring/Management
- Process Reliability
- Condition Based Monitoring
- Vibration Analysis
- Autonomous Operations
- Remote Monitoring
- Enterprise Integration (P,Q,M)
- Downtime Tracking/OEE
- Manufacturing Intelligence
- Predictive Maint, Perf, Quality
- Process Analytical Technology
- SPC/SQC
- CAPA
- Enterprise Quality Management
- Lab Info Management Systems
- Error/Mistake Proofing
- Defect Tracking & Reporting
- Weigh & Dispense
- Batch Management
- Electronic Batch Records
- Production Management
- Production Scheduling, APS/FCS
- Recipe Management
- Product/Process Genealogy
- Traceability & Containment
- HACCP Plan Gen & Compliance
- Material Ledger/Management
- Inventory Control/Management
- Supply Chain Visibility
- Supply Chain Event Management
- Many more...
**CESMII Recognized – SM Principles, Imperatives**

**SM Business Outcomes**
- Cash Generation
  - Reduced Inventory
  - Higher Return on Assets
- Revenue Improvements
  - Daily Production Sched Attainment
  - Expanded Capacity
  - Supply Chain Visibility
- Cost Improvements
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- Product/Process Genealogy
- Traceability & Containment
- HACCP Plan Gen & Compliance
- Material Ledger/Management
- Inventory Control/Management
- Supply Chain Visibility
- Supply Chain Event Management
- Many more…
Update to Education Services **Catalog**

- **Foundational Education**
  - CESMII’s foundational SM principles and imperatives
  - Education available to members and required for users and partners on the SM Innovation Platform covering training on how to create profiles, connect your software, and use the marketplace.

- **Extended Education**
  - Education available for a fee to non-members and members (at a discounted price)
  - Can include both CESMII produced and licensed education
  - Education topics go beyond the SM Innovation Platform and cover the broader SM EWD Framework

- **Extended Transformational Services**
  - Provide consulting, system architecture and integration services beyond education to help businesses in their Smart Manufacturing adoption and implementation efforts.
  - Provided by CESMII ecosystem partners providing CESMII Recognized services.
Ecosystem and Workforce Development

EXECUTION
TO-DATE
I. Framing the Smart Manufacturing Journey and Business Strategy
SM trends, SM overview and concepts, SM ecosystem readiness, competitiveness

II. Smart Manufacturing Cultural & Technological Transformation
The SM Landscape, SM benchmarks, SM Readiness, SM Roadmaps, SM Business Impact, Value and Justification, SM Mfg Process Overview, SM and Manufacturing Functional Disciplines

III. Smart Manufacturing Orchestration, Automation & Connectivity

IV. Smart Manufacturing Secured Infrastructure & Technologies
Advanced Manufacturing, Additive/Subtractive, Smart Machines, Robotics, Cloud and Edge Computing, Cyber-Security Infrastructure
SM Ecosystem and Workforce Development - **Execution**

- Knowledge Sharing Community and Webcast Series

6° of Smart Manufacturing

https://www.cesmii.org/web-series-6-degrees-of-smart-manufacturing/

What Does Smart Manufacturing look like in NC State’s COVID-19 Response?

https://www.youtube.com/watch?v=9GQQG6S4VXgU&list=PLtH3B3EUuDooO2QQLZrrrRBaAyTwFYbz1&index=2

What Does Disruption Look Like with/without SM?

Guest: Jim Wetzel, NxGen Group

https://www.youtube.com/watch?v=ZWyzfUSP7aQ
SM Ecosystem and Workforce Development - **Execution**

- Knowledge Sharing Community and Webcast Series
  - 20-minute Talks with Some of Industry's Best and Brightest (2 per month)

https://www.cesmii.org/web-series-6-degrees-of-smart-manufacturing/
## SM Ecosystem and Workforce Development - Execution

### Educational Areas of Focus

<table>
<thead>
<tr>
<th>I. Framing the Smart Manufacturing Journey and Business Strategy</th>
<th>Execs, Enterprise Leaders, Consultants</th>
<th>Audiences</th>
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<td>III. Smart Manufacturing Orchestration, Automation &amp; Connectivity</td>
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<td>SM Learning Centers with SM Learning Platforms</td>
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SM Ecosystem and Workforce Development - **Execution**

- **Education and Workforce Development Projects**
  
  **RFP2 Wave 2**
  Education & Workforce Development
  - 19 white papers received
  - 11 selected for full proposals
  - **4 proposals selected for negotiation**

  **RFP 1**
  Enabling Technologies and Education
  - 2 Education Projects in Execution
  - SM Workforce Development Model
    - National inventory of SM education programs
    - SM Core competencies gap analysis
  - SM College Modules and SM Career Pathway
  - Factory 4.0 Educational Toolkit
    - Tabletop Hardware and Education Modules
### SM Ecosystem and Workforce Development - Execution

- **Education and Workforce Development Projects**
  - **SM Workforce Development Model**, El Camino College, CSUN, UC Berkeley, UCLA
    - SM Core competencies gap analysis
    - National inventory of SM education programs from MIT, Purdue, Wayne State, U Michigan, Carnegie Mellon University, Virginia Tech, NC State

In-Progress:
- SM College Modules and SM Career Pathway

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SM Ecosystem and Workforce Development - Execution

• Education and Workforce Development Projects
  - Factory 4.0 Educational Toolkit, Penn State, MIT (Completing soon)
SM Ecosystem and Workforce Development - **Execution**

### Educational Areas of Focus

**I. Framing the Smart Manufacturing Journey and Business Strategy**
SM trends, SM overview and concepts, SM ecosystem readiness, competitiveness

**II. Smart Manufacturing Cultural & Technological Transformation**
The SM Landscape, SM benchmarks, SM Readiness, SM Roadmaps, SM Business Impact, Value and Justification, SM Mfg Process Overview, SM and Manufacturing Functional Disciplines

**III. Smart Manufacturing Orchestration, Automation & Connectivity**

**IV. Smart Manufacturing Secured Infrastructure & Technologies**
Advanced Manufacturing, Additive/Subtractive, Smart Machines, Robotics, Cloud and Edge Computing, Cyber-Security Infrastructure

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**Audiences**

- Execs, Enterprise Leaders, Consultants
- Plants Functional & IT Leaders
- Practitioners, Engineers, Colleges
- Ecosystem Partners, Vendors, Integrators

**Extended Education and Transformational Services**
- Knowledge Sharing Community and Web Series
- Educational Workshops
- eLearning and Videos on SM Concepts and Methods
- Education and Workforce Development Projects
- SM Learning Centers with SM Learning Platforms
- Foundational eLearning and Videos on Platform
- Extended eLearning and Videos on Technology

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SM Ecosystem and Workforce Development - **Execution**

- **Extended Transformational Services**
  - 2 Pilots
    - SM Assessment
    - SM Deep Dive

- **Educational Workshops - at SMICs**
  - Framing Smart Manufacturing (SM)
    - Institute Overview
    - SM Landscape Explained
    - SM Tied to Manufacturing Competitiveness
    - SM Business Value
  - Next Workshops – **(September)**

- **Training Webcasts (recorded videos)**
  - SM Technical Concepts
    - Introduction to Machine Learning
  - SM Platform Concepts and Tools
    - Introduction to Information Modeling on the SM Innovation Platform  **(June 16th)**
    - Introduction to Workflow on the SM Innovation Platform  **(June 18th)**

Audiences:
- Execs, Enterprise Leaders, Consultants
- Plants Functional & IT Leaders
- Practitioners, Engineers, Colleges
- Ecosystem Partners, Vendors, Integrators

Extended Education and Transformational Services

Knowledge Sharing Community and Web Series

Educational Workshops

eLearning and Videos on SM Concepts and Methods

Education and Workforce Development Projects

SM Learning Centers with SM Learning Platforms

Foundational eLearning and Videos on Platform

Extended eLearning and Videos on Technology
Mission: Provide value-added services to accelerate adoption by helping manufacturing leaders with their internal “why” and “what” analysis of Smart Manufacturing initiatives

What was Learned:
- Linkage between strategic goals and Smart Manufacturing capabilities is typically missing.
- Smart Manufacturing is viewed in terms of operating efficiency and productivity.
- We TALK People-Process-Technology … The WALK is Technology.
- This causes senior leadership to see Smart Manufacturing as tactical not as strategic and compelling.
- Directors accountable for SM are not getting independent guidance to develop a roadmap and business case.
- Directors want the opportunity to have sharing experiences with other companies in a very confidential setting.
- Pilots need to demonstrate the true potential for strategic and competitive gains vs. technical proof of concept.

Potential Catalog of Transformational Services:
- Smart Manufacturing transformation workshop
- Smart Manufacturing maturity assessment, benchmark and insight
- 90 day sprint to business value
- Deep-dives on specific topics
- Roadmap development

Follow up presentation by NxGen Group and General Mills on July 9th. Don’t miss it!
Establish “CESMII Recognized” Program
  • Based on SM Principles, Imperatives, SM Benchmarking

Establish EWD Repositories
  • Learning Management System (LMS)
  • Education Sharing Repository

Expand the Catalog filling gaps in SM EWD Framework
  • EWD Project Waves (Complete RFP1 projects, Start RFP2 W2 projects, Plan next wave)
  • Top Down and Bottom Up with internal team, members and partners
  • Extended Transformational Education and Services (Catalog Revision coming July)

Expand SM EWD Upskilling Engine
  • More eLearning, More Hands-on, More On-The-Job, More Regions and Industries

Engage with Members and Community
  • Restart EWD Outreach Committee in Agile engagement cycle
  • More Educational Workshops at SMICs
  • Build Knowledge Sharing Community
    • Started with Web Series and LinkedIn but we need more…

SM Ecosystem and Workforce Development – Roadmap Priorities
Engage with CESMII

• Community
  • Join CESMII LinkedIn Smart Manufacturing Community (request to join)
    • [https://www.linkedin.com/groups/12285245/](https://www.linkedin.com/groups/12285245/)
  • Check out Web Series and download Resources
    • [https://www.cesmii.org/web-series-6-degrees-of-smart-manufacturing/](https://www.cesmii.org/web-series-6-degrees-of-smart-manufacturing/)
    • [https://www.cesmii.org/resource-library/](https://www.cesmii.org/resource-library/)

• Upcoming Online Events
  • Extended Transformational Education and Services
    • Presentation by NxGen Group and General Mills (July 9th – Continuation Presentation)
  • Foundational Education
    • Introduction to Information Modeling on the SM Innovation Platform (June 16th)
      • [https://www.cesmii.org/online-learning-smip-training-thinkiq-20200616/](https://www.cesmii.org/online-learning-smip-training-thinkiq-20200616/)
    • Introduction to Workflow on the SM Innovation Platform (June 18th)
      • [https://www.cesmii.org/online-learning-smip-training-savigent-20200618/](https://www.cesmii.org/online-learning-smip-training-savigent-20200618/)

• Future EWD Project Waves
  • Next project wave to fill the gaps in the SM EWD Framework

• Educational Workshops at SMICs (In-person in September)
• EWD Outreach Committee (Next online meeting - JULY 16th)
Engage with the EWD Outreach Committee

CESMII Integrated Strategy
*Accelerating Smart Manufacturing for Transformative Performance and Energy Productivity*

- **SM Business Practices**
  - Facilitate SM Adoption
  - Develop value proposition
  - Mitigate risks and barriers
  - Provide strategies & tools

- **SM Enabling Technologies**
  - Collaborative R&D
  - Develop key technologies
  - Robust & configurable
  - Integration into SM system
  - Platform & Marketplace
  - Enable reuse of technologies
  - Secure, flexible, scalable
  - Cost effective deployment

- **SM Ecosystem and Workforce Development**
  - SM principles & practices
  - Build & sustain SM skills
  - SM platform & tech training
  - Educator resources

Members,
Who in your team is interested in SM Education?

Sign them or yourself up for the EWD Outreach Committee!

Meet every other month.

Email: conrad.leiva@cesmii.org
“At the time when Covid-19 has brought upon us a new reality of social distancing and remote work, might there be an opportunity for us to invest in strengthening and rebuilding our talent, for us to be ready when we emerge on the other side of this? I strongly believe there is!”

Haresh Malkani, CESMII CTO

Source: The Importance of Subject Matter Experts in Ensuring Broad Success of Smart Manufacturing, Haresh Malkani, MyTechMag, 2020
ENGAGE WITH US!

Democratizing SMART MANUFACTURING

EDUCATED, DATA-DRIVEN CULTURE
SMART ASSETS
SMART DECISIONS
OPERATIONS & SUPPLY CHAIN VISIBILITY

conrad.leiva@cesmii.org
www.cesmii.org