Clean Energy Smart Manufacturing Innovation Institute

DE-EE0007613
CESMII - UCLA
Dec 2016 – Sep 2019

John Dyck – CEO – CESMII

U.S. DOE Advanced Manufacturing Office Program Review Meeting
Washington, D.C.
June 11 - 12, 2019

This presentation does not contain any proprietary, confidential or otherwise restricted information.

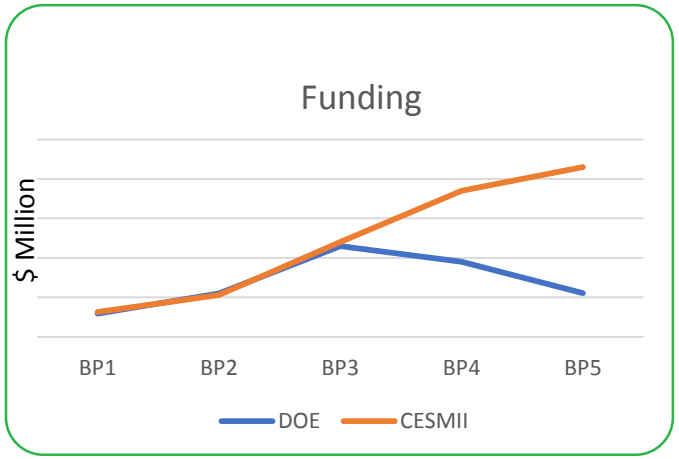
CESMII Overview

TIMELINE

- CESMII awarded – Dec. 2016
- Project End date - Dec. 2021
- Start up period (BP1) completed 2/28/2018
- Currently in BP2 (2 ext – 9/30)
- Project 50% complete

BUDGET

	2017 BP1	2018 BP2	Total (BP3 – BP5)
DOE Funded	$5.9M	$11M	$53.1M
CESMII Cost Share	$6.3M	$10.6M	$104M
Total	$12.2M	$21.6M	$157.1M

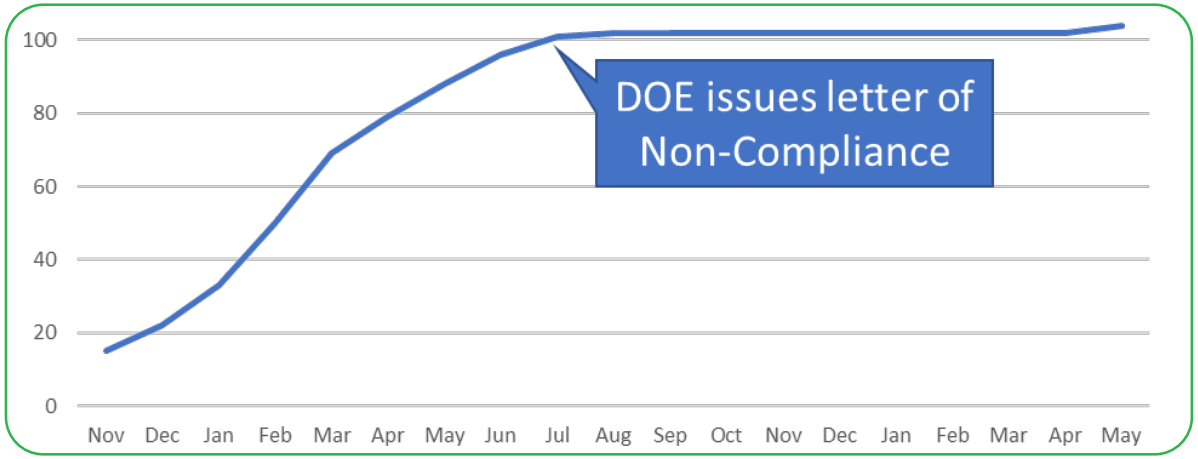


MANAGEMENT

- UCLA now owns Co-operative Agreement
- UCLA manages CESMII operations
- CESMII executes the program / agreement
- Governance Board manages

MEMBERSHIP

- 102 Institutional members
  - 52% Industrial
  - 41% Academics
  - 7% Other
- Outreach, Business Development, Workforce Development, Technology Development, Projects
- Strong Pipeline



CESMII's Mission is to Accelerate Smart Manufacturing Adoption

Vision: Smart Manufacturing is manufacturing in 2030

MISSION

Radically accelerate advanced sensor, controls, modeling, simulation, and platform development and adoption in U.S. manufacturing through integrated, industry-led Smart Manufacturing technical, business, and educational methodologies.

OBJECTIVES

To enhance U.S. manufacturing productivity, global competitiveness, and reinvestment, significantly:

- ↑ energy productivity
- ↑ economic performance
- ↑ environmental sustainability
- ↑ workforce capacity

GOALS

Demonstrate at least a **15% improvement in energy efficiency** in first-of-a-kind demonstrations at manufacturing plants or major processes **within five years** of Institute operation, supporting a goal of at least **50% improvement in energy productivity in 10 years**.

Develop tools and technologies to **reduce the cost of deploying Smart Manufacturing in existing processes by 50%** relative to the existing state of the art within five years.

Demonstrate **significant industry adoption of Smart Manufacturing technology** in each of the following topic areas within five years: advanced sensors; control systems and data analytics; high-fidelity modeling; and toolkits.

Establish a portfolio for technology RD&D and workforce development that directly replaces the initial Federal funding (i.e., $14 million per year), starting in the sixth year of operation.

Broad Deployment – "ALL Manufacturing"

CESMII has an Integrated Strategy & Roadmap to Advance the DOE's Mission

Engage the Entire Manufacturing Ecosystem (OT & IT) to Accelerate the **Democratization of Smart Manufacturing**


Manufacturer


Systems Integrator


App Vendor(s)


Academia


Machine Builder

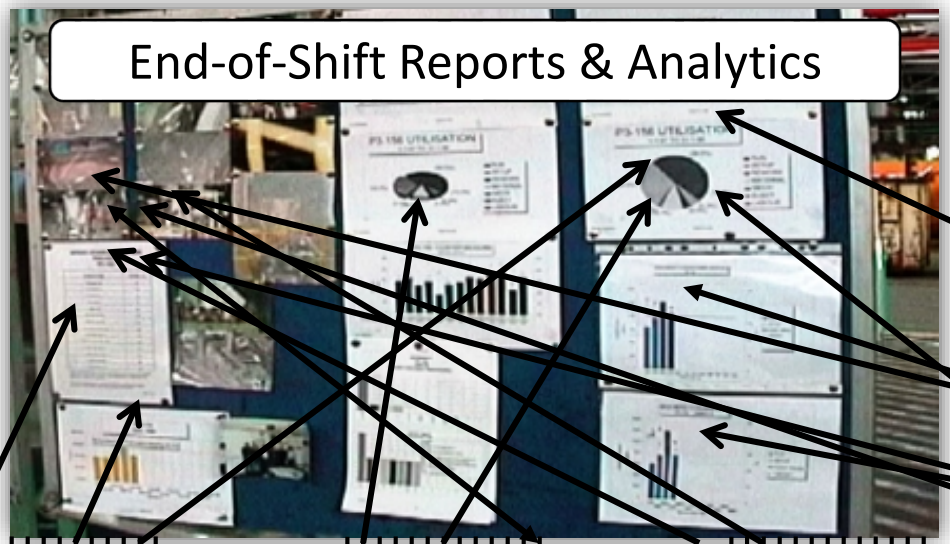
Democratizing SM Knowledge
Data-Driven Culture, Education
Workforce Development

Democratizing SM Innovation
Business Practices
Safe Harbor Collaboration

Democratizing SM Technology
Platform Infrastructure
Models (Data, Analytics, Design)

The Enormous Complexity Preventing Manufacturers from Innovating

Actual 'End-of-Shift' report board to facilitate production & maintenance hand-off to new shift



- Significant Cybersecurity Risk
- Corporate R&D and Academia struggle to engage
- Supply Chain Optimization almost unattainable
- IIoT adds risk and complexity
- IT constrained in their ability to engage and add value

Actual taxonomy of mission-critical manufacturing systems for large discrete manufacturer

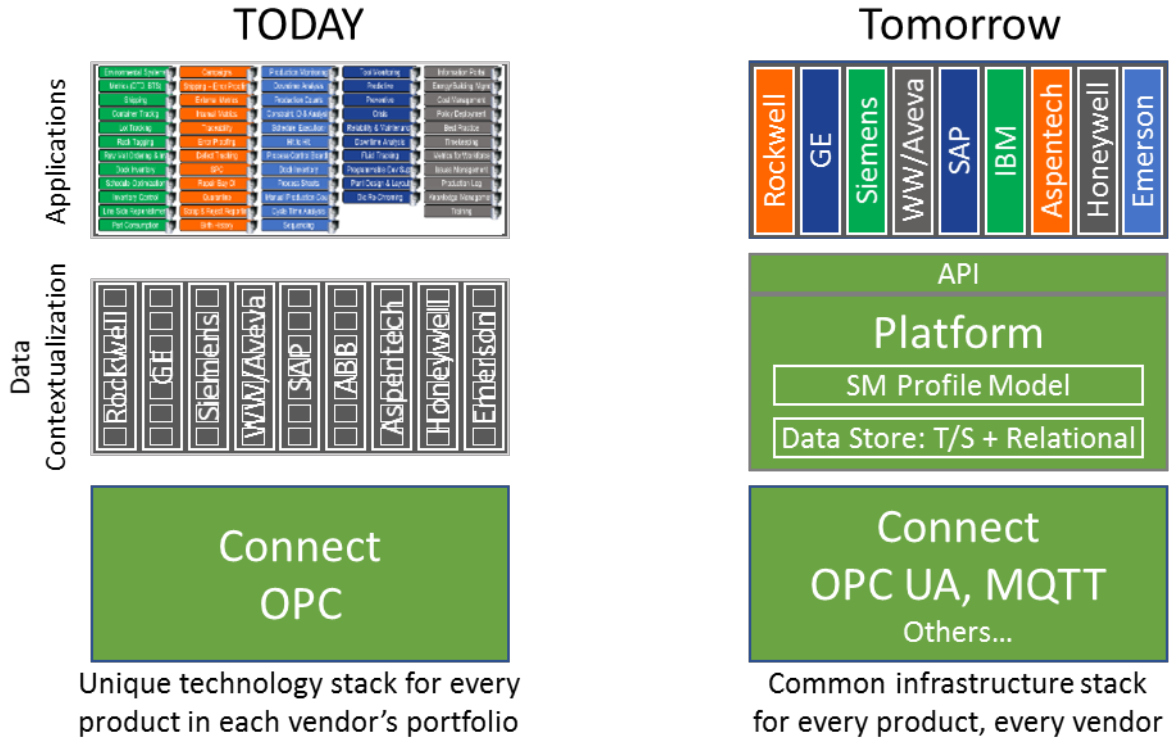
Logistics	Quality	Production	Maintenance	Management
Environmental Systems	Campaigns	Production Monitoring	Tool Monitoring	Information Portal
Metrics (DTD, BTS)	Shipping – Error Proofin	Downtime Analysis	Predictive	Energy/Building Mgmt
Shipping	External Metrics	Production Counts	Preventive	Cost Management
Container Track'g	Internal Metrics	Constraint ID & Analysi	Crisis	Policy Deployment
Lot Tracking	Traceability	Schedule Execution/	Reliability & Maintenanc	Best Practice
Rack Tagging	Error Proofing	Hit to Hit	Downtime Analysis	Timekeeping
Raw Mat Ordering & In	Defect Tracking	Process Control Boards	Fluid Tracking	Metrics for Workforce
Dock Inventory	SPC	Dock Inventory	Programmable Dev Sup	Issues Management
Schedule Optimization	Repair Bay OI	Process Sheets	Plant Design & Layout	Production Log
Inventory Control	Quarantine	Manual Production Cou	Die Re-Chroming	Knowledge Managemer
Line Side Replenishmer	Scrap & Reject Reportir	Cycle Time Analysis		Training
Part Consumption	Birth History	Sequencing		

A Bold Vision for Smart Manufacturing

A De Facto Standard for Data Ingestion & Contextualization

A Plug & Play Framework for ALL Manufacturing Devices, Machines, Processes

An Agile Innovation & Collaboration Environment to



Unique technology stack for every product in each vendor's portfolio

Common infrastructure stack for every product, every vendor

- Dramatically transform Smart Manufacturing initiatives (50% reduction in implementation cost)
  - Secure, sanctioned, sustainable innovation platform for OT & IT
  - 'Instant' provisioning of SM Platform
  - 'Instant' data collection & contextualization
  - 'Instant' access to Apps
- Facilitate meaningful R&D
  - Focus on problem-solving, not infrastructure
  - Immediate access to 'real' data
  - Opportunity to commercialize solutions/IP
- Triage Corporate Initiatives
  - Innovate Fast…
  - Fail Fast…
  - …but know you can scale up into a production system if you're successful

A New Baseline of OT Infrastructure to Dramatically Reduce the Cost & Complexity of R&D & Innovation

SM Profiles – A De facto Standard for Data Models

Crowd-Sourcing Manufacturing Domain Expertise

CESMII Members
Industry thought leaders & SME's

Manufacturers

- App Vendors
- Academia
- Device Vendors
- System Vendors (OEMs…)
- System Integrators

SM Profile (data model) definitions include at a minimum data source, data definitions and data acquisition rules

Capabilities & Performance
- Data to be collected/ingested/stored
- Events, Faults, alarms
- Material Flow, Buffers, Routes, etc.

Analytics
- Images, video, audio
- AI/ML requirements, KPI calculations, etc.
- Vis Content (visualization, reports, dashboards)

Workflow & Actionability (local & supply chain)
- Enterprise Integration touchpoints
- Operations, maintenance, quality, etc.

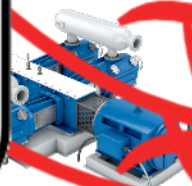
Machine Profile
A collection of devices (machine, compressor…)

Process Profile
A collection of Machines (line, supply chain…)

Data Lifecycle Management, Preserving Context at every level

Device Profile

Device Profile: Vendor 1, Model A – Available Options	
1 - Device Health & Diagnostics	Data, KPI's, Events, Rules, Dashboards…
2 - Asset Management	Data, KPI's, Events, Rules, Calibration…
3 - Business Process Integration	Data, Event rules, Workflows, Integration Touchpoints
4 - Support SLA	Data, Events



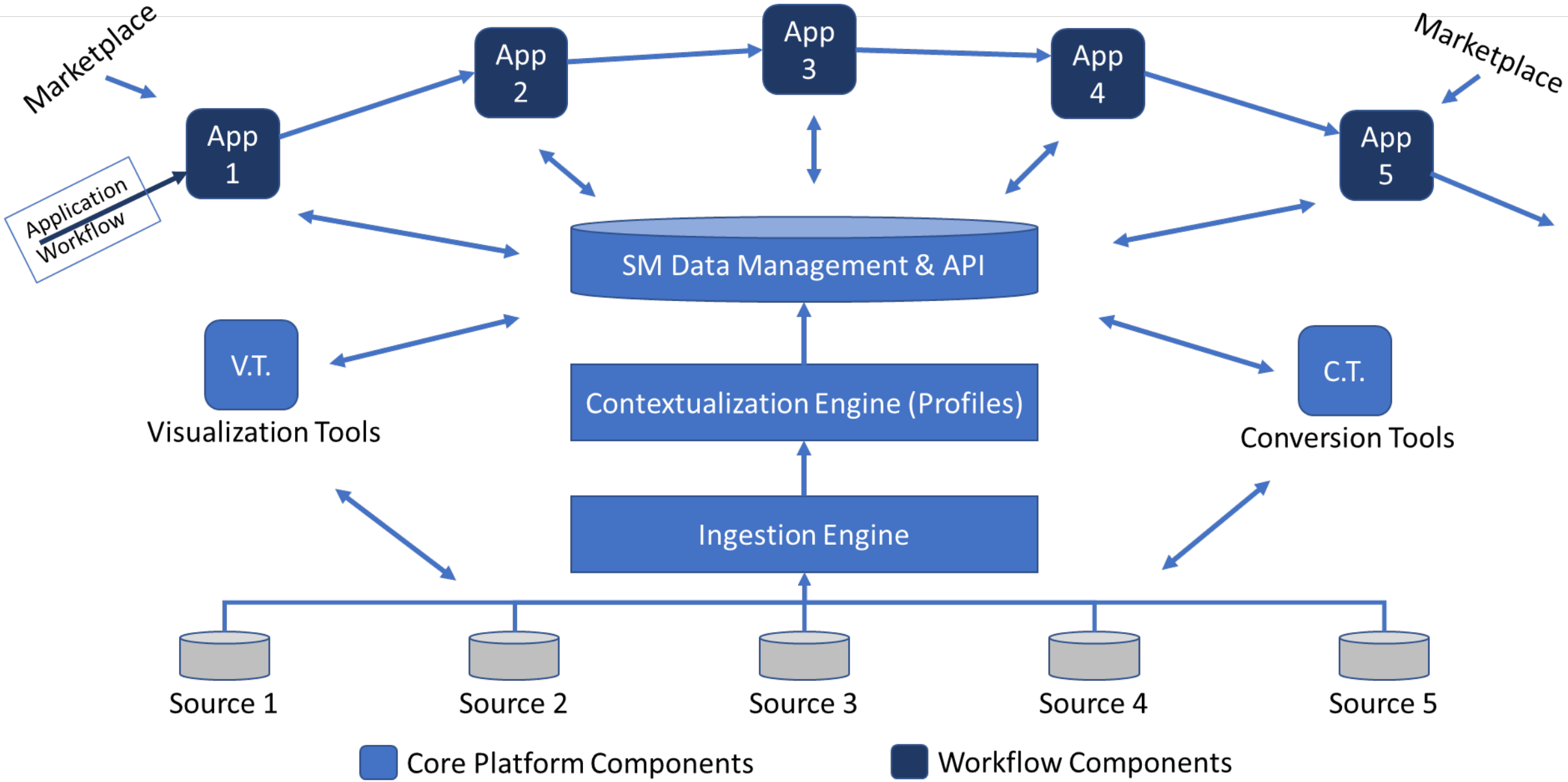
Machine Profile

Machine Profile: Vendor 1, Model A – Available Options	
1 - Performance	Data, KPI's, Events, Rules, Design, Dashboards…
2 – Energy Prediction/Efficiency	Data, KPI's, Events, Rules, Dashboards…
3 - Quality	Data, KPI's, Events, Rules, Design, Dashboards…
4 - Material & Production	Data, KPI's, Events, Rules, Integration touchpoints
5 - Predictive Maintenance	Data, KPI's, Events, Rules, Design, Dashboards…
6 - Asset Management	Data, KPI's, Events, Rules, Design, Dashboards…
7 - Business Process Integration	Data, Event rules, Workflows, Integration Touchpoints
8 - Support SLA	Data, Events

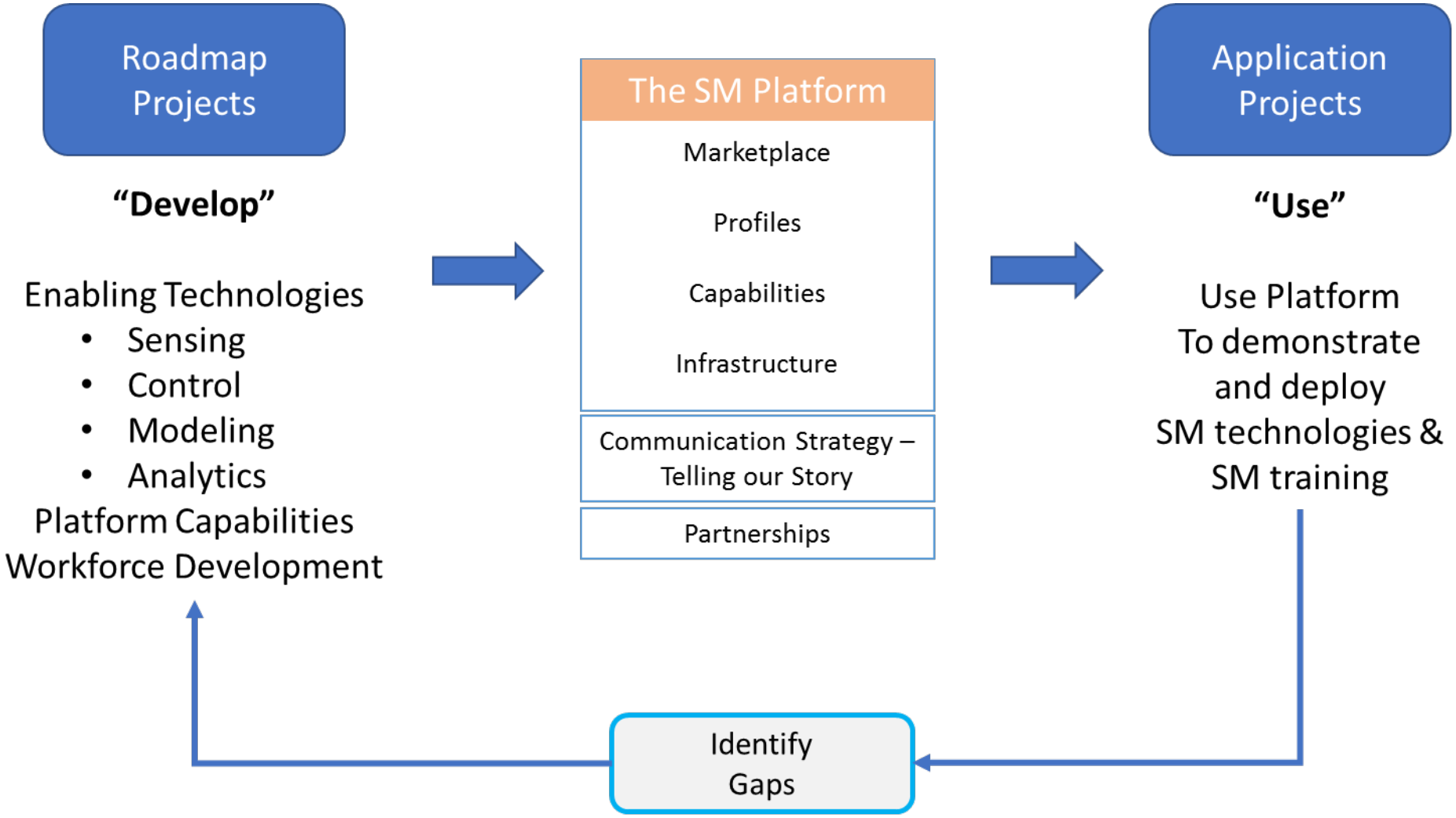
Process Profile

Process (Supply Chain) Profile: NAME – Available Options	
1 - Performance	Data, KPI's, Events, Rules, Dashboards…
2 - Energy	Data, KPI's, Events, Rules, Dashboards…
3 - Material Flow	Data, BOM, Events, Rules, Integration touchpoints
4 - Buffers	Data, KPI's, Events, Rules, Dashboards…
5 - Inventory	Data, KPI's, Events, Rules, Dashboards…
6 - Routes	Data, Rules, Dashboards…
7 - Location	Data, Dashboards…
8 - Business Process Integration	Data, Event rules, Workflows, Integration Touchpoints
9 - Support SLA	Data, Events

The SM Platform – High Level View of Core Functionalities

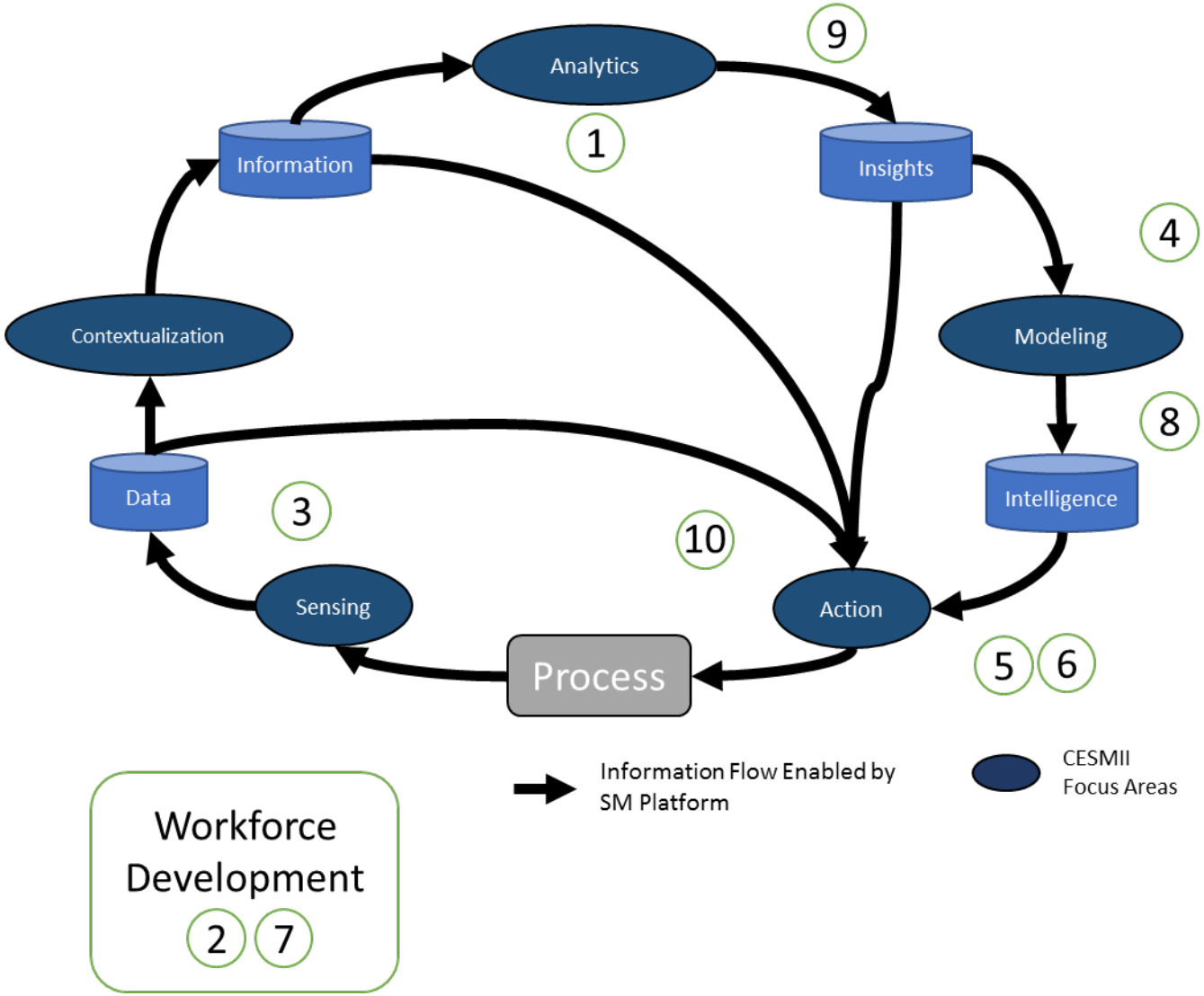


Technical Approach to Accelerate Smart Manufacturing Adoption



Projects Support our Focus Areas

	Selected Projects
1	Data Analytics-Machine Learning and Data Centric Analytics for discrete manufacturing
2	Smart Manufacturing Workforce Development Community College and University Curriculum Program
3	Mobile ,Connected Plant Floor Smart Worker
4	Inferential Modeling/Contextualization for Energy Optimization
5	SM for Chemical Processing – Energy Efficiency – Air Separation
6	Energy Management for Subtractive/Additive Manufacturing
7	SM Training Simulator/Toolkit for Educational Learning
8	Zero Defect Steel Slab Manufacturing thru SM technologies
9	Energy Efficiency for Cement Manufacturing
10	Energy efficient metal material processing through SM technologies (sensors, controls, modeling)



Results and Accomplishments

BUSINESS PRACTICES

- Value Proposition Defined
- Membership Increased (99)
- Readiness Maturity Assessment
- 12,000 Mfg contacted
- Embedded MEP
- (20) Affinity Groups Chartered
- Annual Membership Mtg
- Business Committee

WORKFORCE DEVELOPMENT

- WFD Workshop (>90 people)
- Knowledge Mgmt Portal created
- (20) SM documents
- Initial Course Catalog defined
- SM 101 – 1st Class
- SM workshops
  - >340 attendees
- WFD Committee

2 Projects

ENABLING TECHNOLOGY

- Project Call
- Technology Gaps defined
- SM Technical Workshops
- SM Common Language Glossary
- Market Place Creation
- Technology Committee

5 Projects

SM PLATFORM

- Demonstration at TAMU
- SM Platfform Vision and Approach
- Arconics Application project
- 12 Application projects defined
- Cloud Provisioning and Security
- Selected foundational technologies for SM Platform

3 Projects

Project Call – 41 submissions – 10 selections - $16M Total Cost

Organization, Staffing and Facility - Restructure

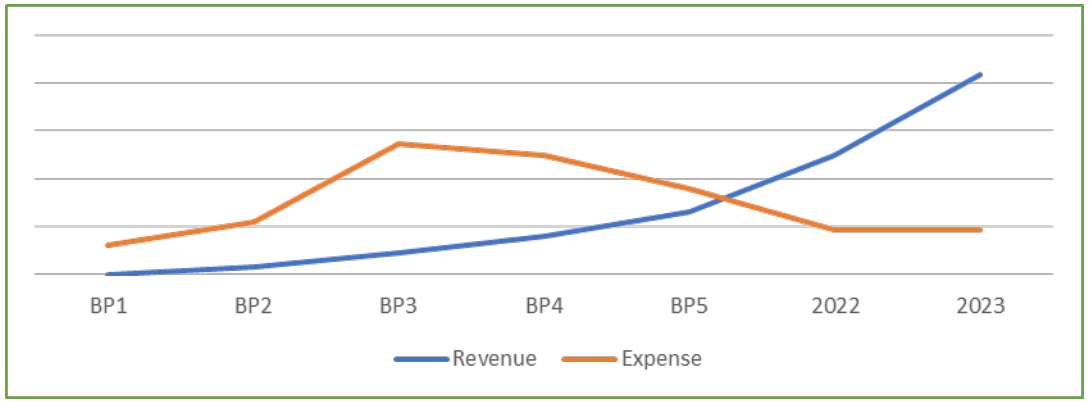
CESMII Roadmap Developed - >130 participants

Transition to Sustainability

CESMII sustainability strategy is to Gain **Broad Adoption** of Smart Technology and Practices

Sustainability Pillars	Revenue Generation Areas		
Membership	Membership Dues	Member funded Projects	Sponsors
SM Technology	SM Platform	SM Marketplace	SM ToolKits
SM Knowledge	Training	Consulting	Certification

- SM Technology drives revenue Growth
- Membership and SM Knowledge Revenue provides operational stability



Thank You

https://twitter.com/CESMII_SM

https://www.linkedin.com/company/clean-energy-smart-manufacturing-innovation-institute/

Email: info@cesmii.org
Website: www.cesmii.org

Accelerating your Smart Manufacturing Transformation