# Chapter # 1

## INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS

## IISE — Manufacturing & Design Division

*All you Need to Know about Industry 4.0*

*Part I—Starters*
- **High Level Overview Frameworks (Birds-eye View)**
- **Implications for Companies and Plants and ISE Practitioners**
- **Implications for ISE Manufacturing Systems Research**

## Session Leaders

**D. Scott Sink**, Ph.D., P.E., Director, Integrated LeanSigma Certification Program, ISE at OSU

**Jack Feng,** VP Operational Excellence and CVG Digital

**Paul Cohen, Ph.D.,** Woolard Distinguished Professor, NC State University

# Agenda

| 12:00 | Scott Tee-up |
| | Quick Overview of Purpose and Objectives of Webinar |
| | |
| | High Level Overview of this Abstraction |

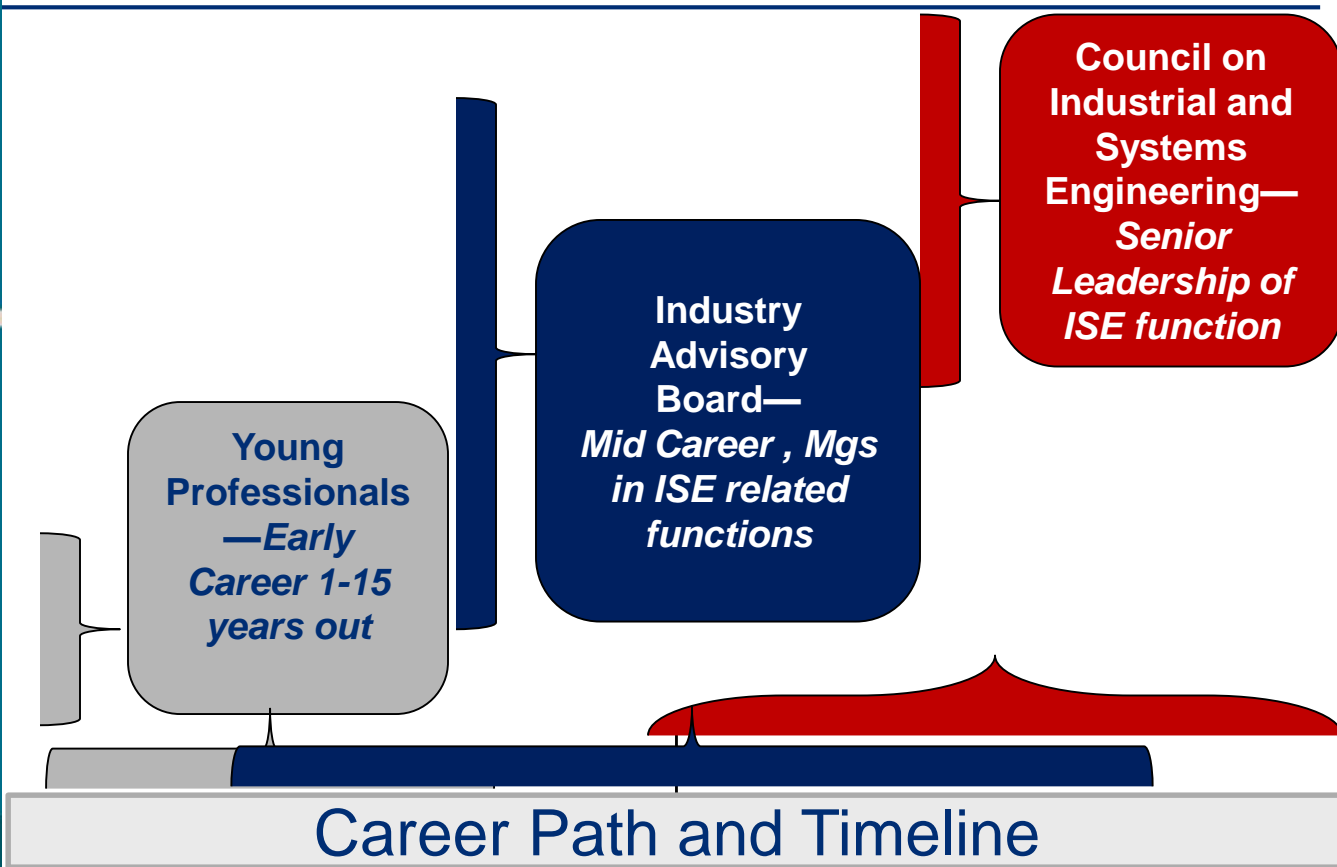| 12:15 | Jack Feng—Implications for ISE's at the Company and Plant Level |

| 12:30 | Paul Cohen--ISE Research Implications |

| 12:45 | Q&A and tee up the rest of the Series |

| 1:00 pm | Adjourn |

# ISE and IISE for Life—how IISE supports you for your entire Career…..

**INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS**

**Council on Industrial and Systems Engineering—** *Senior Leadership of ISE function*

**Industry Advisory Board—** *Mid Career , Mgs in ISE related functions*

**Young Professionals —** *Early Career 1-15 years out*

## Career Path and Timeline

**SEMS** — Society for Engineering and Management Systems

**IISE** — Manufacturing & Design Division

**LEAN DIVISION**

**IISE** — Institute of Industrial & Systems Engineers

The Premier Industrial & Systems Engineering Student Organization at OSU since 1963

# Questions?

## How We'll Handle

Please write your question in the webinar question web form. We will address as many as we can at the end of the webinar and send and email with follow up's to attendees for those not able to be responded to.

**INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS**

1. **304 Professional Members** in Region IV but also from around the Country/World.

2. **Support and partner with Student Chapters:** Youngstown State, Ohio University, Louisville, Purdue, and Ohio State University Student Chapters.

3. **Partner with IAB-**-Industry Advisory Board, **CISE**, and the **Young Professionals Group** and a number of **Societies and Divisions**.

4. **Partner with our Sister Chapter #2** in Dayton/Cincinnati on our Annual IISE All Ohio Event and other things

5. **10+ timely, Valuable Webinars** each year; topics developed from Voice of Member

6. **12 Monthly Memo's** help Members get to know each other and keep members aware of upcoming opportunities AND also provide Self-Help Features on personal and professional mastery

7. quarterly **GoToMeeting small group calls** with members that focus on topics of interest from 'affinity groups'/segments of our members.

# We created and delivered a series of webinars on Operational Analytics in 2017-18

INSTITUTE OF **INDUSTRIAL & SYSTEMS** ENGINEERS

**Webinar #1:** Foundations       **7 Dec 2017 (and GLR Conference)**  ✓

Share the Framework, the Models, the Abstractions, the Principles
Management Systems Model
Intel "Triangle" Model

**Webinar #2:** Foundational Data Role--Measurement and Analysis
              Planning   20 **March 2018**  ✓

Measurement Planning using Value Stream Maps, Data Models derive from refining the Management System Model, The Data Management Role of ISE's in Process Improvement Projects
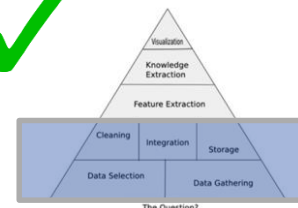
**Webinar #3:** Best in Class ILSS Project Final TG's   25 **April 2018**  ✓

Showcase best in class projects, shine spotlight on Op Analytics

**Webinar #4:** Decision Support Role—M&A Execution 12 June 2018  ✓

Feature and Knowledge Extraction, Creating Chartbooks and VSM's, supporting the evaluation phase of DMAIC projects and then also the Control Stage.
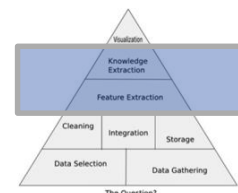
**Webinar #5:** Putting it all together 24 July 2018  ✓

Revisiting the Management Systems Model with Case Examples
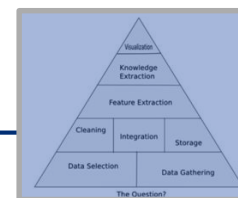
# That has led to the creation of this Industry 4.0 Series

Webinar #1: Starters **11 Oct 2018** (Jack Feng, Paul Cohen)

Overview the History and Evolution of NNMI and Industry 4.0

Discuss ISE and Corporate/Plant Implications and Strategies

Discuss ISE Mftg Systems Eng Research Implications

Webinar #2: Successful Real Case Examples (Steve Savoie and TBD)

Strategic Planning, Migration Strategies, Leveraging NNMI

Migration Plan Examples

Webinar #3: Smart Factory & Buildings (Rudy Santacroce & TBD)

Webinar #4: Smart Products (TBD)

Webinar #5: Smart Logistics (Jim Tompkins or Ga Tech Physical Internet Center)

Webinar #6: Smart Analytics (Scott Sink, Jared Frederici, and TBD)

Webinar #7: Smart Grids (Elaine Johns)

Webinar #8: Smart Integration (Eric Stebbins)

Webinar #9: Best in class Case Examples (Steve Savoie & TBD)

# Agenda

| 11:55 am | Scott Tee-up |
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| 12:10 pm | High Level Overview of the Evolution of the Current and Near Future State in Industry |

| 12:25 | Jack Feng—Implications for ISE's at the Company and Plant Level |

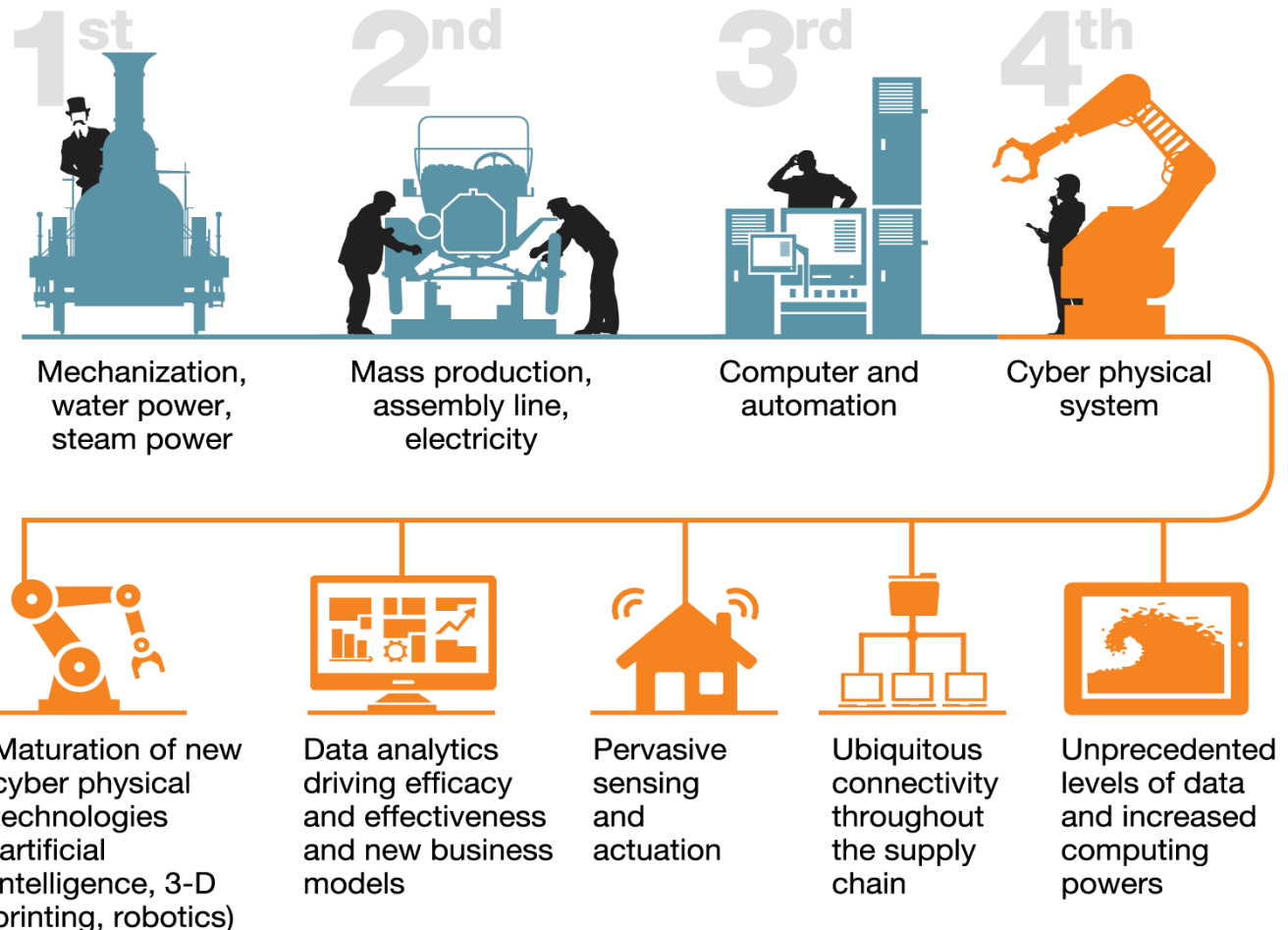| 12:40 | Paul Cohen--ISE Research Implications |

| 12:55 pm | Scott:  Closing Comments |

| 1:00 pm | Adjourn |

# Key Context Points as to why succeeding with "Industry 4.0" is important to the US

- the standard of living, quality of life, cost of labor gaps are still significant and a big factor impacting our competitiveness which is why the Trade War is raging and will probably escalate.

- **Trade wars win battles they don't win the War.**

- "Industry 4.0" is just a label we've given to the integration of technology and data utilization that reflects a solution/path forward for us. It's an umbrella term for the confluence of a large number of innovations that are coming to fruition and now being integrated.

- **We want to help you understand this buzz word, "Industry 4.0" and then think about how you can play a role, as an ISE in making it happen.**

- We also want to help you understand what the US Government is doing with initiatives like NNMI to facilitate a speedier migration to the future state.

- **And, for most manufacturers in the US, there are still significant gaps in understanding all this and therefore the migration strategies of often flawed and moving too slowly.**

Let's look at some High Level "Models"/Views of this Abstraction

In the fourth industrial revolution, digital analytics enables a new level of operational productivity.

**1st** — Mechanization, water power, steam power

**2nd** — Mass production, assembly line, electricity

**3rd** — Computer and automation

**4th** — Cyber physical system

- Maturation of new cyber physical technologies (artificial intelligence, 3-D printing, robotics)
- Data analytics driving efficacy and effectiveness and new business models
- Pervasive sensing and actuation
- Ubiquitous connectivity throughout the supply chain
- Unprecedented levels of data and increased computing powers

McKinsey&Company | Source: *Forbes*; World Economic Forum

# Industrial Revolution 4.0
## "a tsunami of technology headed toward the factory floor"

- Hybrid and autonomous vehicles
- Sensors, Controls and Vision Systems
- Nanotechnology
- Alloys, Composites and Adhesives
- Model Based Enterprise
- Multi-variant Simulations
- Additive Manufacturing/3D Printing
- Collaborative Robots
- Integrated Supply Chain
- Smart Maintenance
- Internet of Things and Real Time Data
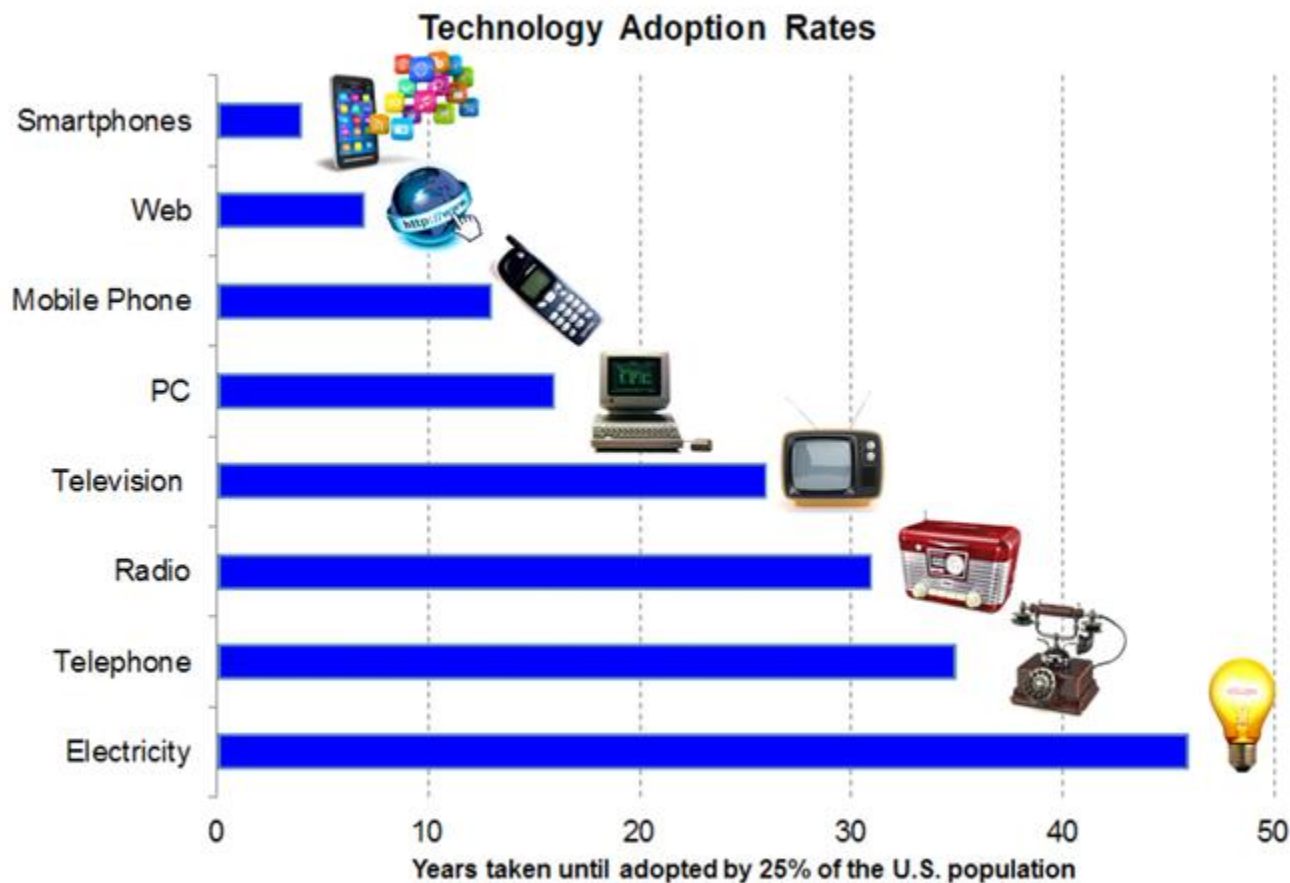- Big Data and Optimization
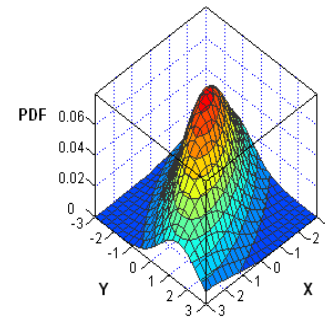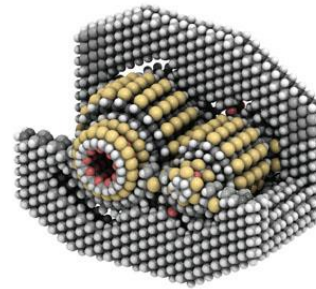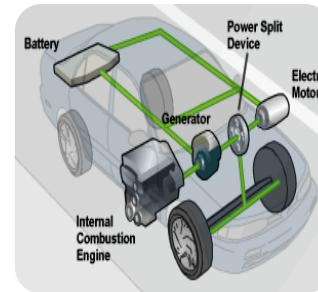
The **Hype Cycle** is a branded graphical presentation developed and used by IT research and advisory firm Gartner for representing the maturity, adoption and social application of specific technologies. Each **Hype Cycle** drills down into the five key phases of a technology's life cycle.
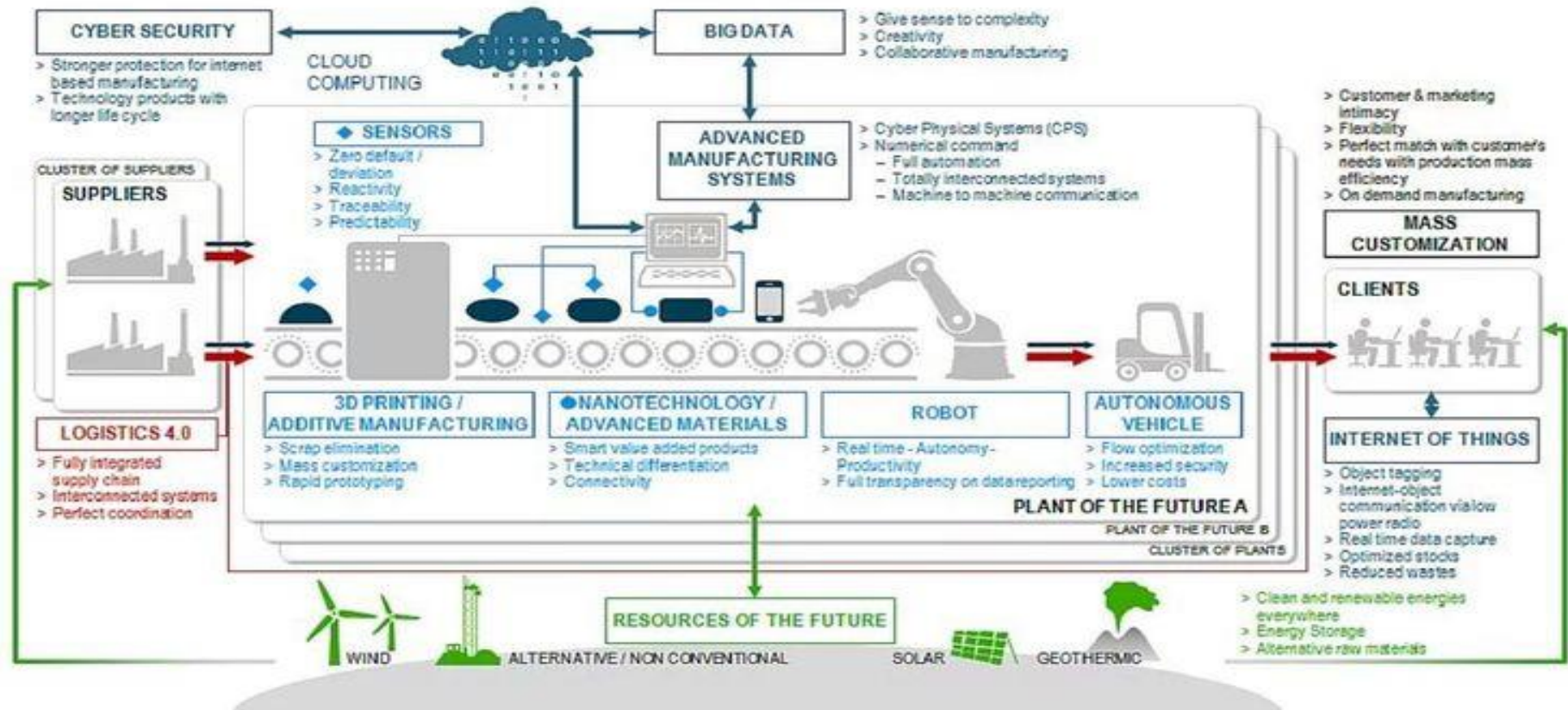
# The Hype Cycle
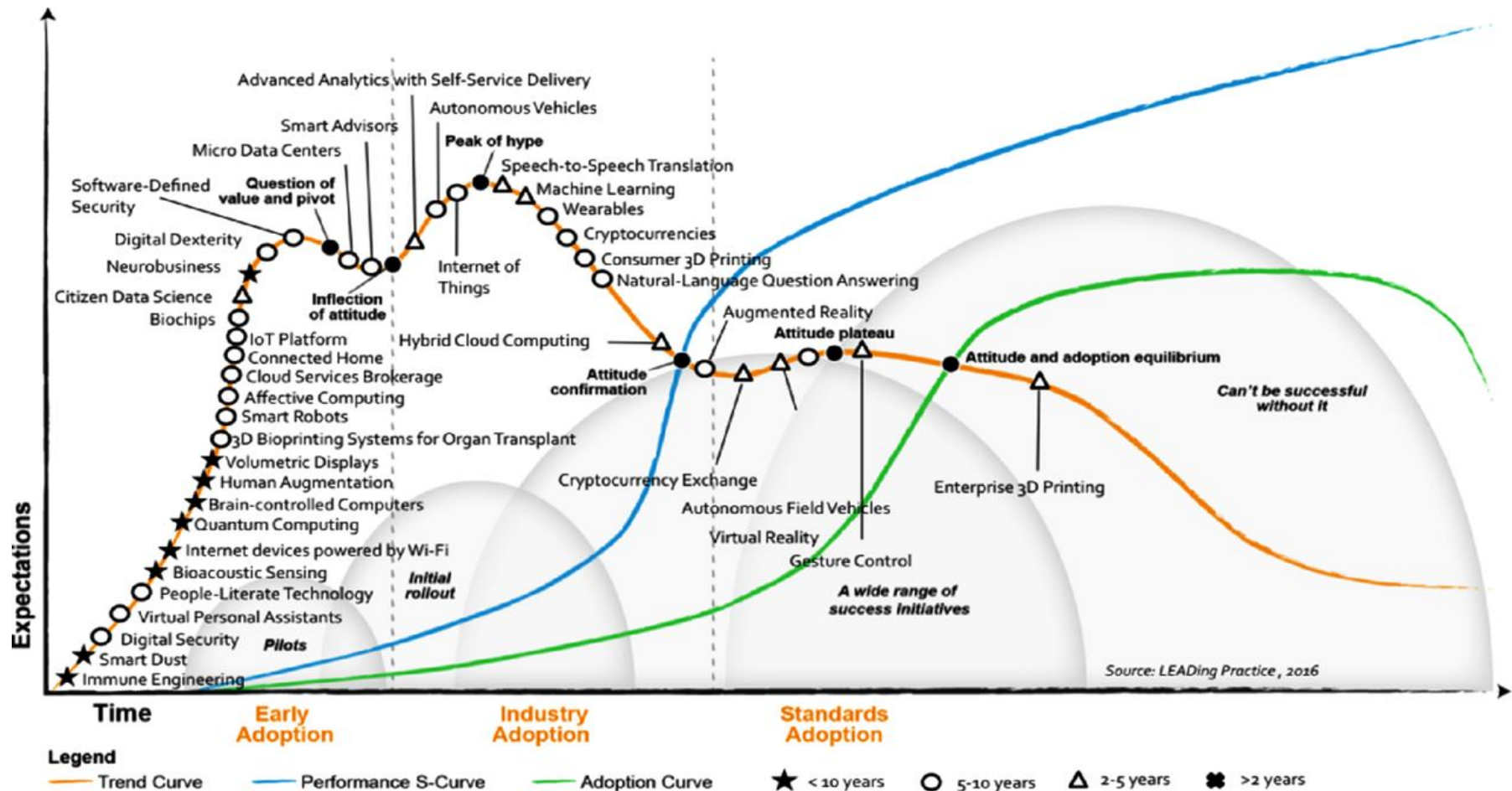
**We do know that Adoption Rates of "Technology" have dramatically gotten faster—but how does that translate in the world of industry**
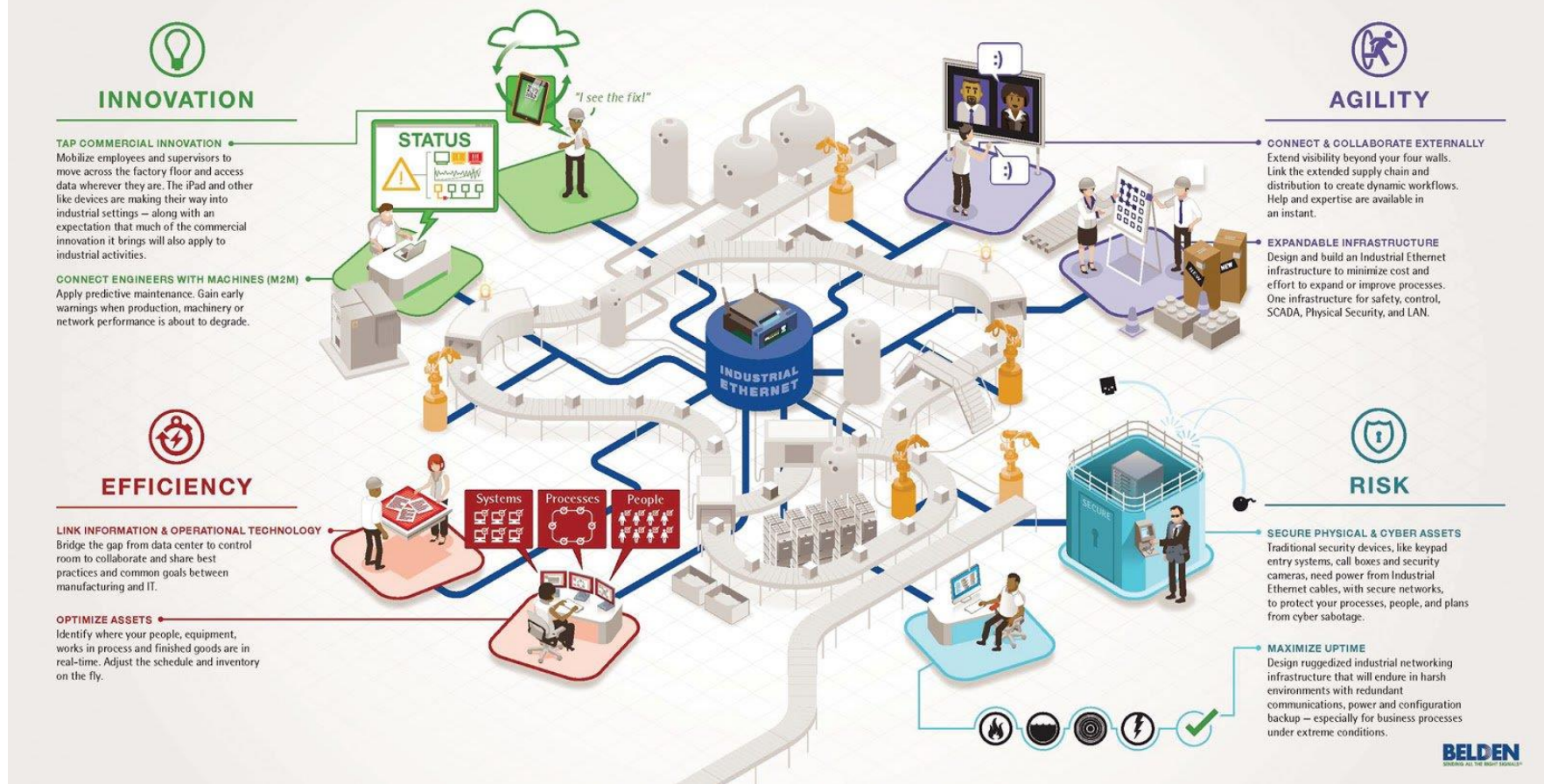


Technology Adoption Rates

Years taken until adopted by 25% of the U.S. population

Source: U.S. Census, Wall Street Journal

Market Realist

# The Industry 4.0 Ecosystem

The Connected Factory in Action

# How are various Nations doing?

# Closing the Gap

- Government investment in private-sector led partnerships

- Addresses the market failure of industry underinvestment in "pre-competitive" applied R&D

- Focus on "de-risking" new technologies and materials to scale-up for U.S. manufacturers
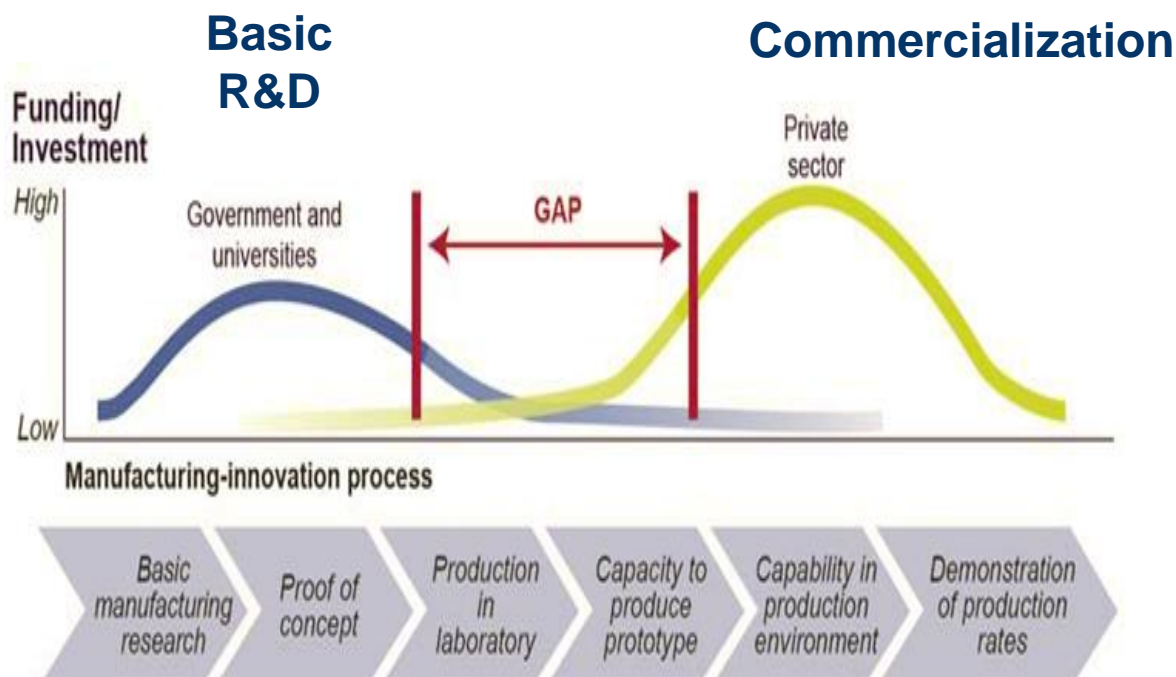
**Basic R&D**   **Commercialization**

Funding/Investment

High

Government and universities

GAP

Private sector

Low

Manufacturing-innovation process

| Basic manufacturing research | Proof of concept | Production in laboratory | Capacity to produce prototype | Capability in production environment | Demonstration of production rates |

*(courtesy of DMDII)*
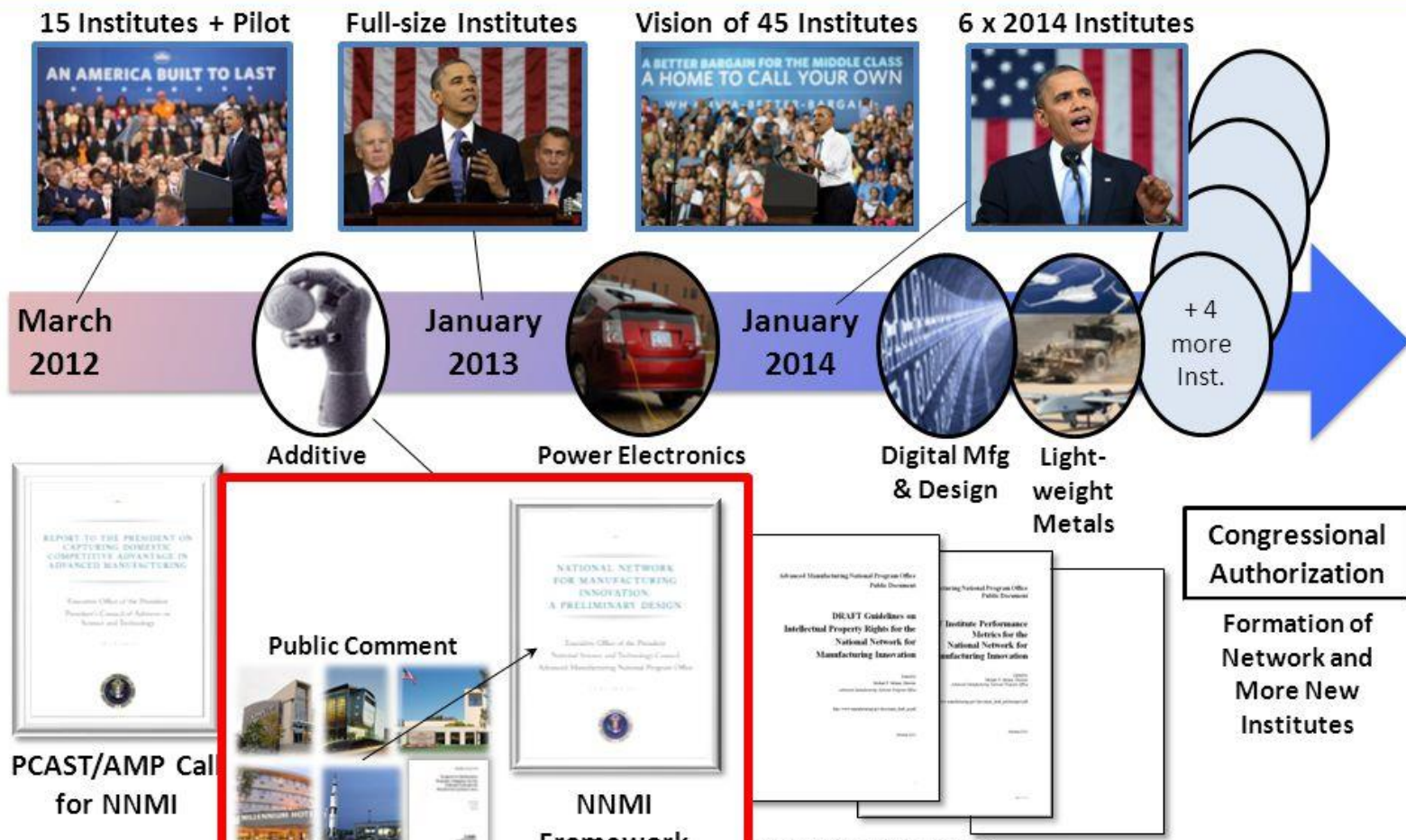
# And NAE's Advanced Manufacturing National Program Office has a model for how to accelerate the transformation



Manufacturing, Design, and Innovation

**MAKING VALUE FOR AMERICA**
NAE REPORT ON THE FUTURE OF MANUFACTURING, TECHNOLOGY, AND WORK
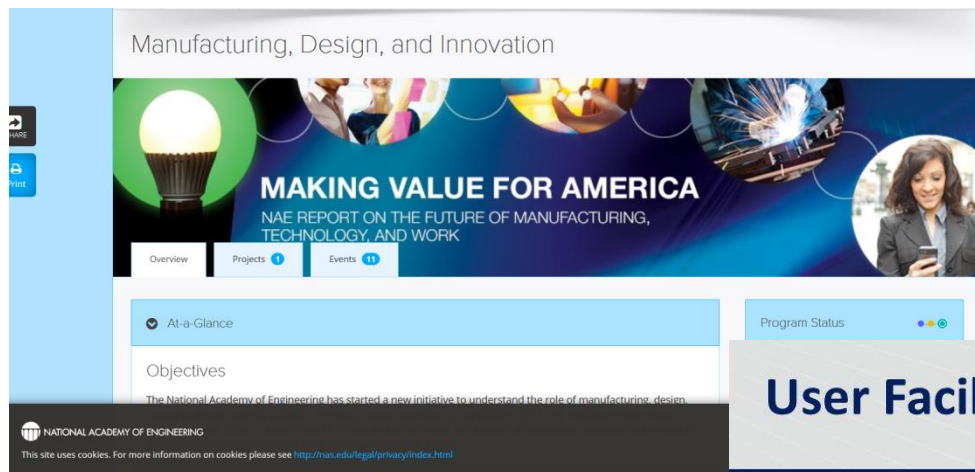


## User Facilities to support Industry RD&D

INPUT: Innovators with *new production-enabling technologies*

INPUT: Innovators with ideas for *new materials or products*

- Advanced Manufacturing Technologies
- Traditional Manufacturing Technologies
- Modeling and Simulation Tools
- Process control / metrology
- Design Capabilities
- Characterization and Testing Equipment

OUTPUT: Data to demonstrate **business case for manufacturing new materials or products:**
- Processes established
- Production rate data
- Cost estimates based on production data
- Risks understood / quantified
- Partners Identified

OUTPUT: *Market adoption* of innovative new production-enabling technologies

**Innovative materials or products to market**

Advanced Manufacturing National Program Office

18

# Manufacturing USA – 14 Institutes Now

**Since Launching in 2012:**
- Over $1 billion Federal funding matched by over $2 billion non-Federal funding
- 1,300+ companies, universities, and non-profits involved
- 40+ states participating

**America Makes**
Additive Manufacturing
*Youngstown, OH*

**Advanced Robotics Manufacturing Institute**
Robots in Manufacturing
*Pittsburgh, PA*

**AIM photonics**
Integrated Photonics
*Albany and Rochester, NY*

**REMADE INSTITUTE**
Recycling Materials
*Rochester, NY*

**armi**
Tissue Biofabrication
*Manchester, NH*

**NEXTFLEX**
Flexible Hybrid Electronics
*San Jose, CA*

**DMDII**
Digital Manufacturing and Design
*Chicago, IL*

**lift**
Lightweight Metals
*Detroit, MI*

**affoa**
Fibers and Textiles
*Cambridge, MA*

**RAPID**
Process Intensification
*New York, NY*

**CLEAN ENERGY SMART MANUFACTURING INNOVATION INSTITUTE**
Clean Energy
*Los Angeles, CA*

*States in blue have major participants in *Manufacturing USA* Institutes

**iacmi**
Advanced Composites
*Oak Ridge, TN*

**PowerAmerica**
Wide Bandgap Semiconductors
*Raleigh, NC*

**NIIMBL**
Biopharma Manufacturing
*Newark, DE*

**Manufacturing USA**℠

# The Case for Action



We are entering into another stage of the Industrial Revolution

Effective implementation of technology will determine the winners

Systems issues abound

Industrial and Systems Engineers need to step up

It starts with a thorough understanding of Industry 4.0

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IISE
Manufacturing & Design Division

ise
**Edward P. Fitts Department of Industrial and Systems Engineering**

# Digital Manufacturing Strategy

**2018 IISE Seminar**

**Dr. Jack Feng, IISE Fellow, VP of Operational Excellence and CVG Digital, Commercial Vehicle Group**

OPERATIONAL EXCELLENCE
LEAN 6-SIGMA

# Outline

- CVG Overview

- Introduction to Industry 4.0

- CVG Digital Manufacturing Strategy

- CVG Plant Level Programs

# The Industrial Revolutions

**Mechanization, mass production, automation, virtualization**

## Four Phases of Industrialization

| Industry 1.0 | Industry 2.0 | Industry 3.0 | Industry 4.0 |
|---|---|---|---|
| **1** | **2** | **3** | **4** |
| End of 18th century | Beginning of 20th century | Early 1970s | Today |
| Use of **water and steam power** to run mechanical production facilities | Use of **electrical power** to enable work-sharing mass production | Use of **electronics and IT** to automate production | Use of **cyber-physical systems** to monitor, analyze, and automate business |

http://saphanatutorial.com/industry-4-0/

# Industry 4.0

# =

# Industrial Internet of Things (IIoT)

# +
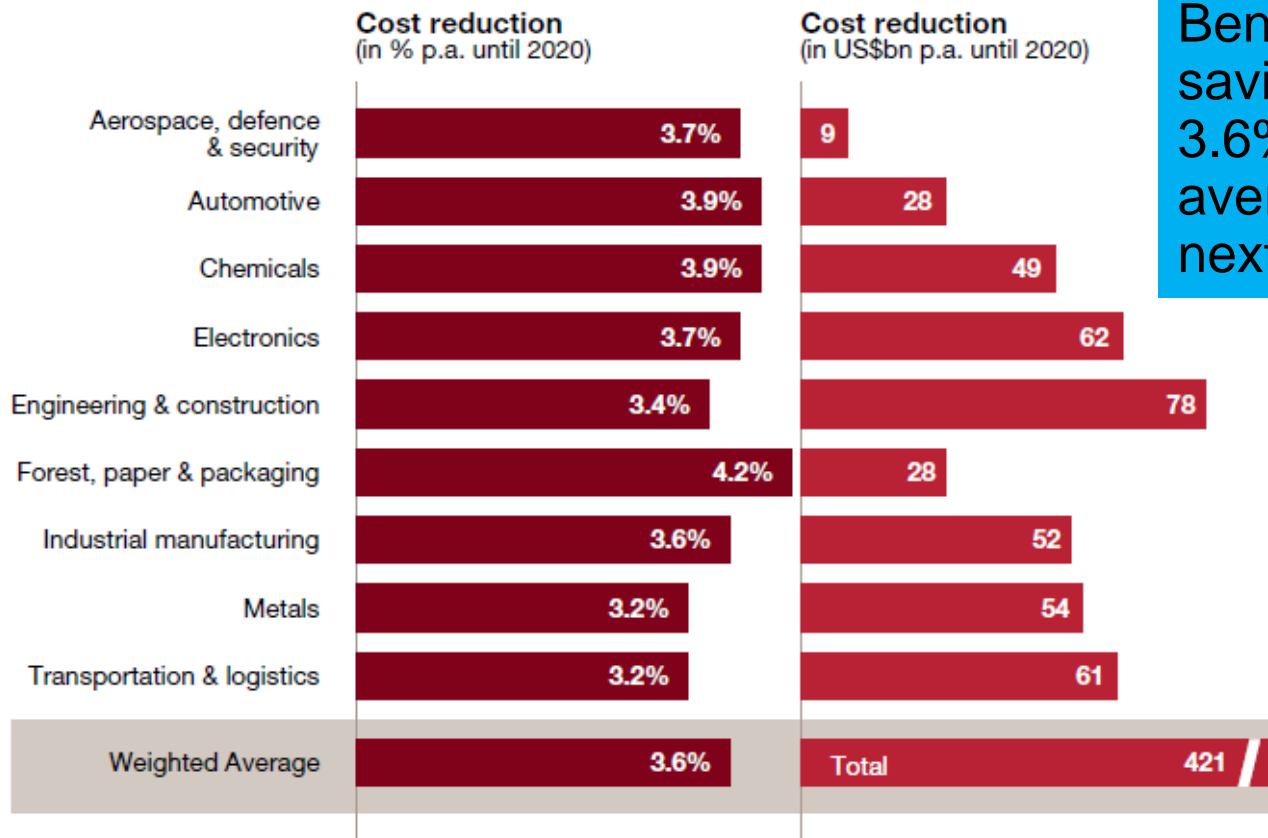
# Digital Design & Manufacturing

Many technologies have been available for a while, why now?
- Increased computing power
- Faster broadband speed
- Much more matured, complete ecosystem

# Cost Saving by Sector from Going Digital

**Companies in every industry sector expect significant cost reductions**

| | Cost reduction (in % p.a. until 2020) | Cost reduction (in US$bn p.a. until 2020) |
|---|---|---|
| Aerospace, defence & security | 3.7% | 9 |
| Automotive | 3.9% | 28 |
| Chemicals | 3.9% | 49 |
| Electronics | 3.7% | 62 |
| Engineering & construction | 3.4% | 78 |
| Forest, paper & packaging | 4.2% | 28 |
| Industrial manufacturing | 3.6% | 52 |
| Metals | 3.2% | 54 |
| Transportation & logistics | 3.2% | 61 |
| Weighted Average | 3.6% | Total 421 |

**Message:** Benefit in cost saving could be 3.6% p.a. on average in the next 5 years

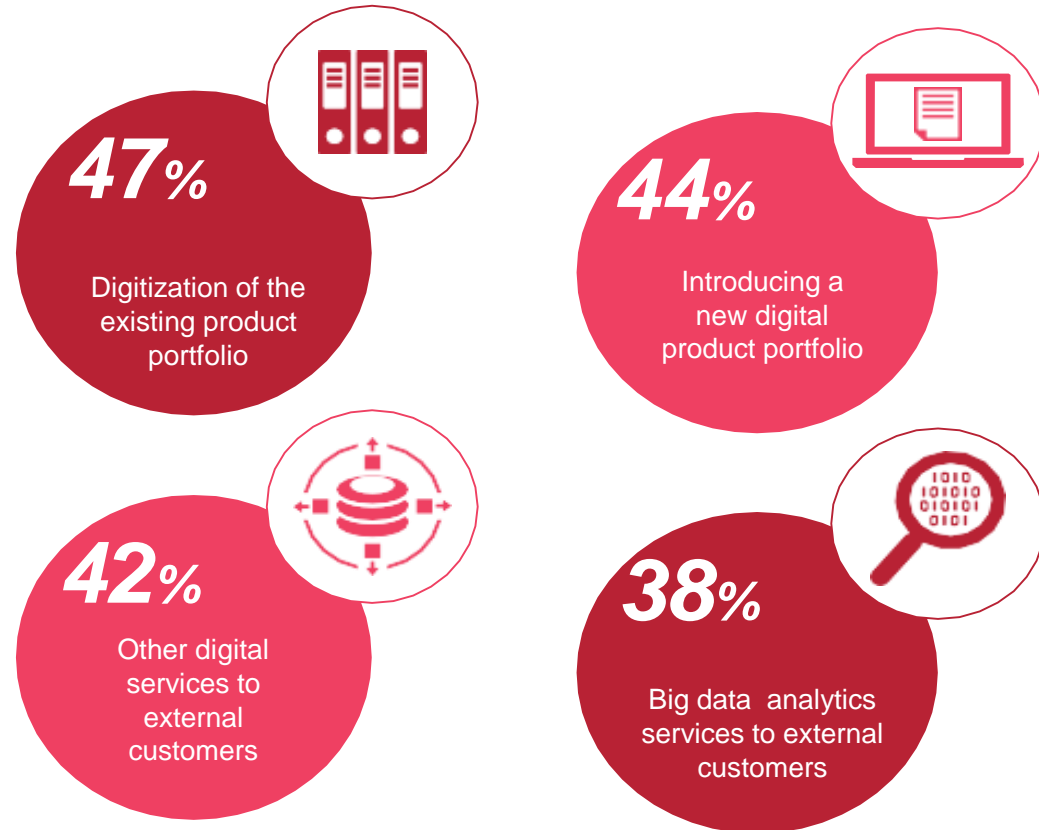Q: What cumulative benefits from digitisation do you expect in the next 5 years? Lower costs.

Source: PwC 2016 Industry 4.0 Survey. This survey covered 2000+ companies over 29 countries.

# % Revenues Growth from Going Digital

*The product and service portfolio will grow significantly in future: Numbers refer to growth between 2017 and 2021*

**Message:**
Benefits include revenue growth in addition to cost savings

**47%** Digitization of the existing product portfolio

**44%** Introducing a new digital product portfolio

**42%** Other digital services to external customers

**38%** Big data analytics services to external customers

Source: PwC 2016 Industry 4.0 Survey

# Cost / Benefits from Deploying Digital / Industry 4.0

**US Department of Defense:** By just creating and using the same solid model to integrate design & manufacturing:

Case 1: Lockheed & two major suppliers Honeywell and
    Rockwell Collins

   - Annual recurring saving: $22M

   - One time saving: $9M

Case 2: 10 additional US defense contractors

   - Annual recurring saving: $48M

   - One time: $28M

(Source: Dr. Greg Harris, Auburn University, Former employee at US Army Manufacturing R & D)

**Message:**
Both one time & recurring benefits could be significant in discrete manufacturing

# Blueprint for Digital Success

2017

2018 - 2021

**Blueprint for digital success**

| | | |
|---|---|---|
| Map out your Industry 4.0 strategy | Create initial pilot projects | Define the capabilities you need |
| ① | ② | ③ |

| | | |
|---|---|---|
| Become a virtuoso in data analytics | Transform into a digital enterprise | Actively plan an ecosystem approach |
| ④ | ⑤ | ⑥ |
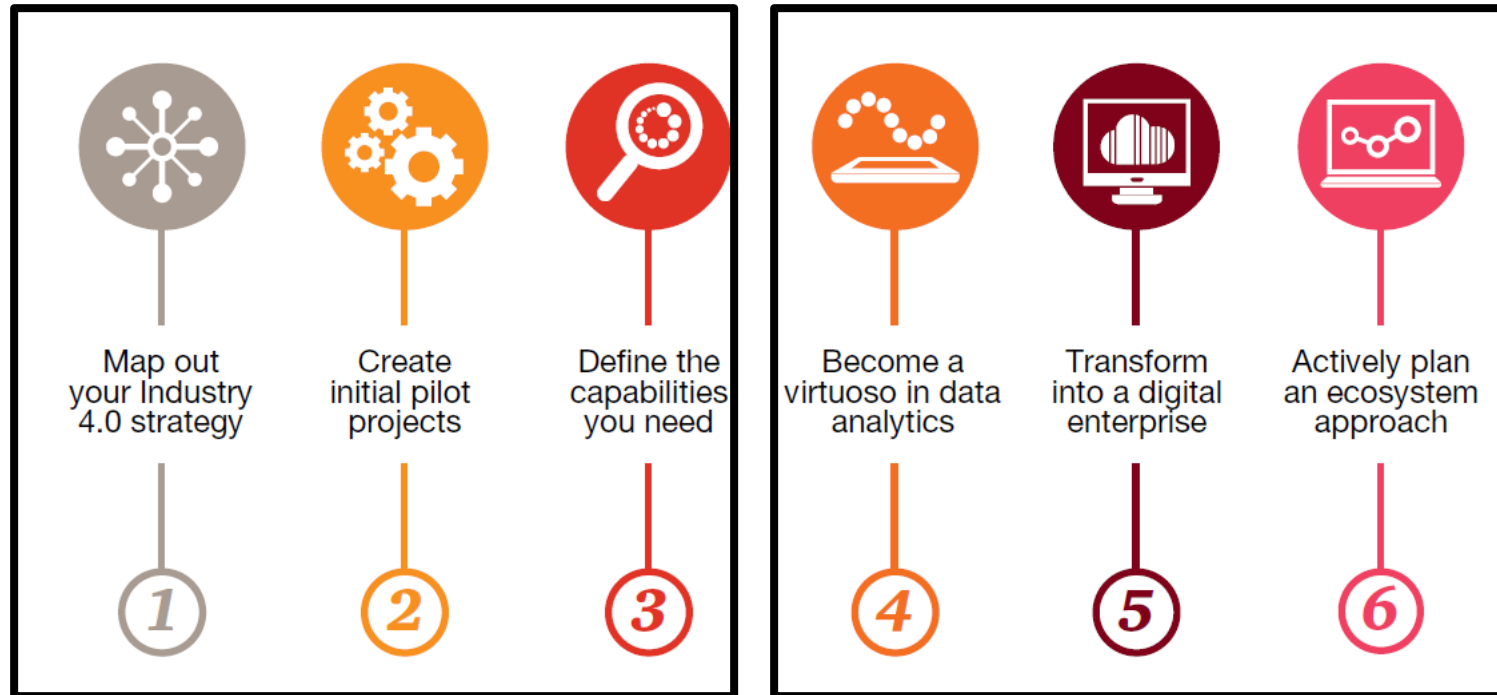
**PLEX and Siemens PLM will be our backbone**

Source: PwC 2016 Industry 4.0 Survey

# Enterprise Information Systems



Michigan City PLEX enabled
1. EDI publication of CVG demand forecast
2. Digital invoice & payment w/ suppliers
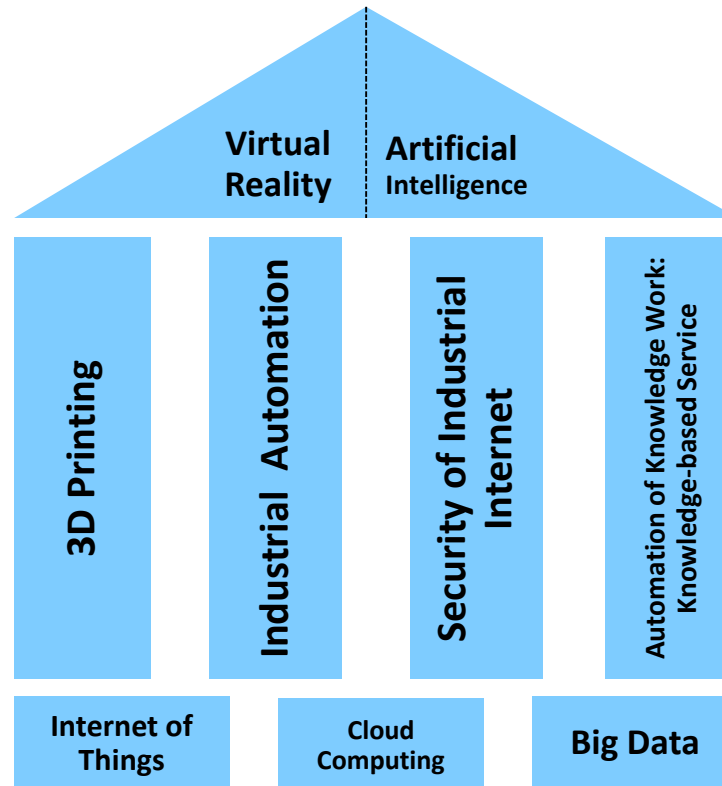
**PLEX:** CVG ERP / MES / SCM / CRM
**Siemens Teamcenter:** CVG PLM / MES

Vertical

ERP

Sales

Suppliers

**SCM** (Purchasing, Logistics, SQE, AP)

**PLM** (PDM + MDM)

**MES** (Mfg Execution System)

Customers

**CRM** (Customer Relationships Management)

Engineering / Product Dvlpmt

Production Operations

Horizontal

Gary Hamberg CRM
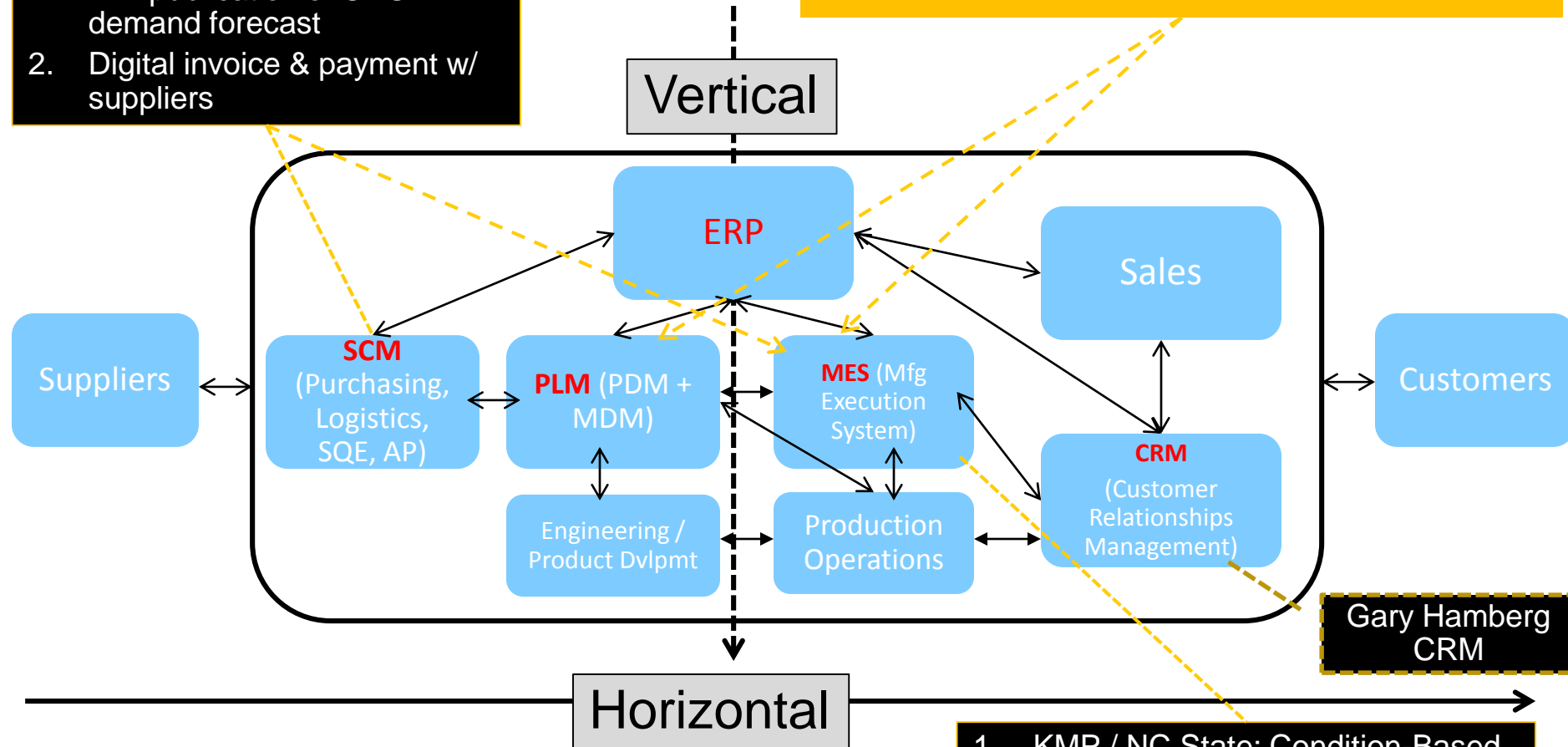
1. KMP / NC State: Condition-Based Maintenance in welding & painting
2. Concord / Chillicothe / Ohio State: Real time inventory tracking / production reporting
3. Northampton: Real time production data report and display

CVG
Commercial Vehicle Group, Inc.

# Nine Enabling Technologies of Industry 4.0

**Nine** Enabling Technologies of Industry 4.0

# CVG Digitized Visual Factory Examples

Northampton real time data collection & display
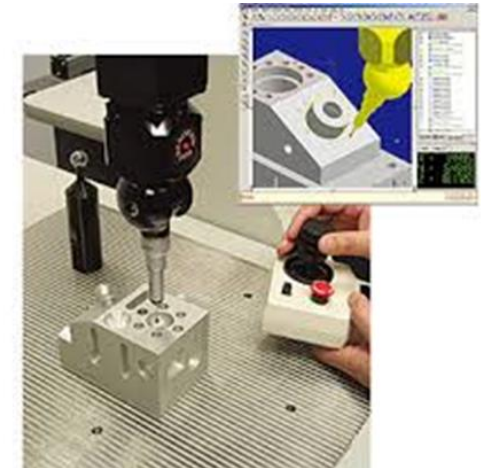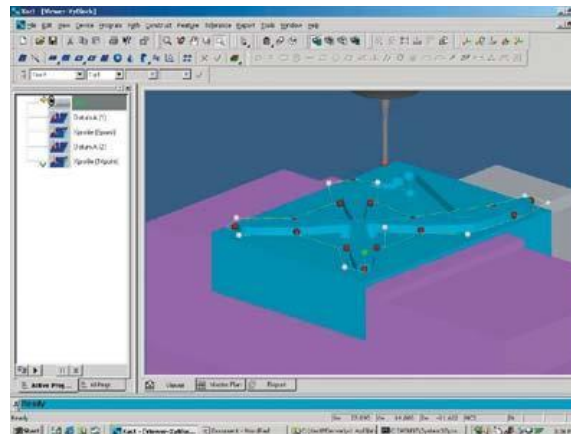
Chillicothe electronic delivery of work instructions and updates

## Digital Design / Product:

1. Align PLM system to Siemens

2. Move from 2D to 3D solid model-based definition

3. Product upgrades/ new designs ready for digital factory

4. Concept to finished product logistics processed with corporate-wide uniformity
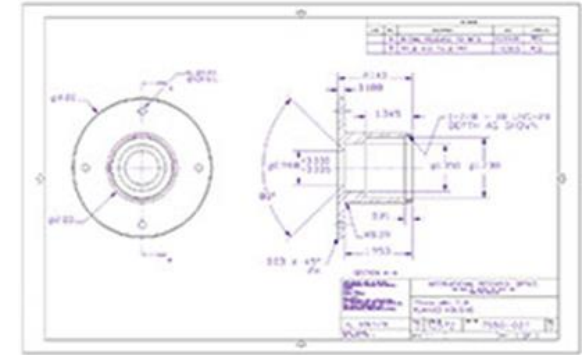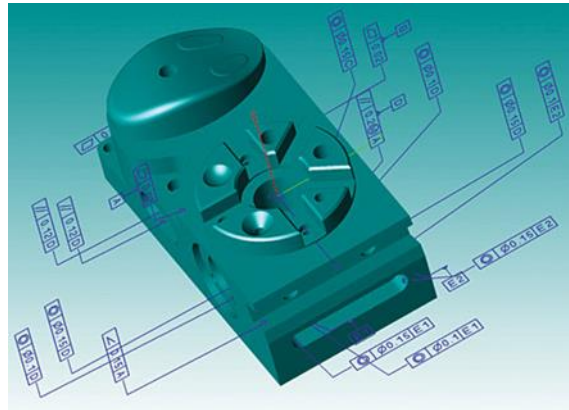


**3D featured or model based models are foundational to enable downstream virtual simulation of products / processes / systems**

# Digital Factory

**Digital Factory:**

1. Digital simulation of production & process planning

2. Real time data collection and display

3. Automatic / real time data consolidation and data mining

4. Connectivity of devices within each plant and with the enterprise system





**Real Time Data Driving Actions**

**Digital Transaction:**

1. EDI demand receiving from customers

2. Digital invoice to customer

3. Digital market intelligence

4. EDI publication of CVG demand

5. Digital payment to suppliers



**Seamless Data Exchange w/ Suppliers & Customers**

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**Edward P. Fitts Department of Industrial and Systems Engineering**

# SMART MANUFACTURING RESEARCH

## Paul H. Cohen

### Edgar Woolard Distinguished Professor
### Edward P. Fitts Department of Industrial and Systems Engineering
### North Carolina State University

**Edward P. Fitts Department of Industrial and Systems Engineering**

# Outline

- Drivers
- What are others are doing?
- Research directions
- Are we preparing the industrial engineering workforce.



**Edward P. Fitts**
**Department of**
**Industrial and Systems**
**Engineering**
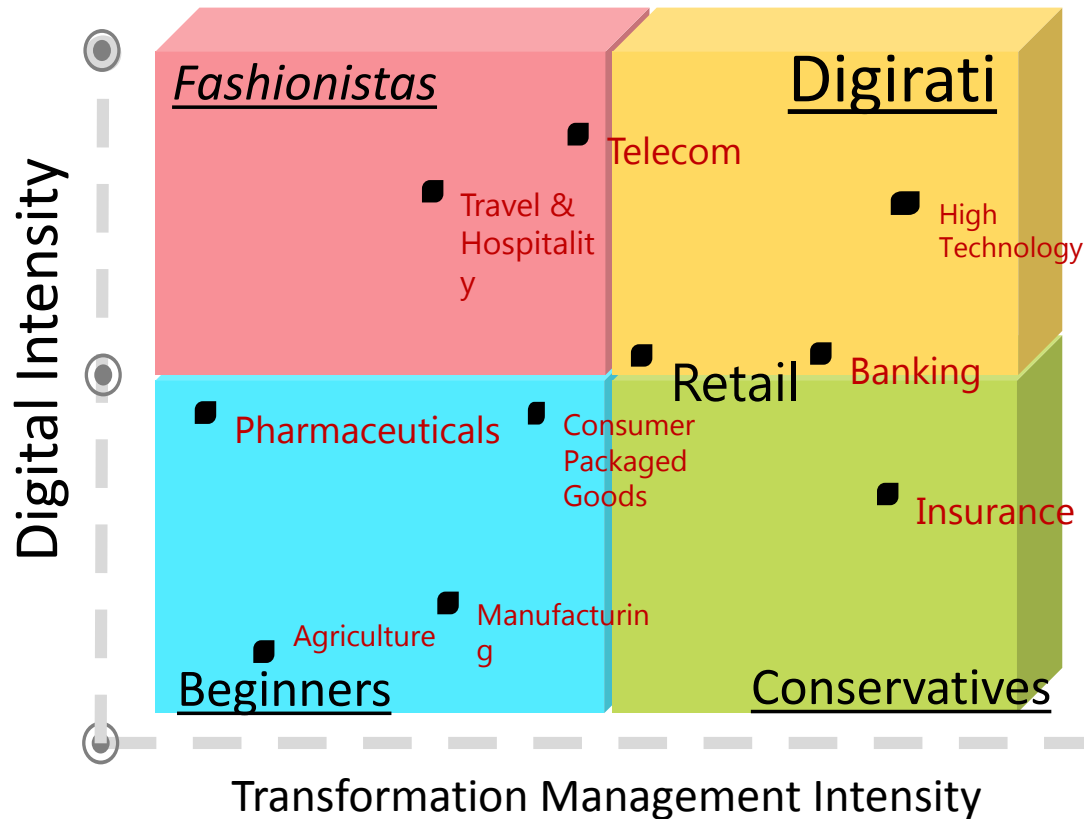
# Digital Intensity



Digital Intensity measures how advanced digital initiatives are within an organization. This includes investment in customer experience, operational processes, business model transformation, as well as digital capabilities.

Transformation Management Intensity measures senior executives' capability to drive change throughout the organization. This includes creating and communicating a clear vision, establishing governance mechanisms, facilitating cross-silo coordination, and building a digital-ready culture

*MIT Center for Digital Business, 2014*

Edward P. Fitts Department of Industrial and Systems Engineering

# Confirm Smart Manufacturing Center (Ireland)
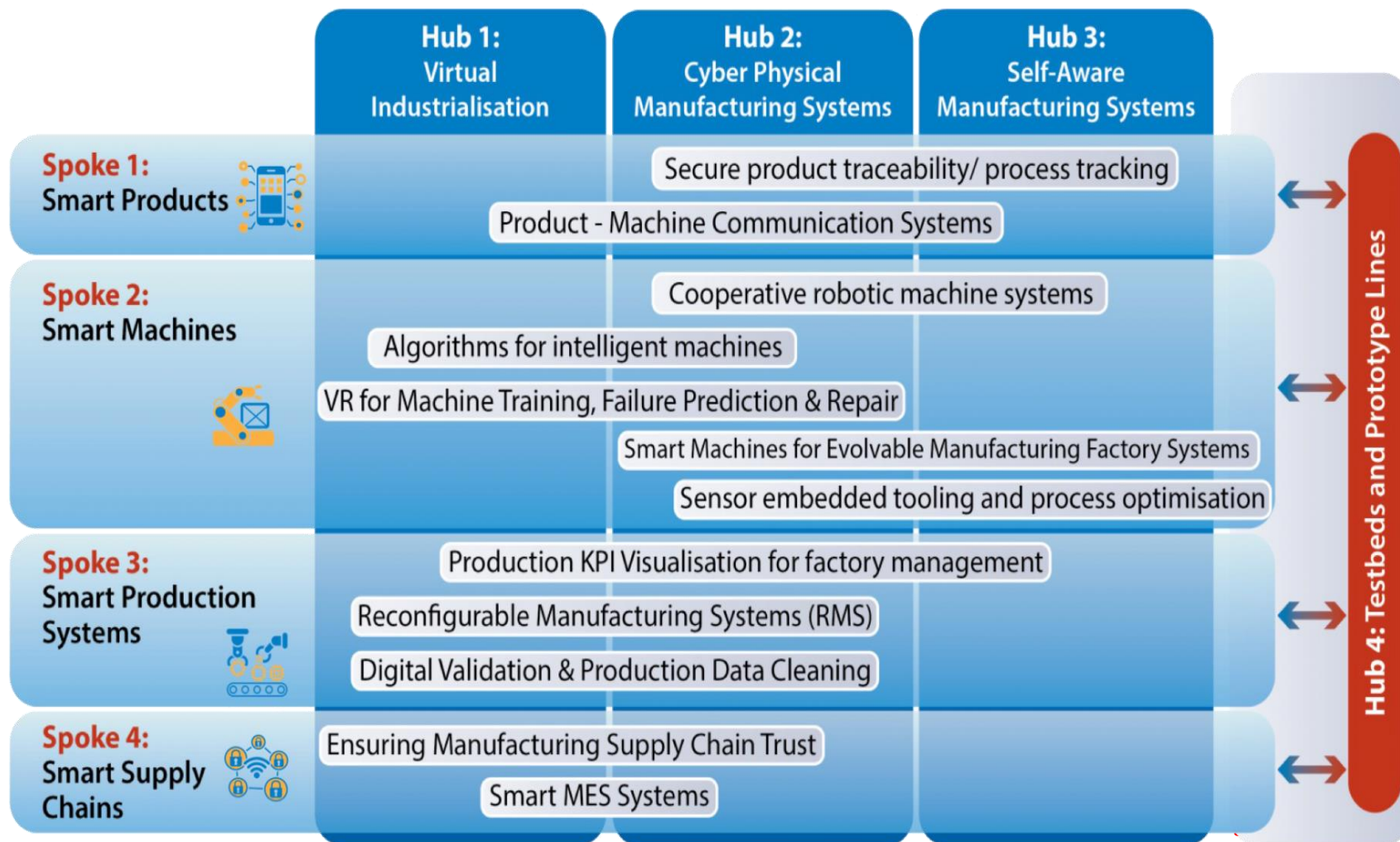
# Clean Energy Smart Manufacturing Innovation Institute (US)

## Defining CESMII'S **R&D Portfolio**

To facilitate implementation of new manufacturing solutions and integration of operational technologies and information technologies (OT/IT), CESMII will **accelerate early-stage R&D** in ways no company or industry can do alone.

The CESMII R&D Portfolio will simultaneously **address knowledge gaps and advance innovation in SM technology, processes, and workforce.**

**Research**

**Technology Development**

**Product Integration**

**Market Implementation**

**Early-Stage R&D**
- Advanced sensors
- Models and computational tools
- Data structures and configurations
- Process controls
- Hardware
- Software

**Early-Stage R&D**
- Reference architectures
- System configurations
- System models
- Interoperability standards

**Early-Stage R&D**
- Security requirements
- Human-technology interfaces
- Data management
- Process models
- Business change management
- Workforce skills development

Industry driven.

Emphasis on energy savings (funded by DOE).

Emphasis on process industries.

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# Smart Manufacturing Research
## *The convergence of the digital and physical worlds*

- Smart Products and Design
  - Product traceability
  - Communication and product reliability
  - "Design made simple" and DFM
  - IoT platforms
- Smart Machines
  - Process modeling, reduced order modeling
  - Sensors and control for process optimization and quality monitoring
  - Self-aware machines that predict when maintenance is needed.
  - Process analytics and machine learning
    - Process control and quality
    - Maintenance



*Where does data reside?*
*Interoperability?*
*How are communications accomplished?*
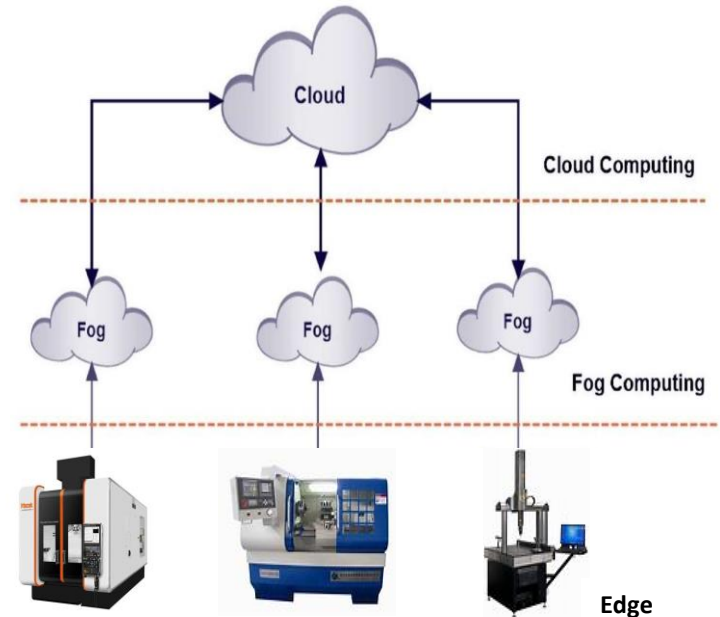*Security?*

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# Smart Manufacturing Research
## *The convergence of the digital and physical worlds*

- Smart Production Systems
  - Real-time scheduling to reduce energy consumption, maximize machine up-time and meet due dates.
  - Reconfiguration of production systems.
  - Predictive anomaly identification and resolution.
  - Can project errors or delays and seamlessly formulate measures to prevent incidents from occurring. (Self-aware)
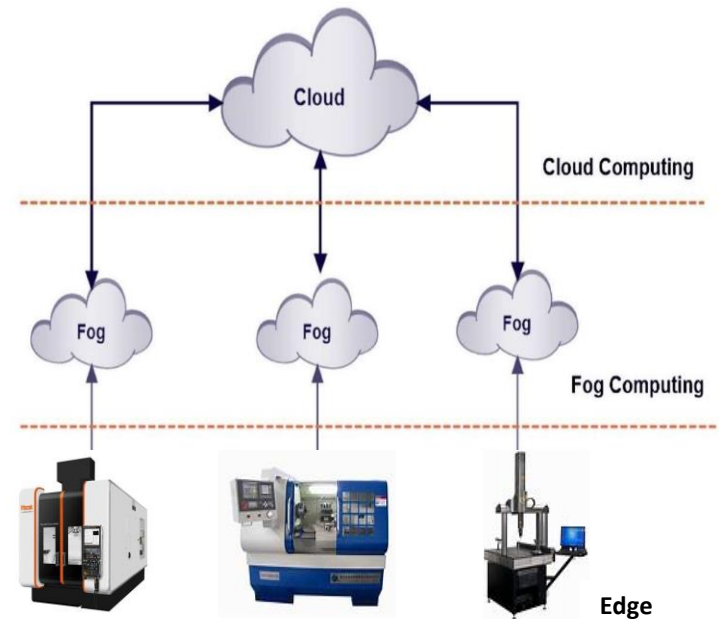
- Smart Supply Chains
  - Real-time linkage and incorporation of customer demand forecasts.
  - Manufacturing as a Service (Maas)
    - Modeling of trust
    - Architectures and algorithms to ensure fairness and participation.



*Where does data reside?*
*Interoperability?*
*How are communications accomplished?*
*Security?*

**Edward P. Fitts**
**Department of**
**Industrial and Systems**
**Engineering**

# Industry 4.0 – Competence Center
## (Hanover, Germany)

**Logistics**
– organization of production networks
– decentralized regulation of production in        networks
– secure flow of materials
– efficient logistics
– efficient use of resources

**Production Automation**
– industry 4.0
– distributed systems
– wireless communication
– automated guided vehicle systems
– intelligent systems

**Process Technology**
– forging processes
            (e. g. flashless precision
            forging)
– hydro forming
– hybrid forging (massive, sheet metal)
– process chain forming technology
– multifunctional tools
– the cost-effectiveness of process chains

**Edward P. Fitts Department of Industrial and Systems Engineering**

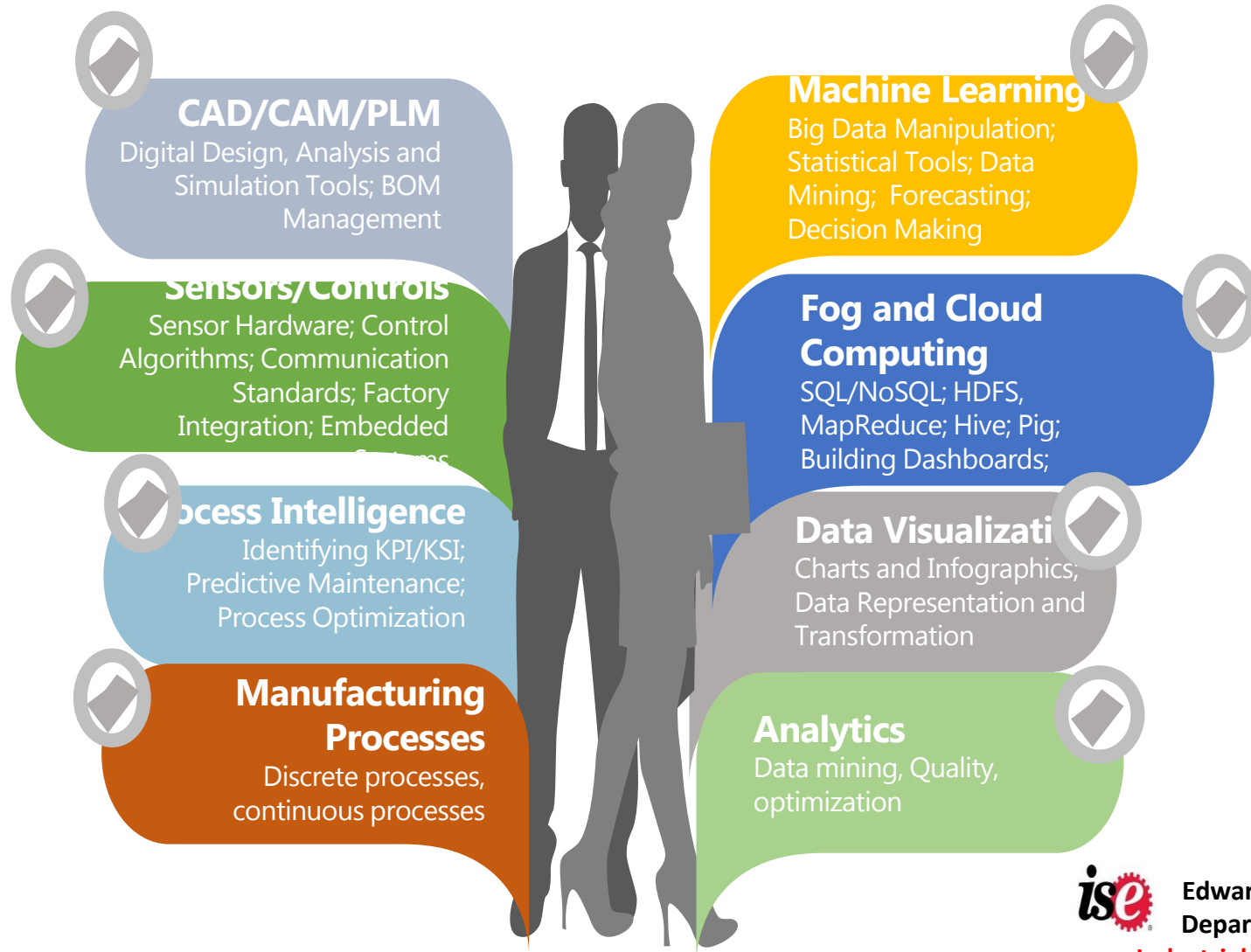# Confirm SM Competencies

- Data Analytics
- Artificial Intelligence
- Predictive Modeling
- Decision Analytics
- Product and Process Modeling
- Enterprise Modelling & Simulation

- Software Systems
- Human Computer Interface
- Security & Integration
- Networking Systems & IOT
- Sensors
- Robotics & Control
- Material Processing

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# Skillsets for Industrial Digital Engineers

## Core Industrial Engineering Skills with Sensors + Information + Computing Skills

**IISE** — Manufacturing & Design Division

**CAD/CAM/PLM**
Digital Design, Analysis and Simulation Tools; BOM Management

**Sensors/Controls**
Sensor Hardware; Control Algorithms; Communication Standards; Factory Integration; Embedded Systems

**Process Intelligence**
Identifying KPI/KSI; Predictive Maintenance; Process Optimization

**Manufacturing Processes**
Discrete processes, continuous processes

**Machine Learning**
Big Data Manipulation; Statistical Tools; Data Mining; Forecasting; Decision Making

**Fog and Cloud Computing**
SQL/NoSQL; HDFS, MapReduce; Hive; Pig; Building Dashboards;

**Data Visualization**
Charts and Infographics; Data Representation and Transformation

**Analytics**
Data mining, Quality, optimization

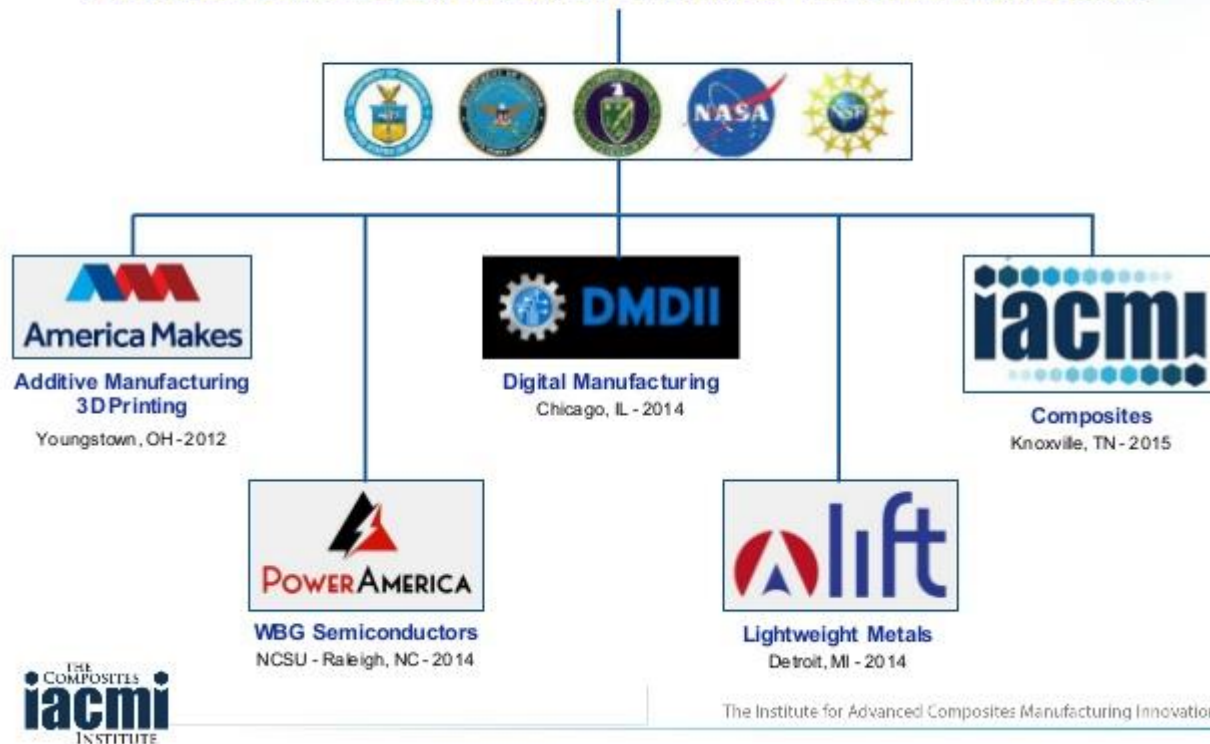**ise** — Edward P. Fitts Department of Industrial and Systems Engineering

# Conclusions

- Research
  - Projections of needs are not in harmony.
  - Large centers internationally are not in agreement of needs.
  - However, it is clear that ISE's should play a large role.

- Education
  - Is ISE education adequate for this challenge....probably not.
  - Organizations are just not organizing to identify the skill sets and these must be translated into courses and programs.

Edward P. Fitts
Department of
Industrial and Systems
Engineering

National Network for Manufacturing Innovation(NNMI)

President Obama's 2013 and 2014 State of the Union Addresses

# Agenda

| | |
|---|---|
| 12:00 | Scott Tee-up |
| | Quick Overview of Purpose and Objectives of Webinar |
| | High Level Overview of this Abstraction |
| 12:15 | Jack Feng—Implications for ISE's at the Company and Plant Level |
| 12:30 | Paul Cohen--ISE Research Implications |
| 12:45 | Q&A and tee up the rest of the Series |
| 1:00 pm | Adjourn |

# Questions

**Nov. 6, 2018**      **Service Systems "4.0"—***Service Systems Engineering and ISE*

❑  Penn State IME Dept. Service Enterprise Engineering Advisory Board— *overview of Service Systems Engineering and the new IISE Award*

❑  Michael Caesar, Executive Director, Data and Implementation Science, University Health Network, Toronto, Canada—*Heathcare 4.0*

❑  David Poirier, CEO, The Poirier Group, Toronto, Canada—*Enterprise Shared Services 4.0*



From Systems to Services: an Introduction to Service Systems Engineering



IMPLEMENTATION SCIENCE

- *Impactful delivery of solutions benefiting the health system*
- Portfolio, Program & Project Management
- Lean SixSigma & Quality Improvement
- Agile & Scrum Approaches
- Business Analysis
- Process Engineering
- Change Management
- Benefits Realization & Value Measurement
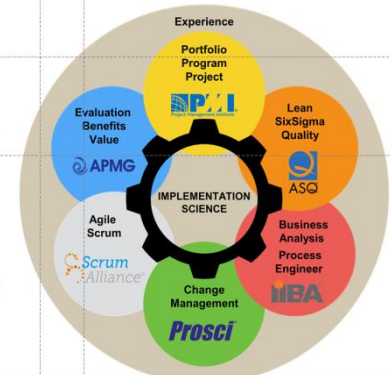
# The "Industry Track" Orlando May 2019

- We have built a mini-conference specifically designed for Young Professionals, Seasoned ISE Practitioners, Leaders and Managers of the ISE Function in Business and Industry.

- Four Focus Areas with 6 great presentations in each of the four areas:

  1. **Soft Skills Development:** improving your change leadership and management knowledge and skills
  2. **Career Development:** Trends and Emerging Opportunities in our Field
  3. Continuing to **broaden and deepen** your ISE Foundational Knowledge and Skills
  4. How to **create more Value** for your Organization and in doing so advance your career faster



Jim Tompkins
Chairman & CEO, Tompkins
Chairman & CEO, MonarchFx

- All Invited Speakers will ensure every session is outstanding.

- **Jim Tompkins** is our Industry Track Keynote Speaker—
  if you haven't heard Jim speak you are in for a treat!!

- Balanced presentations across Industry Segments (services, Healthcare, Manufacturing, Supply Chain and Logistics)

- Goal is to make it efficient and fun for you to do some Personal and Professional Development in 2019

**ANNUAL CONFERENCE & EXPO 2019**

May 18-21, 2019 • Rosen Shingle Creek Hotel • Orlando, Florida

Home    Registration    Schedule    Program    Hotel/Travel    Exhibitors    Sponsors    University Sponsors    Join IISE

# The "Industry" Track for Orlando 2019



And, in addition to those 24 Practical, Pragmatic Presentations by hand-picked presenters on topics ranging from habits of highly effective Young Professionals to Smart Manufacturing and Physical Internet we'll wrap around some Networking opportunities:

- the Annual CISE Leadership Mixer
- the Annual Industry Advisory Board Mixer



- Industry Track Kick-off and Capstone Plenary Sessions
- The Executive Roundtable
- Townhalls for IAB and Young Professionals

- Huge opportunity to build your network and mentor and get mentored

# INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS
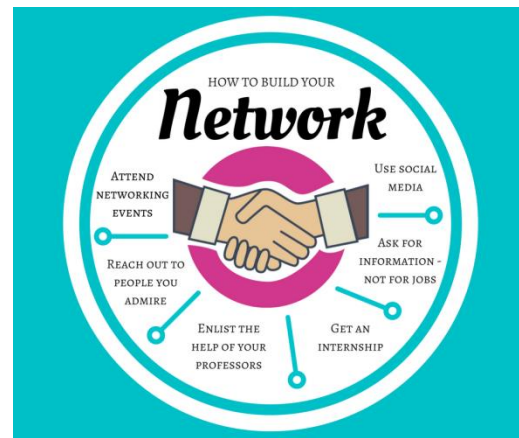
## So, First things First, take some time out and invest in yourself



It Pays Off—I've attended 45 IISE Conferences and the Return on Investment has been 25+:1 !!!