Model-Based Enterprise Summit 2016

Overview NSF Center for e-Design

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Challenges and Opportunities

The landscape of competitiveness is constantly changing !

- Difficult economic times and several years of off-shoring
- Complex systems
- Rapidly changing technology
- Global economy
- Investments in innovation
- Diversifying the workforce
- Innovative engaged engineering education

People, Processes and Systems …

Faster, Smarter, Higher Quality, Lower Cost

YES !

Center for e-Design

IT Enabled Design and Realization of Products and Systems





+ PennState College of Engineering

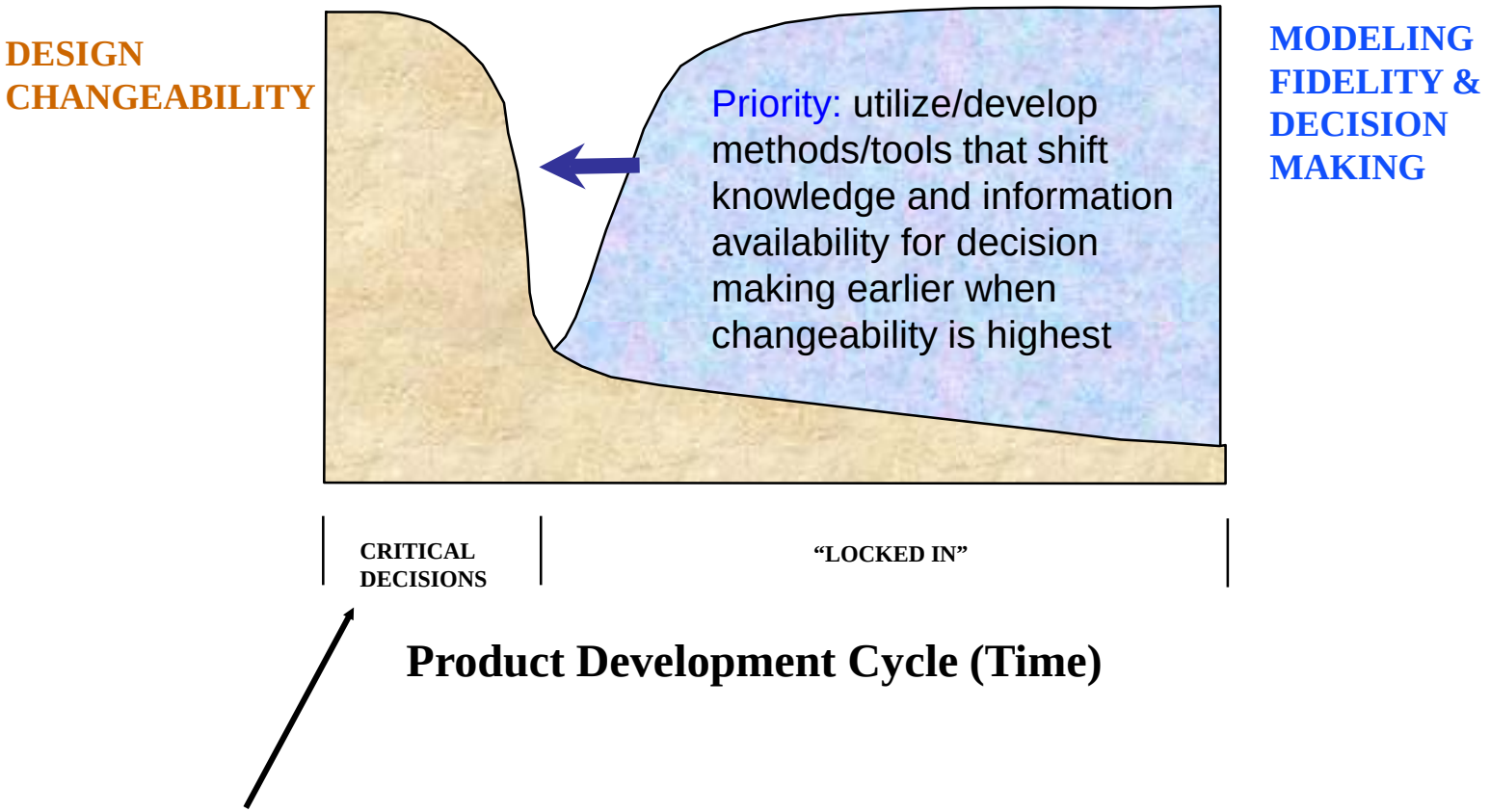
BYU Brigham Young University · Illinois · Iowa State University · OSU Oregon State University · University at Buffalo The State University of New York · UMass Amherst · Wayne State

Efficient, Effective, Competitive

Design of products and systems considering a variety of stakeholders and life-cycle stages

- Designers
- Suppliers
- Customers
- System Integrators
- Manufacturers

Impact of Design Decisions



-- COST, PERFORMANCE, and QUALITY GET LOCKED IN EARLY --

Industry Technology Needs

- Remote and distributed collaborative design
- Collaboration among stakeholders
- Customer-oriented
- Interoperability among heterogeneous systems and tools
- Multidisciplinary constraints
- Scalable, flexible and efficient
- Virtual product prototyping
  - Physically realistic
- Design for X

Two-fold Mission

1. Enable the design and realization of high quality products and systems at reduced cost and reduced time to market through **research and development of methods and tools** for:
   - Improved design process and methods
   - Knowledge/information capture and reuse
   - Integration environments
   - Decision support

2. To **nurture and cultivate a new breed of engineers, scientists, and business leaders** through a synergistic university/industry collaborative model

Research Thrust Areas

- Enabling Information Infrastructure
- New Design Paradigms and Processes
- Design Optimization
- Visualization and Virtual Prototyping
- Design Education

Thrust Area: **Integration** – Develop new methods and tools to integrate engineering design with manufacturing, supply chain, and maintenance.

Capabilities: Designing for Additive Manufacturing (tools, processes, procedures), Automated Manufacturability Analysis, Supply Chain Analytics

Industrial relevance: Disrupting the traditional siloes of design, manufacturing, and maintenance processes

Thrust Area: **Innovation** – Develop new engineering design processes such as social-centric design methodologies and crowdsourcing for collective innovation.

Capabilities: Development of tools and processes for Additive Manufacturing, Crowd sourced design paradigms and tools

Industrial Relevance: Open source paradigms have proved successful in the software development domain. Similar success is anticipated in the design and development of hardware systems. Tools and processes are the key to unlocking the potential of social-centric design and manufacturing of products and services.

Thrust Area: **Infrastructure** – Develop new computing and communication infrastructures to simplify, normalize, and accelerate product development processes used by corporations and their supply chains.

Capabilities: Cloud Computing, Cloud-Based Digital Manufacturing, Network and graph analytics

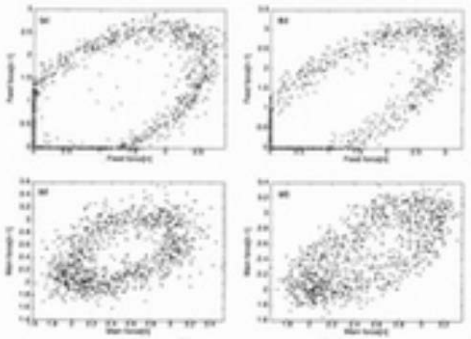
Industrial Relevance: The manufacturing sector generates a significant amount of data and represents a largely untapped tapped resource. Big data analytics and cloud computing can harness this potential and improve design, manufacturing and maintenance of complex products.

Thrust Area: **Intelligence** – Develop intelligent and data-driven systems that allow companies and organizations to make better and faster business decisions.

Capabilities: Cloud Computing, Cloud-Based Digital Manufacturing, Supply chain modeling and analysis, Sensors and sensor Networks, Graph Analytics

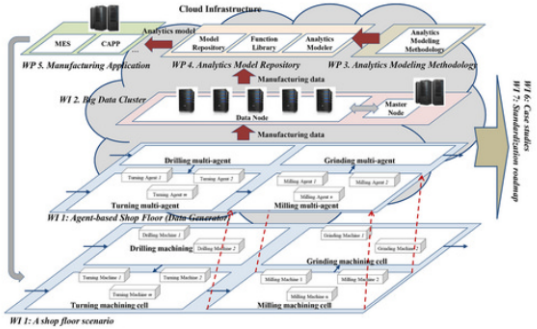
Industrial Relevance: Leveraging advances in computing and analytics infrastructure, advanced algorithms and tools enable data-driven systems to provide critical decision making information to the right person at the right time.

Cloud-Based Digital Manufacturing is a customer-centric manufacturing model that exploits on-demand access to a shared collection of diversified and distributed manufacturing resources to form temporary, reconfigurable production lines.



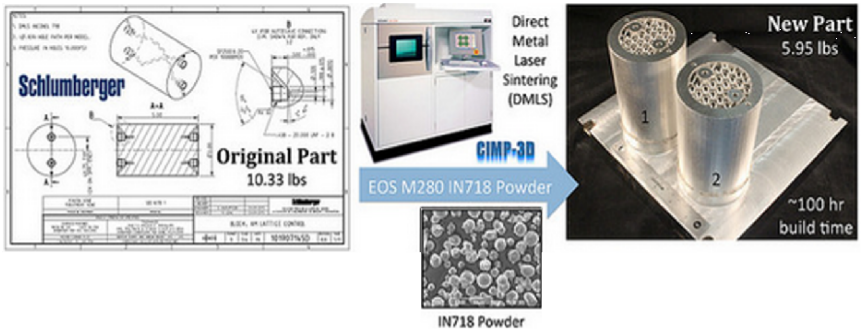
Sensors & Sensor Networks

Hardware and software research to collect and analyze shop floor data.



Cloud Computing

Computational and information processing research and development to enable on-demand data analysis.

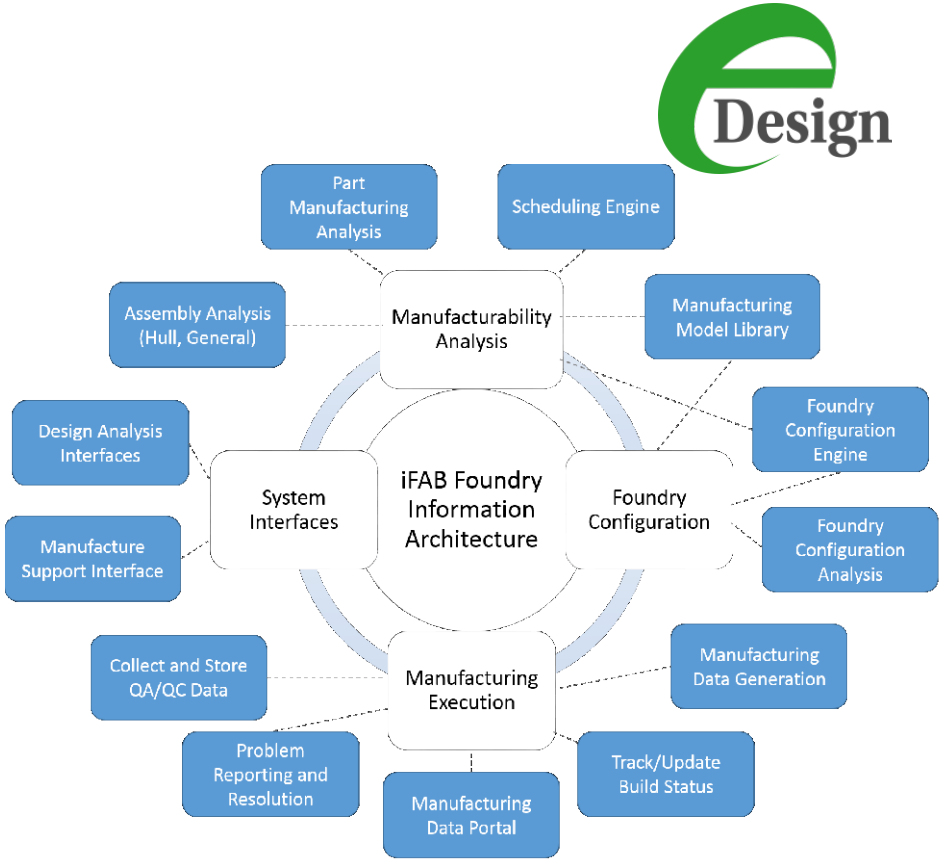


Designing for Additive Manufacturing:

Lightweighting a 3D Printed Metal Part, Part Consolidation, etc. Developing an integrated tool suite / design process to go from print to part.

PennState Applied Research Laboratory

Collaborative relationship with the PSU Applied Research Lab Materials and Manufacturing Office to increase TRL levels. Leverage experience in additive manufacturing (CIMP-3D), production engineering, and supply chain.



Automated Manufacturability Analysis and Assessment: CAD-enabled tools that bring manufacturing (fabrication, assembly, supply chain) to the left.

Manufacturability of Complex, Custom Engineered Components

Product and process design and development for complex components and assemblies.

Supply Chain Analytics

Strategic: Tools and Analyses for planning and forecasting. Tactical: Tools and Techniques to support real-time decision making. Research thrusts in global supply chain design, visibility, and suppler selection.

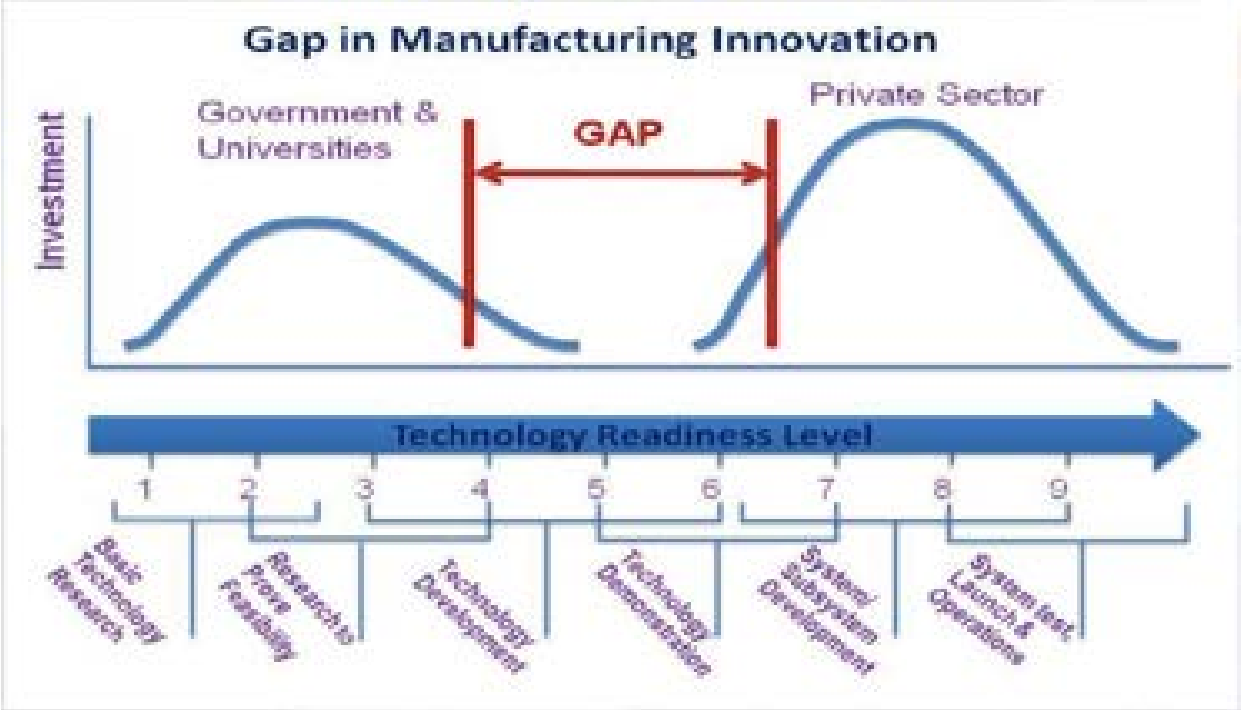
Factory for Advanced Manufacturing Education (FAME)

The Factory for Advance Manufacturing Education (FAME Lab)serves as a research and development testbed for manufacturing, cloud-based digital manufacturing, industrial internet of things, and machining projects in addition to training the next generation Industrial and Manufacturing Engineers.

A Strong and Growing Public Private Partnership

DMDII
DIGITAL MANUFACTURING AND DESIGN INNOVATION INSTITUTE

I/UCRC NNMI



Innovative Engaged Education

- Potential partnership in “micro-factory” for rapid product development and prototyping
- Engineering PRIDE: PRofessional and Integrated Design Education
  - Project-based learning with authentic problems throughout core IME courses
- Millennium Scholars: Growing diversity K-12 to PhD
- NSF INCLUDES proposal: TREES (Teams Researching, Educating and Engineering for Social-Relevance)

Think and work differently

Systems … Integration … in Partnership

Thank you!

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