



Doing More with Less:

Digital Manufacturing and Design Opportunities

Presented by: **6/19/2018**

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Helping manufacturers
SUCCEED

UW-STOUT MANUFACTURING OUTREACH CENTER
A resource of the Discovery Center
Phone. 866.880.2262

Web. www.uwstout.edu/moc

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Abstract –

The workforce challenge is not going away anytime soon. How can businesses continue to **Do More with Less**? UW-Stout's Manufacturing Outreach Center (MOC) facilitates a systematic approach to determine the best path for your operation's future. Recent advancements in Digital Manufacturing and Design (DMD) technology are providing new opportunities to support growth and productivity. The MOC and DMD are here to support your need to **Do More with Less**.

Helping manufacturers
SUCCEED

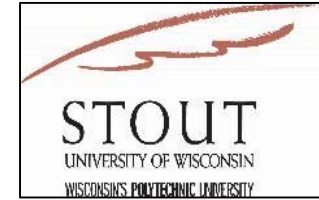
UW-STOUT MANUFACTURING OUTREACH CENTER
www.uwstout.edu/moc

Ron's Background

- 20+ years in Engineering
- BSME, MS Eng, MS PM
- Research, Development and Education
 - Product Development Engineer
 - Procurement Engineer
 - Senior Engineer
 - Remote ET Program Lead/Lecturer
 - Senior PM
- Lead engineer for family of products that became it's own business unit.
- Experience with early adopter of Digital Manufacturing and Design strategy.
- Lead engineer for a \$10M+ DOD R&D project in marine wear coatings. Generated MMC IP.



UW-Stout:



Wisconsin's Polytechnic University

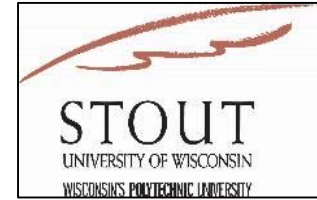


Manufacturing Engineering, Packaging, Food Science, Math, Plastics Engineering, Industrial Design, Hotel and Restaurant Management, Mechanical Engineering, Video Game Design ...

**OUR SAYING: HANDS-ON, MINDS-ON
IN-MAJOR PLACEMENT OF OVER 97%**

9,600+ STUDENTS AND INCREASING

UW-Stout MOC

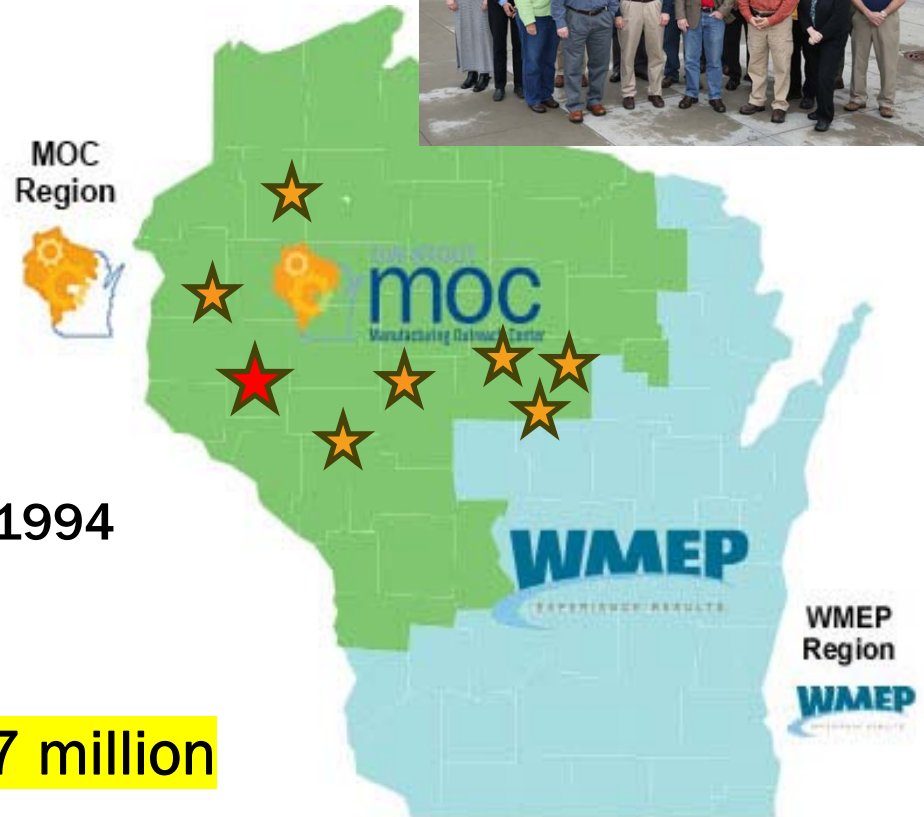


UW-Stout MOC – A Snapshot

3,584 manufacturers in
33 Wisconsin Counties
(green shaded region)



- 8 Project Managers
- 200+ years of industry experience
- Over 700 million \$\$ in **impacts** since 1994
- In the last 4 quarters: (June 2018)
 - Served 198 Manufacturers
 - Create / retained 413 jobs
 - Achieved *client reported* impacts of **\$147 million**



MOC Service Areas

1. Define & Solve Project Resource:

- Strategic Direction
- Growth Services
- Process Improvement
- Digital Manufacturing and Design




Current Condition

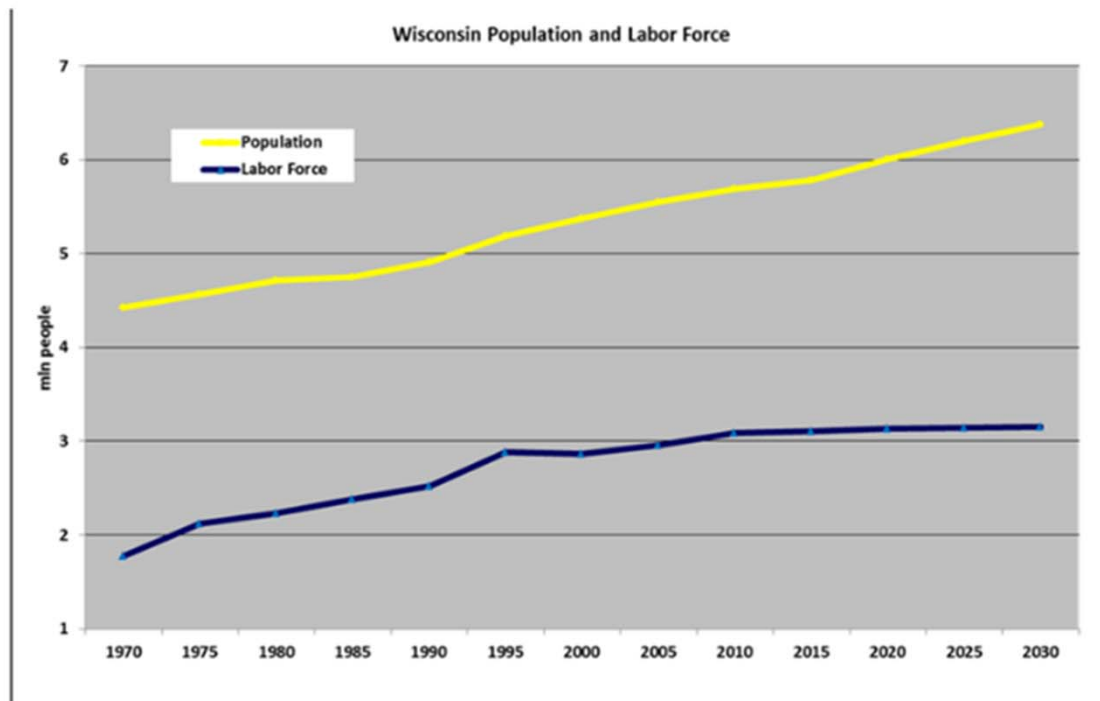
- Discussion:
 - Labor?
 - Capacity?
 - Lead times?
 - Why? Why? Why!
 - Trends...
 - Technology...
 - ???...



Trends

Population increase but, available Labor flat...

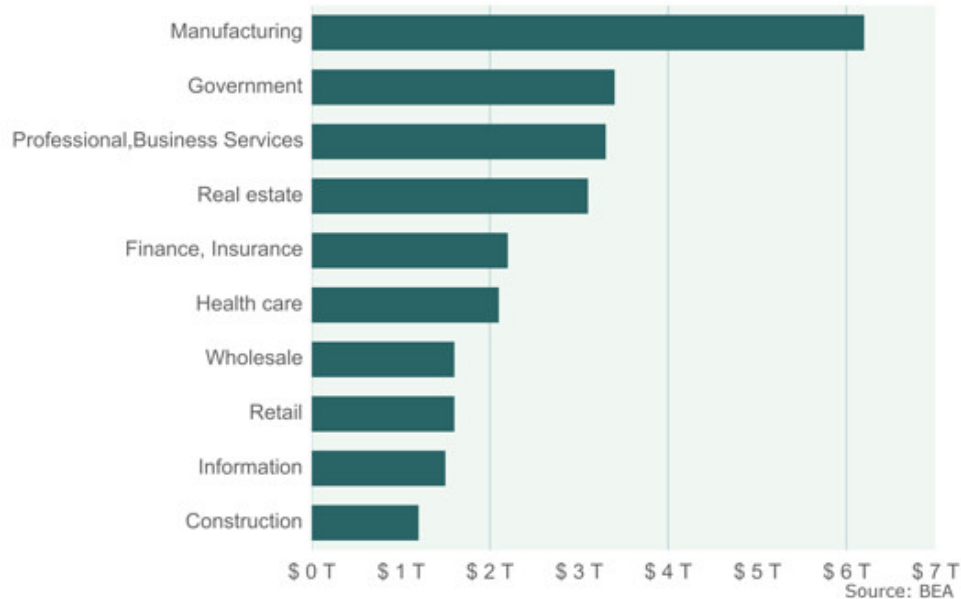
WI Population and Labor Force 



Trends

...still manufacturing is largest sector and growing...How?

Manufacturing is largest sector



■ 2014 gross output, in trillions of dollars

Manufacturing output near record

Index 2012 = 100

Three-month moving average

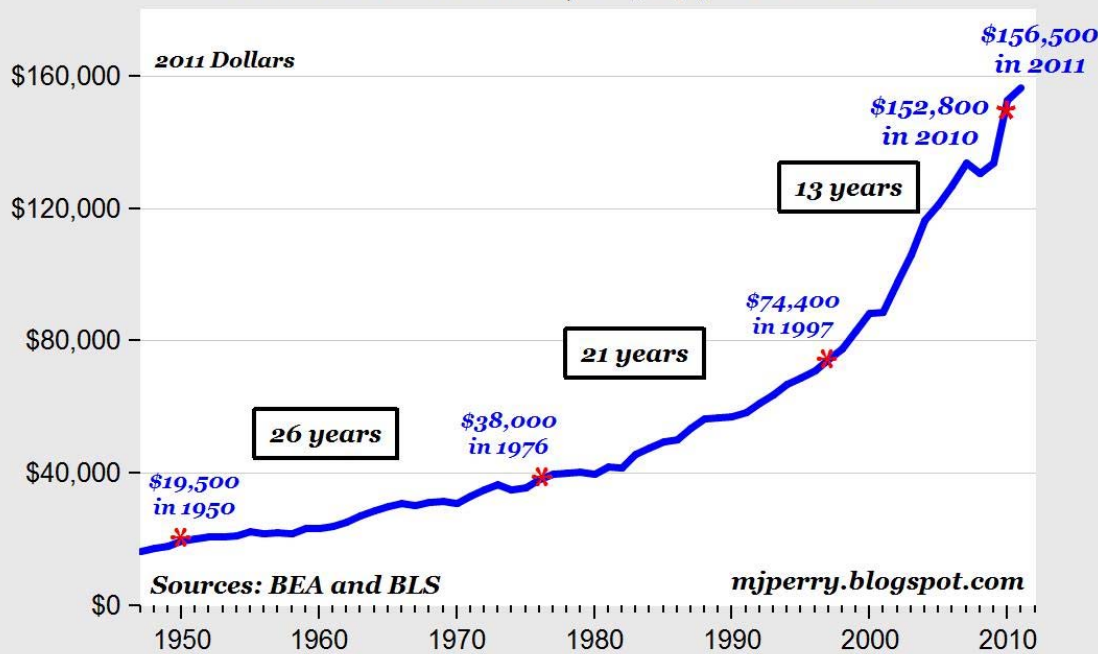


<https://www.marketwatch.com/story/us-manufacturing-dead-output-has-doubled-in-three-decades-2016-03-28>

Trends

...driven by exponential Productivity gains, Technology.

Real Manufacturing Output per U.S. Worker, 1947 to 2011



BOTTOM LINE:

Today's factory workers produce more output in an hour than workers in the 1940s produced in a day.

<https://mjperry.blogspot.com/2012/04/phenomenal-gains-in-manufacturing.html>

Technology

Digital technologies have changed dramatically in recent years, driven largely by three key developments:

- ✓ lower computing costs
- ✓ cheaper storage
- ✓ less costly bandwidth

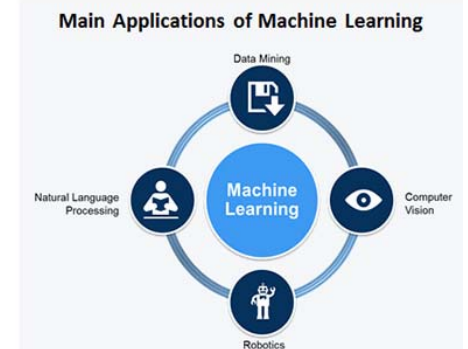


<https://willrobotstakemyjob.com/>



Now > > 2030

Artificial Intelligence could automate close to 50% of jobs in the Western world within the next two decades



In Stock. Ships from and sold by Amazon.com

Quantity:

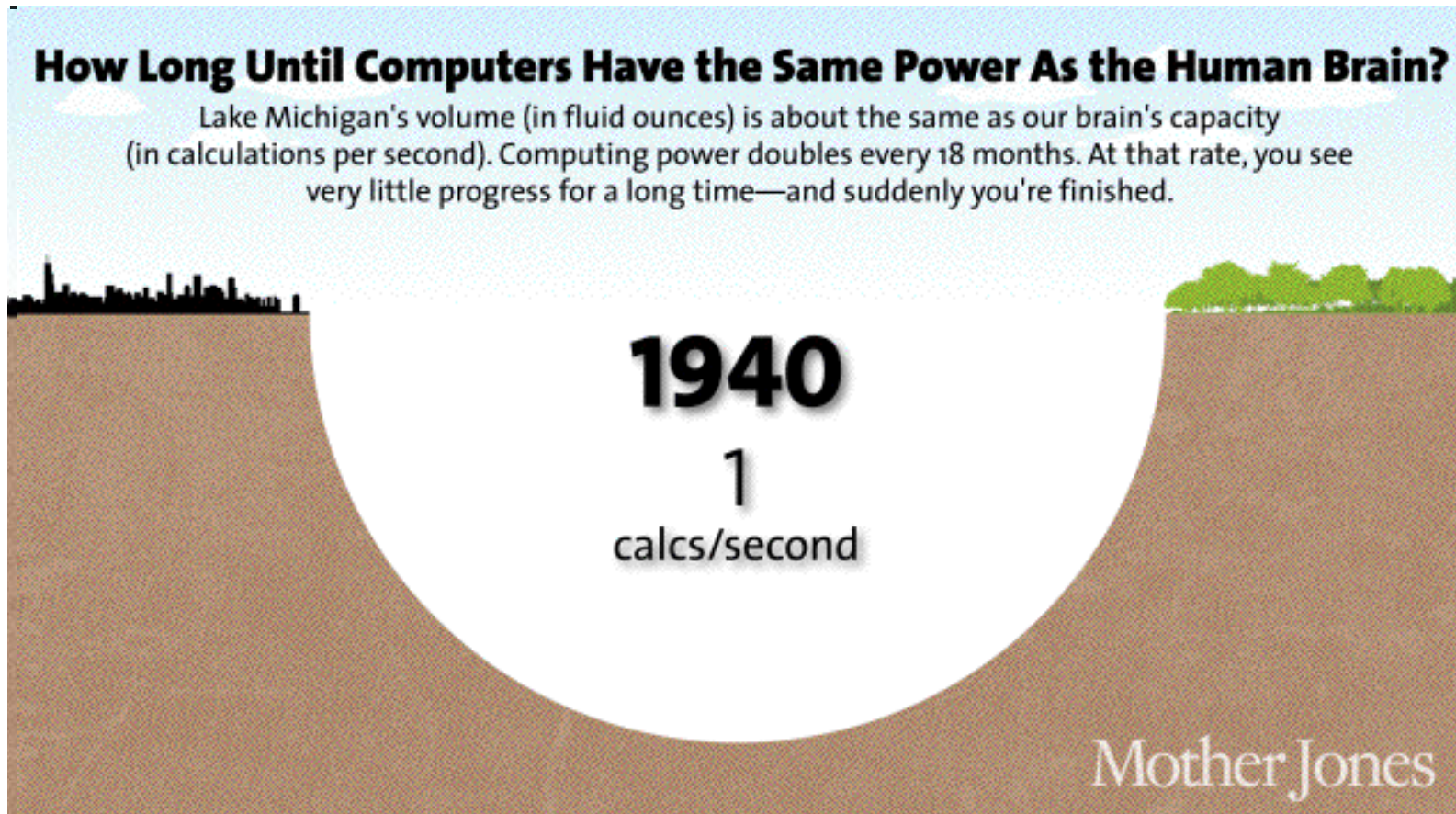
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Technology

Moore's Law in Action



Technology => Data Driven Decision (3D)



“If you went to bed last night as an industrial company, you’re going to wake up this morning as a software and analytics company.”

Jeff Immelt, GE Chairman & CEO

3D = 5 to 6% more Productive

3D + IOT = 25% more Productive

Erik Brynjolfsson, Lorin M. , Hitt and Heekyung Hellen Kim, Strength in numbers: How does data-driven decision making affect firm performance?, (ICIS Proceedings, Paper 13, 2011).

<https://www.upwork.com/hiring/trends/iot-business-cost-reduction-revenue-growth/>

Technology => Data Driven Decision (3D)

Example: Digitally enabled smart home with IOT

Industrial Manufacture

1957

Honeywell T87 Round



2011+

Nest disrupts the thermostat industry by launching a smart, learning, connected thermostat and data platform

Besides introducing new form factors and programmability, they typical residential thermostat has not significantly changed in nearly *60 years*

Software & Analytics

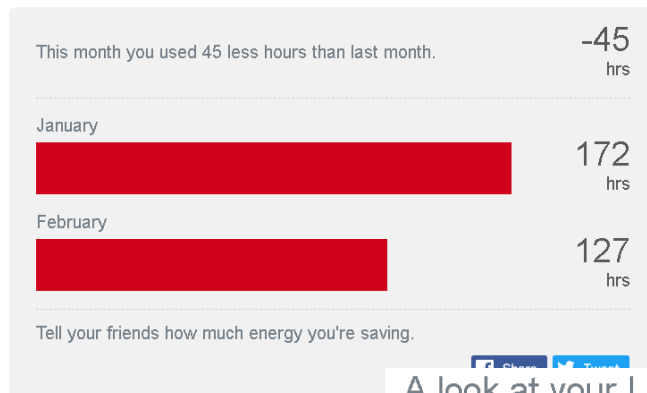
Technology => Data Driven Decision (3D)

Smart home data leads to information and decisions

Energy summary as of February 28

We're looking at info from your Nest Thermostat: Living Room.

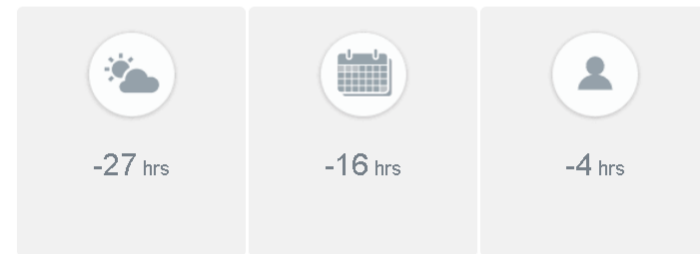
Here's how you did:



Why did your energy use change?

We look at a lot of reasons your energy use can change — from weather to your Eco Temperatures — and these are the ones that made the biggest difference this month.

They add up to -47 hours of energy use. The difference of +2 hours was caused by other factors. [Learn more >](#)



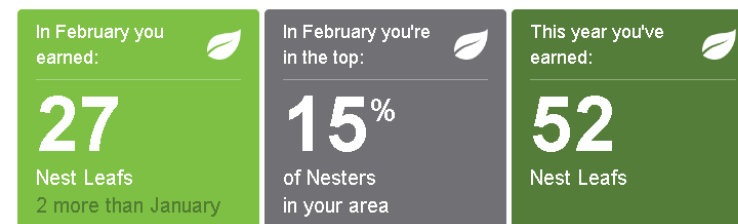
Warmer weather helped you save.

February had fewer days than January.

You adjusted the temperature to use less energy this month.

A look at your Leafs:

You get a **Leaf** when you choose an energy-efficient temperature. This month, the average Nest Thermostat owner in your area earned 8 Leafs. Here's how you did:



Let your friends know how many Leafs you earned.

The Fourth Industrial Revolution

| From Industry 1.0 to Industry 4.0

1.0 | 1784 | based on mechanical production equipment driven by water and steam power 

2.0 | 1870 | based on mass production enabled by the division of labor and the use of electrical energy 

3.0 | 1969 | based on the use of electronics and IT to further automate production 

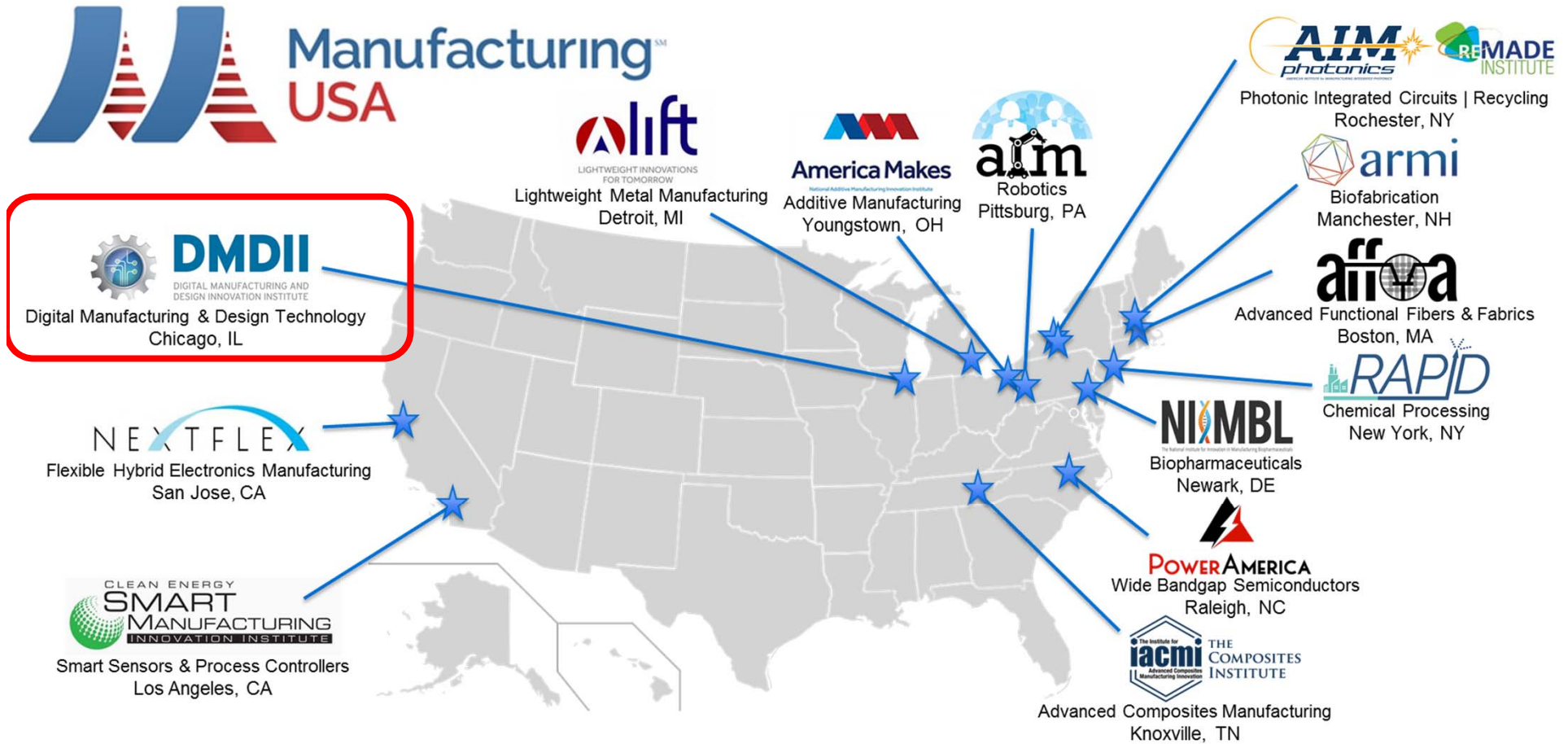
4.0 | tomorrow | based on the use of cyber-physical systems 

Source: Bruce Hoy (CEO Genesis NanoTech), "The Fourth Industrial Revolution"

Industry 4.0 design principles:

- ✓ **Interoperability**
- ✓ **Information transparency**
- ✓ **Technical assistance**
- ✓ **Decentralized decisions**
- ✓ **All enabled through data**

The Manufacturing USA program exists to allow U.S. manufacturers to lead the disruptive innovation impacting their industries



DMDII Snapshot: A Public-Private Partnership with 300+ Members



DMDII
 + a UI LABS Collaboration



NORTHROP GRUMMAN



SIEMENS

StanleyBlack&Decker

CATERPILLAR



JOHN DEERE

Microsoft

McKinsey&Company

P&G

faurecia

Johnson & Johnson

BOEING



TW

applied research & development
 REDUCE COST AND RISK OF COMMERCIALIZING NEW TECHNOLOGY

technology integration & commercialization
 DEVELOP INNOVATIVE METHODS AND PRACTICES FOR SUPPLY CHAIN INTEGRATION

education, technical skills & workforce development
 ENGAGE WITH SMALL & MEDIUM-SIZED MANUFACTURING ENTERPRISES

Factory's of the Future

Ford River Rouge Plant(Circa 1913)



Vertical Integration and the Manual Assembly Line

Factory's of the Future

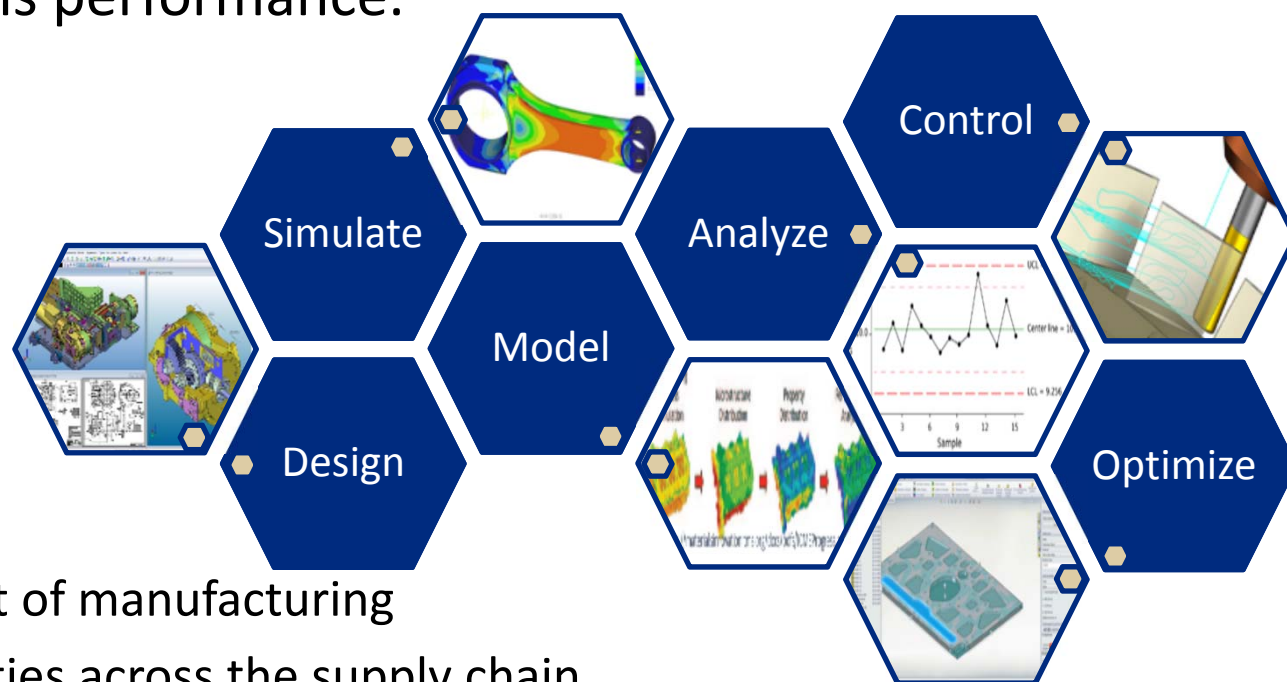
Tesla Automobile(Circa 2016)



Extended Digital Enterprise and Robotic Assembly

Digital Manufacturing & Design

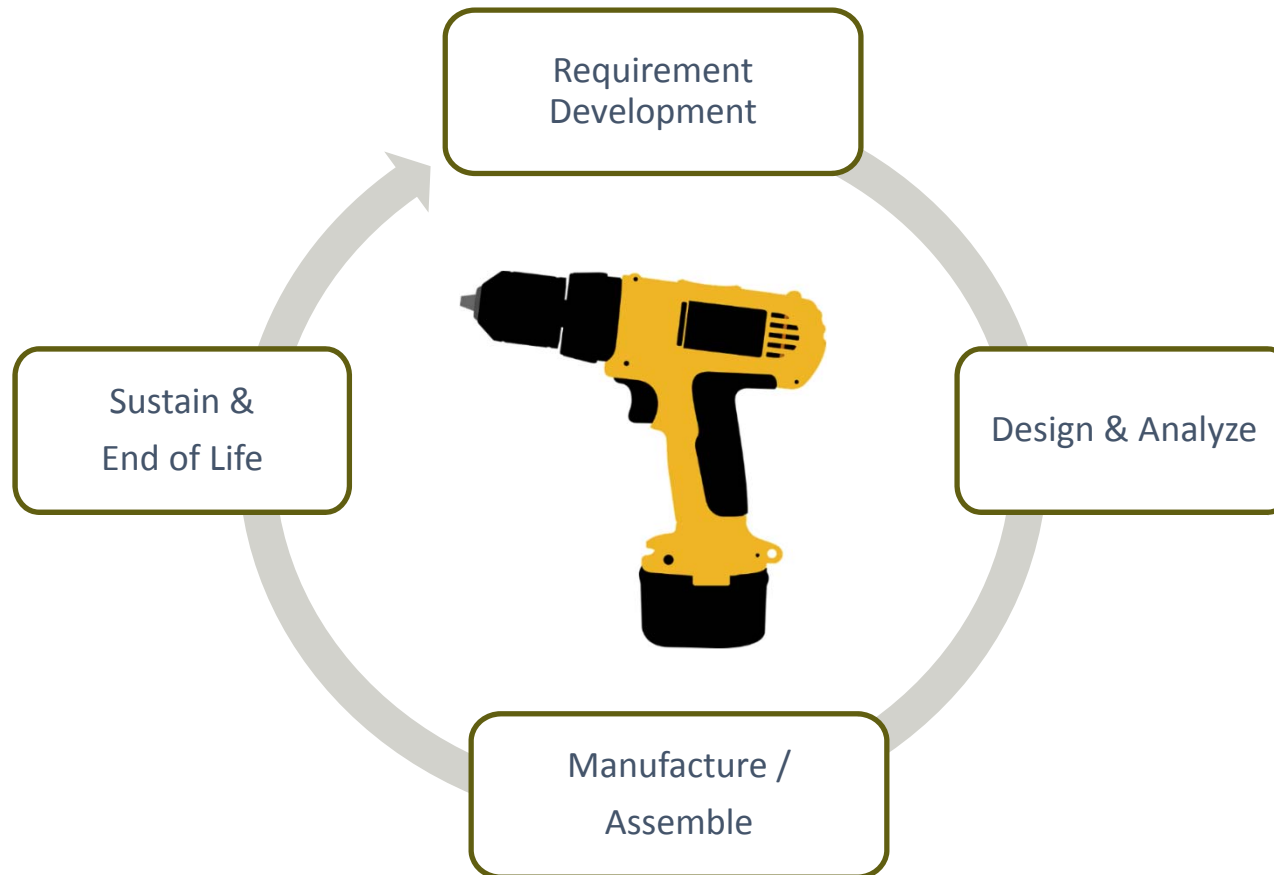
Digital Manufacturing and Design (DM&D) is an integrated approach that **brings together software, data, and control systems to model, simulate, analyze, control, and optimize** both a product and its manufacturing systems performance.



- ✓ Reduced time and cost of manufacturing
- ✓ Strengthened capabilities across the supply chain
- ✓ Eliminate waste from extended Value Chain

Digital Manufacturing & Design

Digital Product Lifecycle



Digital Manufacturing & Design

The Digital Twin is a real-time, virtual representation of an asset or system across its lifecycle.



Asset



System

Digital Manufacturing & Design

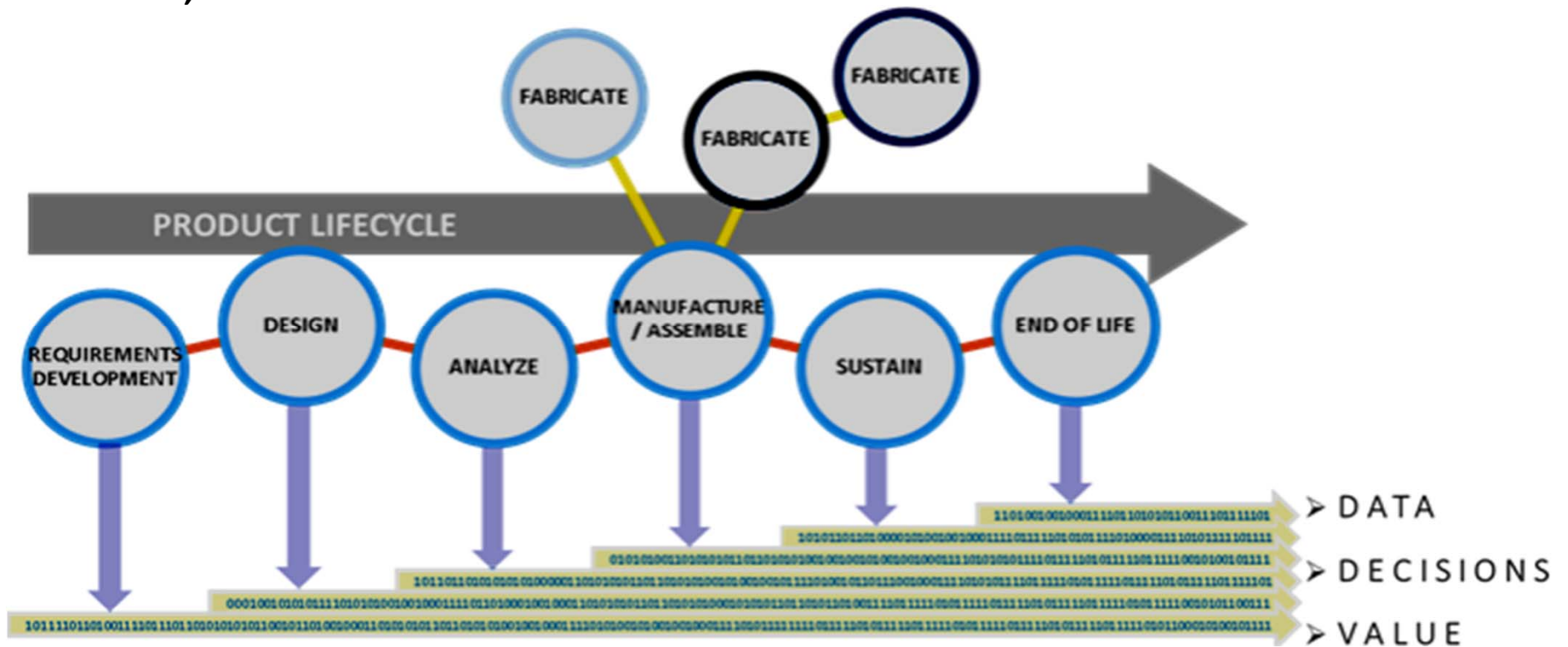
The Digital Thread enables information flow between all elements of the product lifecycle creating the channel for real-time collaboration between product stakeholders, Sales to Service.



Ref: Epicor – Digital Thread Infographic

DM&D Solution Process

Digital Manufacturing and Design, DM&D, solutions use digital technology to connect internal machines and processes with each other, with customers, and with the enterprise value chain by transferring necessary product and process data in a seamless, secure manner.

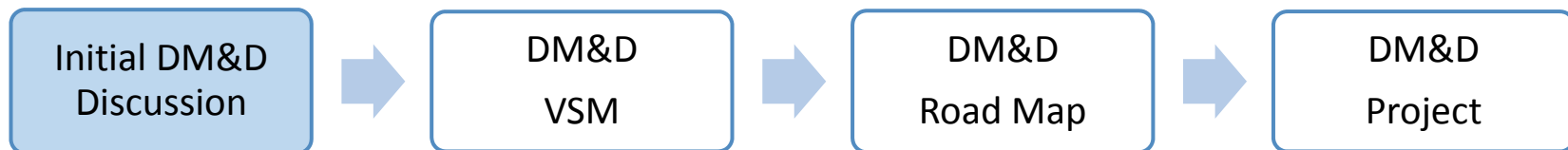


DM&D Solution Process

- Do you want to improve productivity, Do More with Less?
- Do you want to optimize your extended value chain?
- Do you have a Value Stream Map (VSM) of your operations?
- Have you aligned DM&D information flows with the VSM?

A discussion with MOC is a good place to start!

DM&D Solution Process



1. Initial DM&D Discussion:

Challenges? Is DM&D the right solution path for you?

2. DM&D Value Stream Map (VSM):

Map Current State, Draft Ideal State, Select Future State, Gaps

3. DM&D Road Map:

Opportunities? Business Cases, Determine Priorities, Scope.

4. DM&D Project:

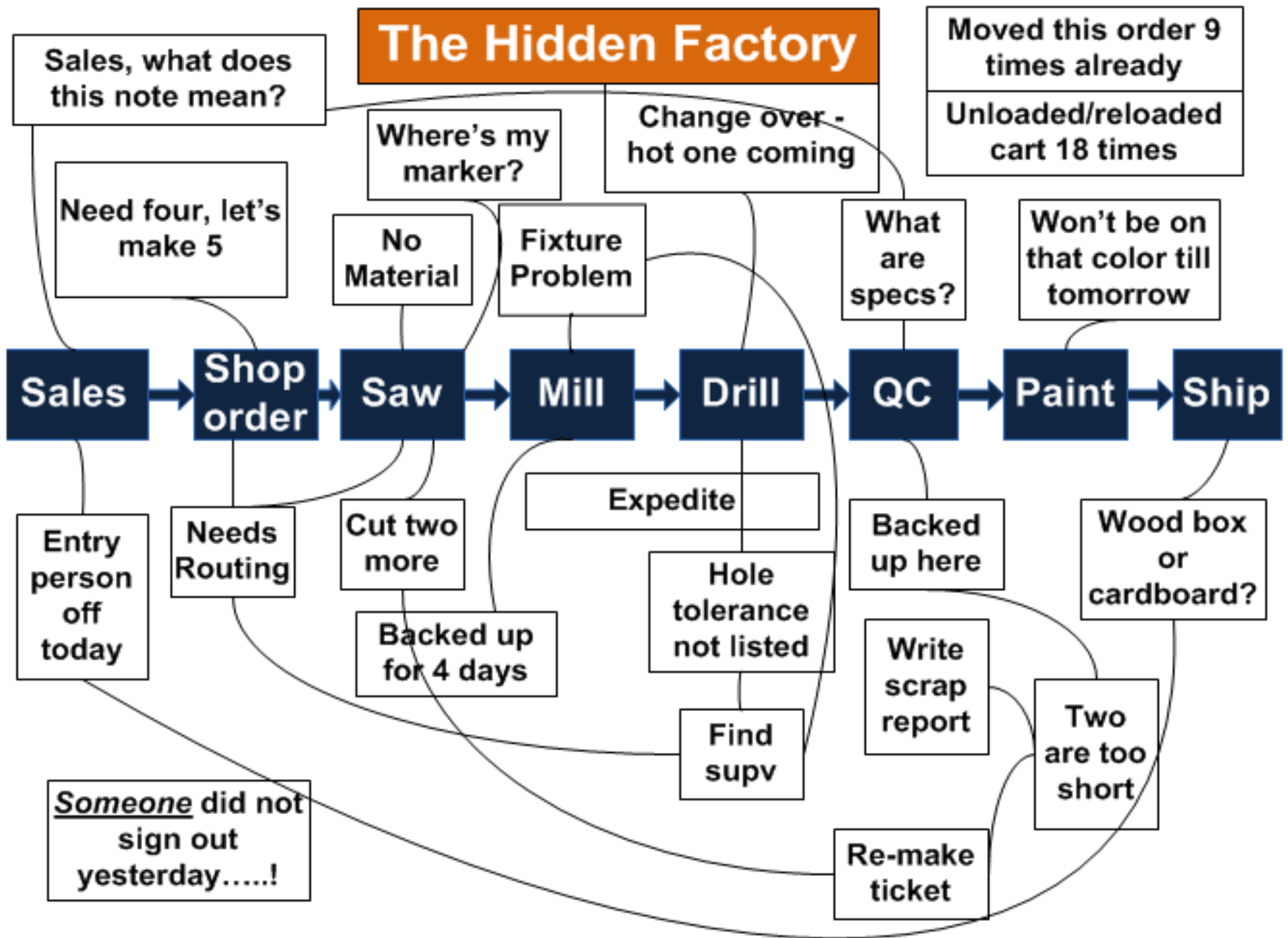
You select the opportunity, MOC scouts the technology solution.

DM&D Solution Process

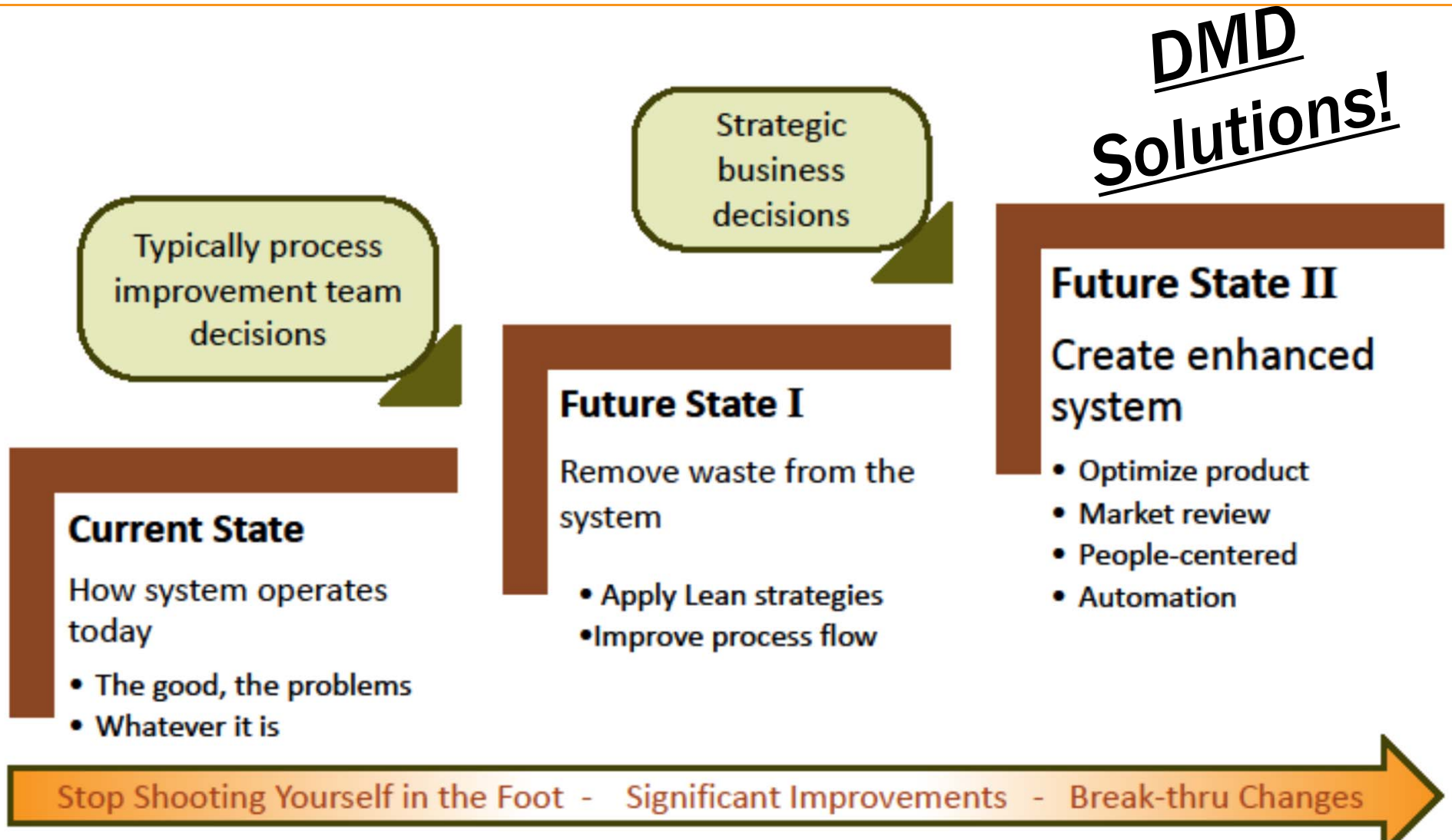
The Factory



The Hidden Factory



DM&D Solution Process



DM&D Solution Process

Technology Scouting (TS)



Conduct Technical Searches to:

- 1. Identify technologies that can meet the need**
- 2. Identify companies skilled in applying them**

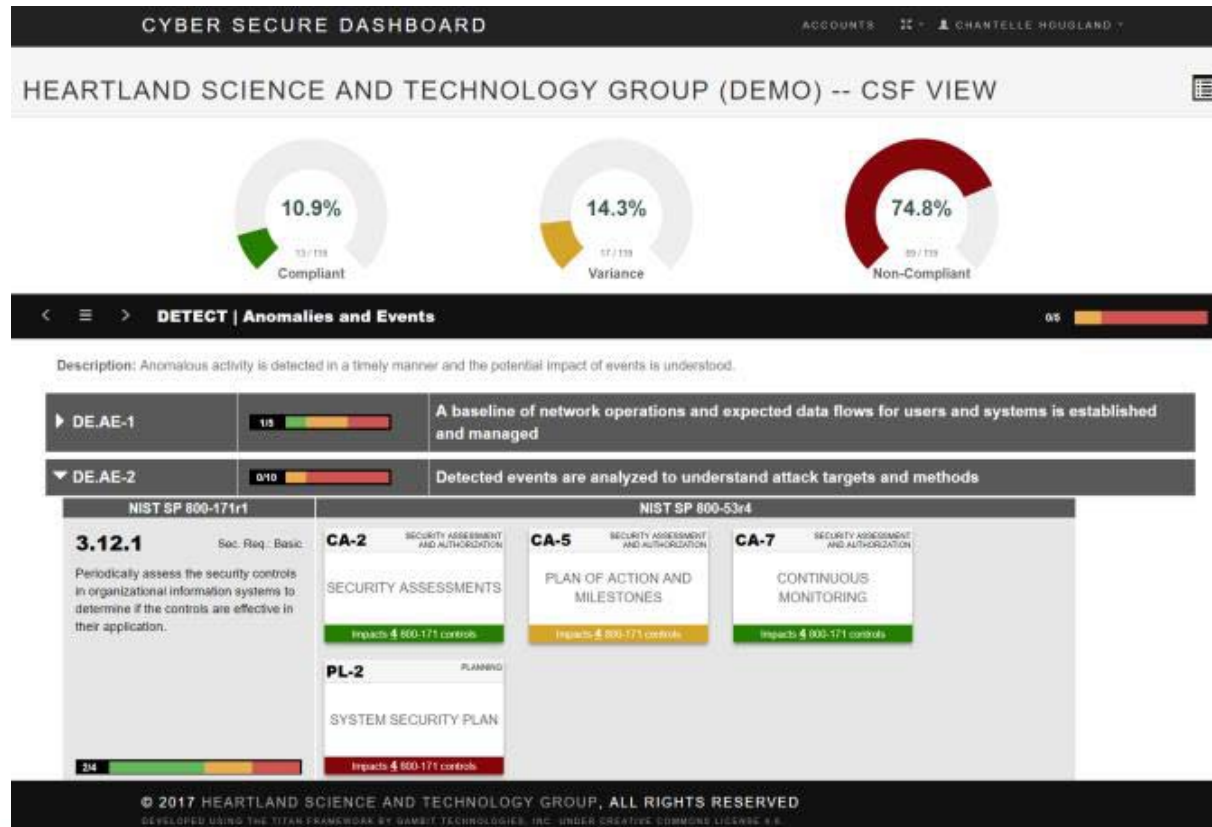
DM&D Solution Example

Need: NIST 800-171 DFARS

www.cybersecuredashboard.com

DM&D Solution: Cyber Security Dashboard

Cybersecurity for Digital Manufacturing
Guiding Small & Mid-Sized Manufacturers Through
Complex Federal Cybersecurity Regulations



DM&D Solution Example

Need: Automate Repetitive Office Tasks

DM&D Solution: RPA Software

The infographic is titled "RPA – Robotic Process Automation". On the left, a robot sits at a desk with a computer. A large blue arrow points from this scene to a box containing the number "10". To the right of the arrow, three boxes list benefits: "No Code Required" (with a red 'X' over a code editor icon), "Automate Repetitive Tasks" (with a robotic arm icon), and "Cost Savings" (with a hand holding coins icon). Below these, a dashed line separates two columns. The left column is titled "Top 3 Tools Implementing RPA" and lists "UiPath", "blue prism", and "Automation ANYWHERE" (with a robot icon). The right column is titled "Companies" and lists "Deloitte", "IBM", "intel", and "DELL". At the bottom left is the "edureka!" logo, and at the bottom right is a "Subscribe" button with a play icon. Copyright text at the bottom reads: "Copyright © 2017, edureka and/or its affiliates. All rights reserved."

<https://www.youtube.com/watch?v=evU3TzbraQM>

DM&D Solution Example

Need: Paperless shopfloor connected to ERP

DM&D Solution: Manufacturing Execution System (MES)

Introducing the Manufacturing App Platform

Create manufacturing apps, connect shop floor IoT, and optimize with manufacturing analytics.

The diagram illustrates a three-step process for the Manufacturing App Platform. Step 1: 'SHOP FLOOR IOT' is represented by a dark grey IoT gateway device with a Wi-Fi symbol above it. Below it, the text says 'Easily connect your machines, sensors and smart tools to unlock their potential.' A blue button labeled 'CONNECT' is positioned above a large blue '99%' which is above the text 'Reduction In Defect Rate'. Step 2: 'APP ENGINE' is represented by a computer monitor displaying a software interface with a play button and a dashed box. Below it, the text says 'Seamlessly create powerful Manufacturing Apps without writing a single line of code.' A blue button labeled 'CREATE' is positioned above a large blue '10%' which is above the text 'Increase In Production Yield'. Step 3: 'ANALYTICS' is represented by a tablet and a smartphone displaying various data charts. Below it, the text says 'Access and analyze production data and harness the power of real-time continuous improvement.' A blue button labeled 'OPTIMIZE' is positioned above a large blue '92%' which is above the text 'Reduction In Training Time'. A reference link is provided at the bottom right: [REF: https://tulip.co/](https://tulip.co/)

Helping Manufacturers Succeed!





Open for Questions...

UW-Stout Manufacturing Outreach Center

Phone 715-232-2397 or toll free 866-880-2262

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