The Emergence of Digital Manufacturing

What Digital Means for the Future of Manufacturing

The factory of the future relies on a digital thread that links the manufacturer, machines, suppliers, shippers, distributers and end users.

Manufacturers get customer feedback in the form of data that can be acted upon, diverting supplier streams or material purchases.

Modeling, simulation and analysis tools allow for troubleshooting in advance and automated in process adjustments.

On the factory floor, equipment linked by sensors can measure operating conditions and make adjustments when parameters are suboptimal; supply information on maintenance needed and timing; adjust and adapt production to coded materials coming through the system.

Humans working alongside collaborative robots are freed from repetitive or labor-intensive tasks.

Production can be done close to the customer, and in smaller, customized batches, via additive manufacturing.

Shippers send alerts regarding capacity and scheduling and work is automatically readjusted or rerouted.

Customers receive goods that can accept and send information about usage and maintenance requirements.

The Potential of Digital Manufacturing Implementation [1]

Resource/process productivity increase	**3-5%**
Labor productivity increase in engineering	**45-55%**
Machine downtime reduction	**30-50%**
Inventory carrying costs reduction	**20-50%**
Quality costs reduction	**10-20%**
Reduction in maintenance costs	**10-40%**
Reduction in time to market	**20-50%**

> ***Approach the opportunity bottom-line value backwards rather than technology forward.***
>
> – McKinsey Digital, 2018

Challenges for Manufacturers [2]

- What platform to choose
- Lack of digital training/culture
- Initial investment
- Cybersecurity to protect proprietary information and processes
- Intellectual property; defining ownership in a collaborative product development environment
- Data analytics integration — being able to complete and fully utilize the feedback loop
- Lack of coordination among departments and divisions

Nine Technologies That Are Transforming Industrial Production [3]

Robotics:
e.g. Robots at a guitar company are used to apply polyester & urethane coatings to guitars.[4]

Simulation:
e.g. Running simulation tests during the design phase helps a large tool manufacturer gauge the static & dynamic loads for its construction & mining earth-moving equipment.[5]

Horizontal and Vertical System Integration:
e.g. Using a common set of processes & data transactions, a group of automotive OEMs & suppliers more effectively manages its packaging & parts supply chains.[6]

The Industrial Internet of Things:
e.g. A car transmission facility uses Bluetooth-enabled devices in the production environment to easily capture data & drive it back to the operator to ensure accuracy in production.[7]

Cybersecurity:
e.g. Protocols & procedures are established to prevent unauthorized access to IT systems that leads to intellectual property theft.

The Cloud:
e.g. A cloud-based analytics solution enables a paper company to analyze paper making and converting processes. Real-time feedback allows the operator to minimize risk of web breaks and optimize quality.[8]

Additive Manufacturing:
e.g. A tool manufacturer uses 3D printing of molds for casting of metal parts at radically reduced lead time and cost.[9]

Augmented Reality:
e.g. Wearable "AR" glasses can deliver repair instructions to a technician on the factory floor, who can look at diagrams while fixing equipment.[10]

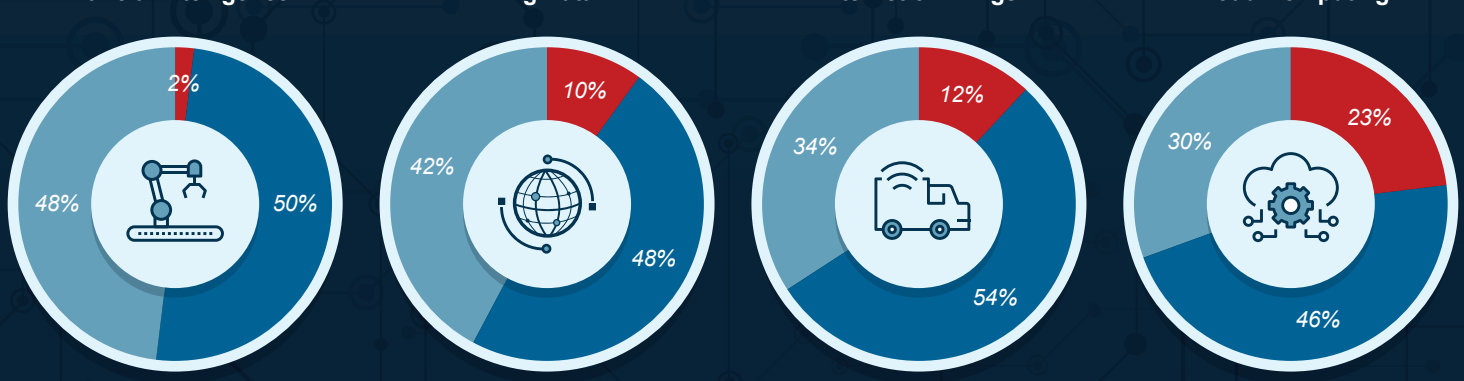
Big Data and Analytics:
e.g. Data from sensors on machinery like gas turbines is collected and analyzed to develop tools and improve efficiency.[11]

The MEP National Network™ Brings Digital Manufacturing to Its Clients

	Additive Manufacturing	Cybersecurity	Robotics
Manufacturer	**Kreg, producing tools for the woodworking industry**	**Caliente, providing innovative heating solutions**	**Applied Engineering, machine shop**
MEP Center	**Center for Industrial Research and Service (CIRAS, IA MEP Center)**	**Purdue MEP (IN MEP Center)**	**South Dakota Manufacturing & Technology Solutions (SD MEP Center)**
Challenges	*Speed up the injection molding process*	*Automate information systems to save costs/improve quality; protect these systems to achieve DFARS compliance*	*Increase production without adding labor (critical labor shortage)*
Solutions	*CIRAS engineers and company team designed a mold insert solution using 3D metal printing. This improved water cooling which enabled a faster molding cycle and eliminated unnecessary handling of the jigs as they cooled.*	*Purdue MEP and company team enabled automation of data logging on factory floor and improved part-tracking. Purdue MEP did a cybersecurity gap analysis and developed a gap response plan.*	*South Dakota Manufacturing & Technology Solutions and company team identified the need and the right technology, and calculated the ROI. Designed, integrated and tested a cobot that loaded and unloaded parts into fixtures.*
Results	*$20K annual production cost savings and increased throughput.*	*Streamlined operations, improved quality control, and increased sales by $150K. The DFARS gap analysis protected the 25% of company revenue derived from DoD work and averted data breach risks.*	*Increased machine utilization by approximately 23%, created a process that is 100% consistent and repeatable and supported business growth without adding labor.*

When Does Your Company Plan to Implement?

(Survey of small and medium-sized manufacturing leaders in Michigan)



Source: Automation Alley, 2019 Technology in Industry Report

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(1) Industry 4.0: How to Navigate Digitization of the Manufacturing Sector, McKinsey Digital, 2015 (2) Industry 4.0: Building Your Digital Enterprise, pwc.com, April 2016 (3) 9 Technologies Identified by Boston Consulting Group, The Future of Productivity and Growth in Manufacturing Industries, April 2015 (4) Meet the New Generation of Robots for Manufacturing, The Wall Street Journal, 6/2/15 (5) Four Companies that Use Simulation Software to Speed Design, PTC, 5/30/18 (6) Share to Gain: Unlocking Data Value in Manufacturing, World Economic Forum and Boston Consulting Group, January 2020 and Surgere.com/autosphere (7) 7 Ways a Japanese Smart Factory in the South Represents the Future of Manufacturing, IoT World Today, 7/19/17 (8) Manufacturing Transformation: Journey to the Cloud, A White Paper by AWS and Frost & Sullivan, 12/5/19 (9) Kreg Case Study (10) Industry 4.0: 7 Real World Examples of Digital Manufacturing in Action, Autonomous Manufacturing (AMFG), 3/28/19 (11) 10 Companies That Are Using Big Data, ICAS, 9/23/16