MANUFACTURING MATTERS!

WMEP MANUFACTURING SOLUTIONS

RISING TO THE CHALLENGE

“Small and Medium Manufacturers-Start on a digital transformation playbook”

Michael Cook, Director Academic Enablement, Rockwell Automation

Wisconsin Legacy

- Manufacturers account for 18.57% of the total output in the state, employing 16.97% of the workforce.
- Total output from manufacturing was **$64.88 billion** in 2019.
- Average of 472,000 manufacturing employees in Wisconsin in 2020, with
- Average annual compensation of $74,252. in 2019.(The National Association of Manufacturers (NAM))
- Coolest things made in Wisconsin- #1 Pierce's electric fire truck-The Volterra Pumper is the first in-service, zero-emissions firetruck in North America. It is produced by Pierce Manufacturing Inc. in Appleton.

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Transformation is underway -Academia + Industry

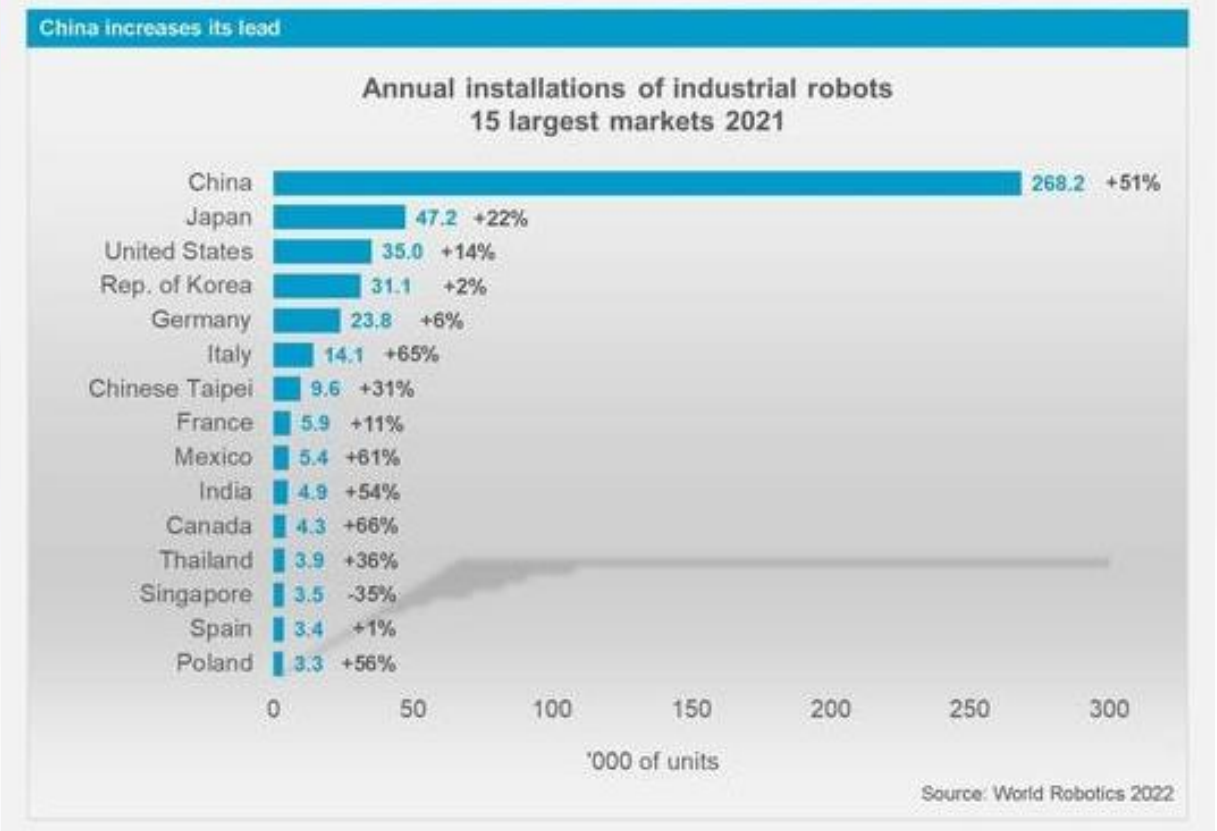
1. **Data informed academic Investment and economic impact models**
   - Skills aligned with Industry needs/projections
   - Flexible educational models- school, 2–4-year degrees, certifications and upskilling

2. **Policy Shift** towards execution - state, regional , national workforce of the future for manufacturing competitiveness and need to scale to meet Industry demand

3. Technology interoperability , but lagging **ind 4.0 applied workforce standards** creating space for thought leaders/marketeers
   - New and emerging occupations

4. **Cybersecurity** an immediate priority and then other key **Ind 4.0 pillars** –"explainable" AI,ML, Data, cloud compute, AR

Industry-Academia *X.0* (2020-2025)



Need both capacity and skills in the workforce to support pace of investment

[World Robotics Report: "All-Time High" with Half a Million Robots Installed in one Year - International Federation of Robotics (ifr.org)
EN-USA-2022-OCT-13_IFR_press_release_World_Robotics_2022.pdf]

"The use of robotics and automation is growing at a breathtaking speed," says Marina Bill, President of the International Federation of Robotics

Frankfurt, Oct 13, 2022 — The new World Robotics report shows an all-time high of 517,385 new industrial robots installed in 2021 in factories around the world. This represents a growth rate of 31% year-on-year and exceeds the pre-pandemic record of robot installation in 2018 by 22%. Today, the stock of operational robots around the globe hits a new record of about 3.5 million units.

Installations for the region´s largest adopter **China** grew strongly by 51% with 268,195 units shipped. Every other robot installed globally in 2021 was deployed here. The operational stock broke the 1-million-unit mark (+27%). This high growth rate indicates the rapid speed of robotization in China.

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Top 5 Challenges faced by US Manufacturing on our current trajectory

1. Continued decline of US manufacturing productivity (as Europe & Asia advance)
2. Supply Chains still relying on emails, phone calls, faxes to detect & address disruptions
3. Growing productivity gap between large & small/medium manufacturers
4. A workforce poorly equipped to engage in the innovation/value creation process
5. Growing complexity, cost & failures of digital transformation

Manufacturing in the US

243,687 firms in the manufacturing sector

1.66%

Are large manufacturers, having more than **500 employees**

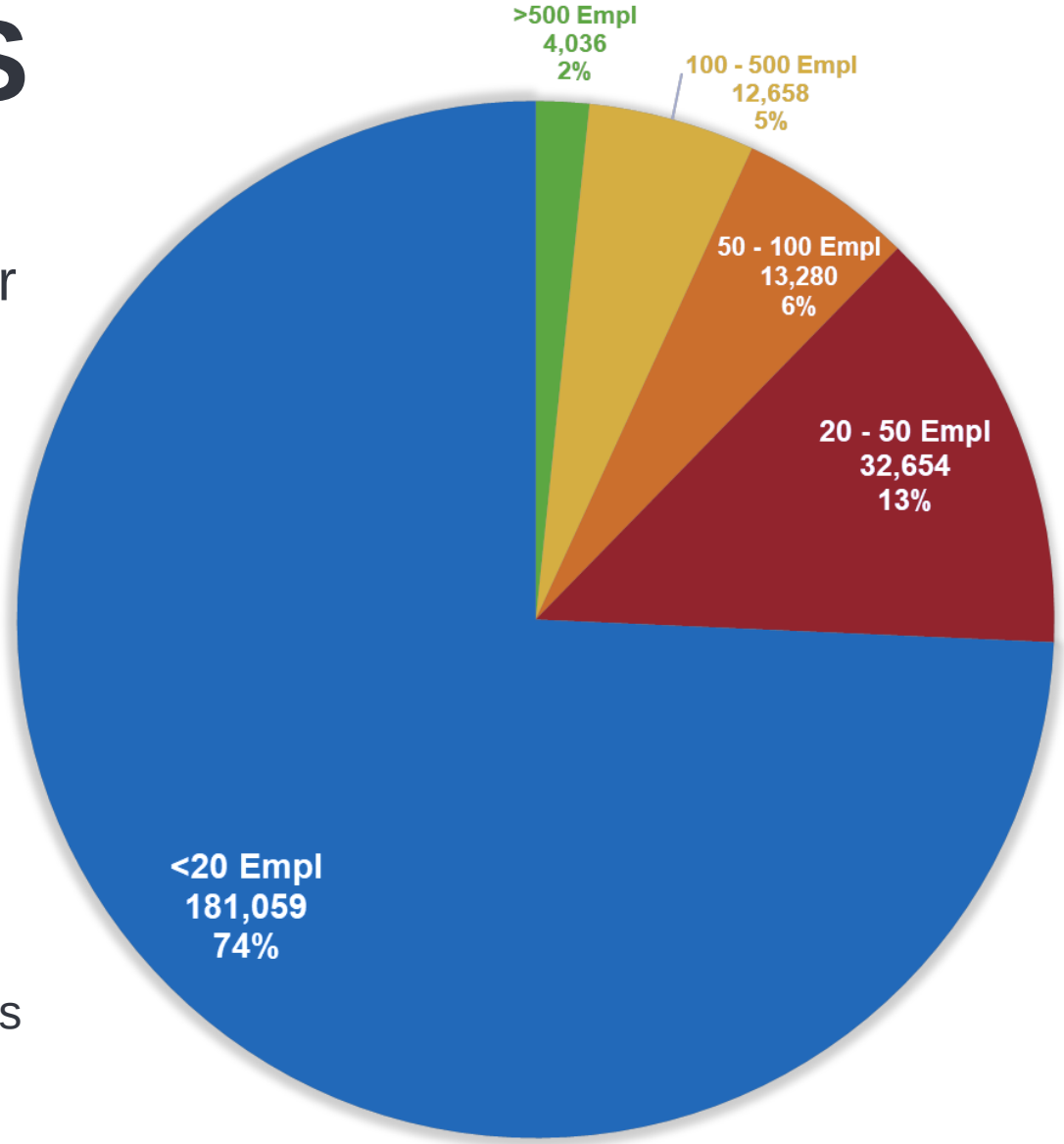
Employ **57.9%** of the manufacturing workforce

98.34%

Firms are small or midsized manufacturers

12,658 firms (5.2%) have between 100 – 500 employees

213,713 (87.7% of all mfg) firms have less than 50 employees

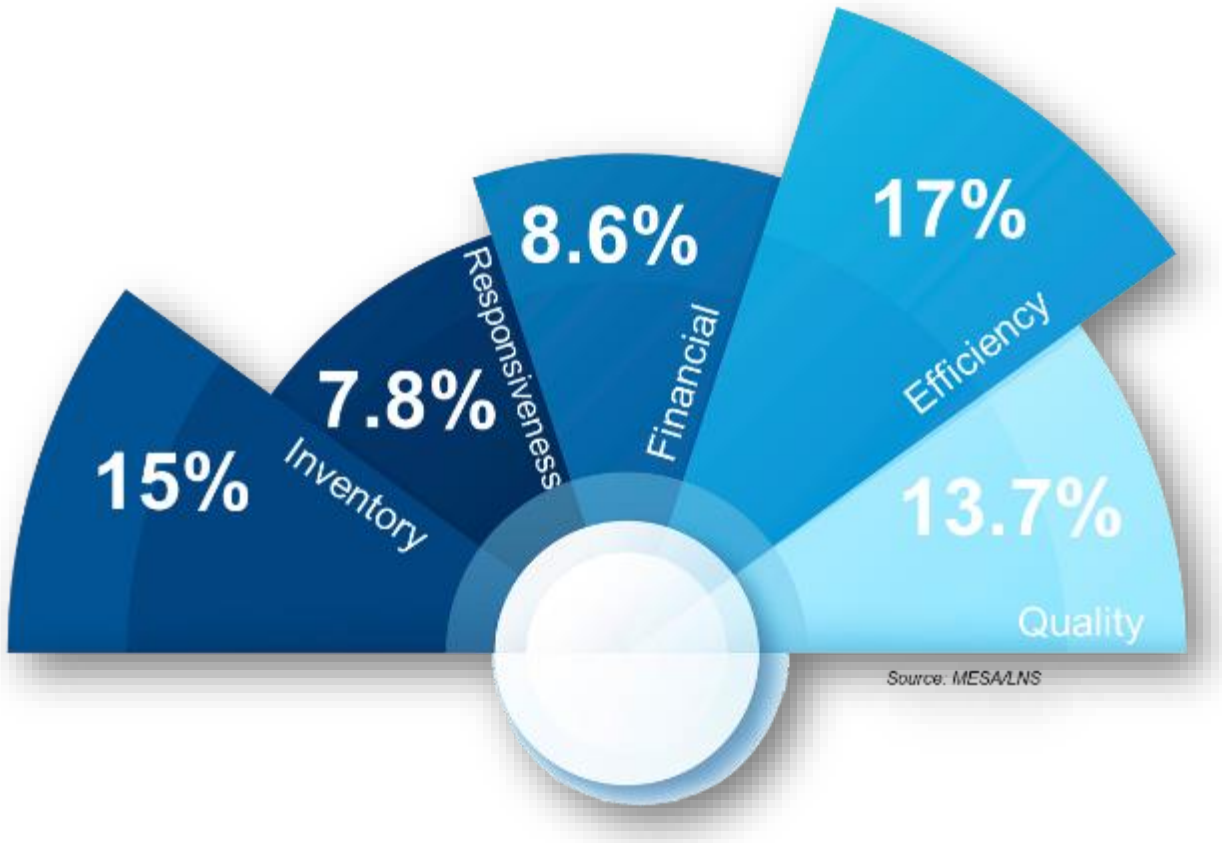


Firms with less than 100 employees by industry U.S. | Statista

Source: NAM

The value of digital

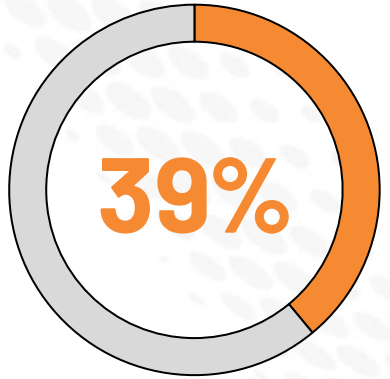
What kind of results are companies seeing from the implementation of digital technologies



BENEFITS OF DIGITAL TRANSFORMATION

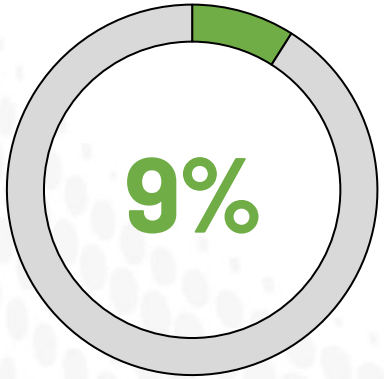
MEDIAN EXPECTED % EBITDA UPLIFT OVER 4 YRS

TYPICAL INDUSTRY OPPORTUNITY



EBITDA Uplift from All Digital Levers

(for example, product, R&D, marketing)



EBITDA Uplift from Smart Manufacturing

Significant improvements have been documented by the early adopters of digitization as reflected in both research and individual use case outcomes. This has established a new bar in terms of competitive advantage.

Roadblocks of digital transformation

Why digital transformation initiatives can fail

By anticipating challenges before they arise, it's more likely that your digital transformation will be a success

Challenges explored:

- Lack of understanding
- Digital transformation as a standalone strategy
- Technology-thinking instead of problems-thinking
- Workforce skills challenge
- Custom and in-house applications
- Lack of scalability
- No clear business case or return of investment
- Difficulty integrating legacy infrastructure
- Picking the wrong partner

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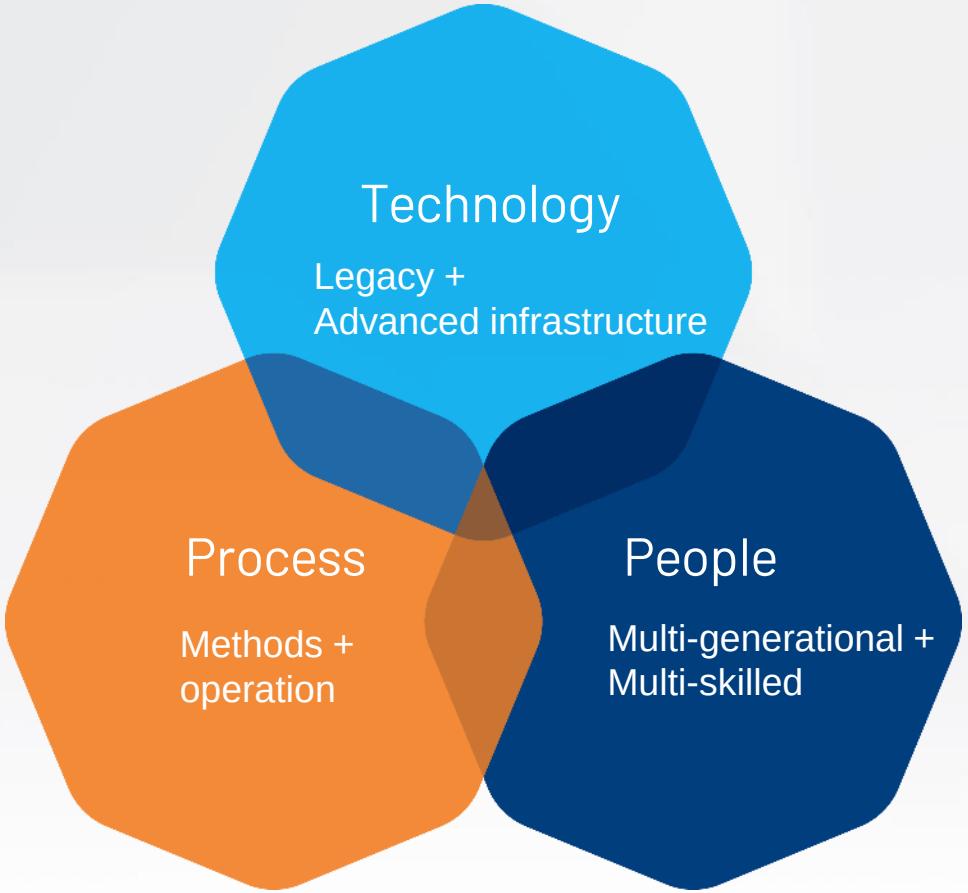
Lack of understanding

Best practice: Digital transformation enables companies to move forward and reduce operational inefficiencies



Digital transformation embraces the tools and processes implemented to **support business transformation**

Around people, processes and technologies

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Workforce skills challenge

Lack of ability to attract or develop skills aligned with the digital strategy

50%

Of mining workers over 45 years of age

Source: *ManpowerGroup*

The risk

Focus on wrong skills

Lack of a broad workforce digital literacy

Low priority on soft skills

- Communication, curiosity and critical thinking are as important as technical skills

> Future workforce must be ready to become 'shallow experts' on many different types of software, platforms, and services."
>
> **Cisco**

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Lack of scalability

Some projects stay isolated and never multiplied across the company

78%

of enterprises today fail to scale their digital transformation initiative

Source: *New Everest Group*

The risk

- Best practices and successful projects across the company cannot be duplicated
- No scalability plan
- Innovation islands

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No clear business case or return of investment

Some digital initiatives don't have a clear business case behind it

The risk

- Weak ability to build a business case to identify opportunity cost
- Obvious value of digital transformation shadows associated risks

Return of most lucrative option not chosen

– **Return** of chosen option

= Opportunity cost

INVESTOPEDIA

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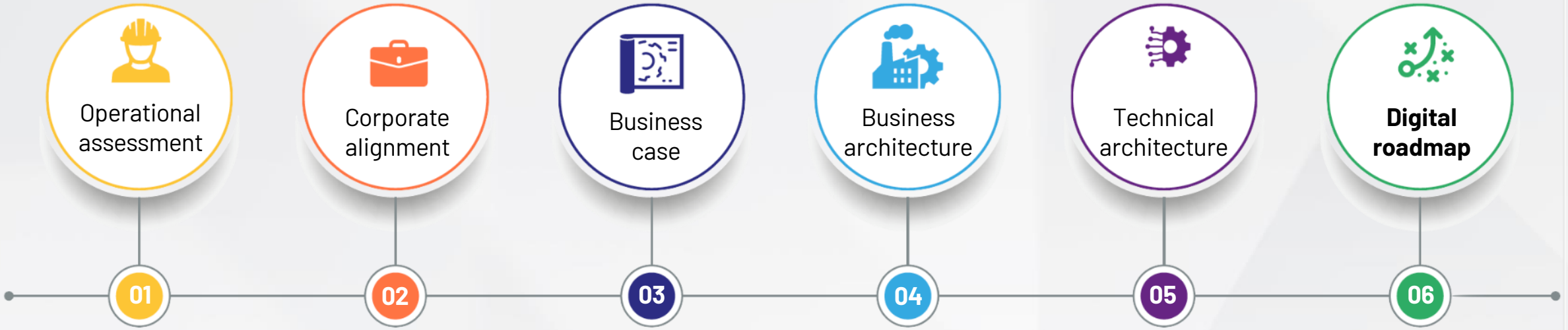
No clear business case or return of investment

Best practice: digital transformation is a journey that starts with pragmatic strategy development that involves analyzing, planning and understanding business needs, available technologies and commercial opportunities



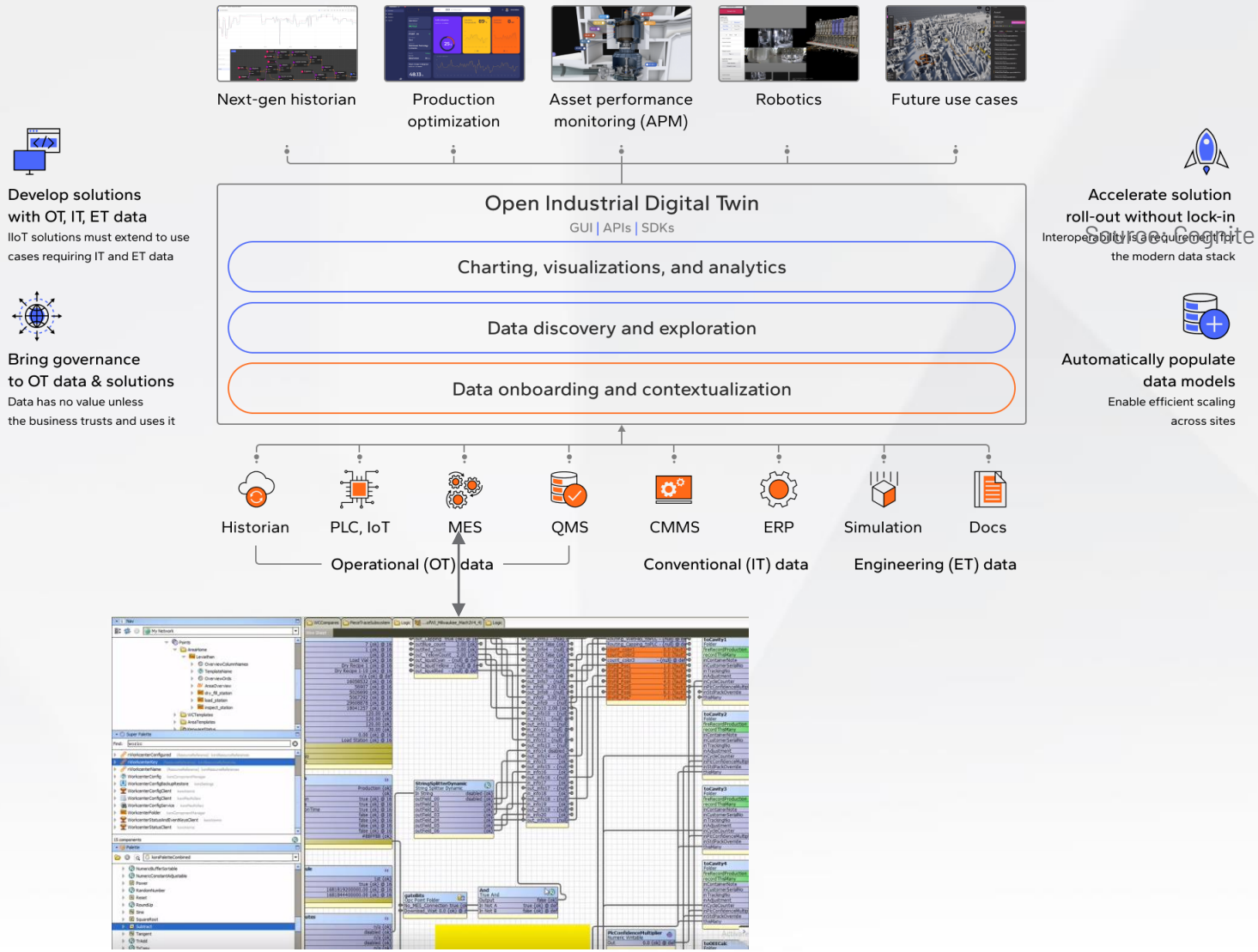
| Strategy development → **| Detailed design** → **| Deployment**

Integrating legacy infrastructure

Best practice: Industrial data ops platform

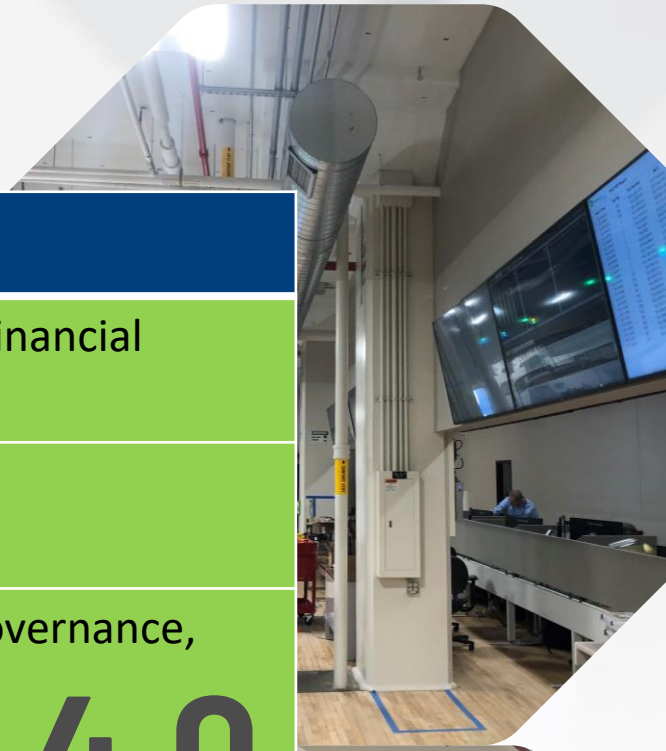
More integrated platforms and collaboration between suppliers help the integration of technologies and data collection of dissimilar / legacy systems

Increased role of programmable controllers as edge gateways of legacy of industrial systems



Connected Enterprise- Multi-disciplinary

Industrial Layers	Components
Enterprise	ERP Integration- Supply Chain, Resource and Financial management
Artificial Intelligence, Machine Learning	Digital Twins, Models, Data Orchestration, decision making intelligence.0
Manufacturing Execution Systems(real time data),Manufacturing Operations Management(business process)	Production, Quality, Maintenance, Security, Governance, Cyber- security(IT-OT) **Ind 4.0**
Data Center	Firewalls, data collection and orchestration
Operational Technology/Information Technology Network	Network – infrastructure, security, performance **Ind 3.0**
Production Line	System of assets to produce a product
Production Asset	Single machine or asset



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System Integration

- Integrated industrial production line- Industry 4.0 IIoT
- FANUC & Rockwell integration
  - Part traceability and marking, Safety PLC, Safety area scan, Assembly station, Fault detection, Vision, Conveyors
- Solution aligns with smart manufacturing career pathways
- Certifications, curriculum and SW

APT MANUFACTURINGsolutions

Integration

This system is truly like no other Industrial System for Education Institutions.
Your students will use FANUC/Rockwell products on a factory system to understand a fully integrated line.
Each cart can also be detached for individual learning.

Integration from:

- FANUC CNC Machine Making Product
- OP-10 Machine Tending the CNC
- OP-20 Laser Marking the product
- OP-30 Assembly of the product
- OP-40 Packaging the product in boxes

FANUC Robotics

- FANUC 30*i*B Plus Robot Controller
- FANUC LR Mate 200*i*D 4S 6 axis robot
- 2D *i*RVision Optional

FANUC's new R-30*i*B Plus Robot Controllers feature the new *i*Pendant with enhanced screen resolution and processing capability. The new user interface, *i*HMI, can display guides for setup and programming, as well as tutorials from the main home page which has a design common to FANUC CNCs, enabling easier use of robots.
Using the programming guide, even first-time robot users can create a program for a simple handling task and execute it in just 30 minutes! Easier usage also improves efficiency by facilitating system setup and maintenance.

FANUC ROBODRILL-CNC

CONNECTING SMART MANUFACTURING
High-Performance Vertical Machining Center
α-D14M*i*B(5) / α-D21M*i*B(5)
The ultimate all-round vertical machining center Model M, perfect for milling and drilling tasks requiring maximum precision, versatility and reliability.

- Optimal acceleration and deceleration control
- Rigid Design
- Easy maintenance and operation
- Extremely Fast .9 second tool change
- High Precision Control
- Designed for easy automation

See FANUC's ROBODRILL Brochure
(not all features included with the education package)

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Features

- Rockwell CompactLogix or GuardLogix PLC cell control
- Rockwell PanelView 10" touch screen interface with cell function screens
- Safety interlocked entry door
- 16 remote accessible configurable I/O points
- 3 color beacon light
- Main power disconnects
- Program access port on outside of panel
- Area scan safety for robot work area

https://aptmfg.com/products/csm/

Academia “X.0”

Gateway Technical College, WI

Advanced Manufacturing Research

CSI provides an environment in which teams of researchers from industry and academia can work together to explore concepts related to the application of research in integrated business and manufacturing processes.

The Institute features a fully functional manufacturing cell that utilizes advanced systems, including:

- Lot size of 1
- Full track-and-trace per item
- Use of AI for quality and performance tracking
- Use of AI for raw materials tracking
- Robotics and mechatronics programming
- OT cybersecurity
- High- and low-order modeling
- Digital twin simulation, both locally and remotely
- Remote access to data generated in the lab

This research environment is designed to nurture an understanding of IIoT manufacturing principles. It also integrates the disciplines of engineering, physics, and business with software, hardware, and firmware solutions. The goal is to provide a place in which creative ideas can be tested and proven – inspiring new functionality and scalability in real-world business applications.

UWM's world-class faculty contributes expertise in combination with some of the world's most respected talent from diverse fields. This includes experts in everything from advanced manufacturing systems to the social and business impacts of technology.

R&D FOCUS

Research at CSI is focused on a wide range of advanced technologies, including:

Digital Twins: Digital representations of advanced manufacturing systems that enable real-time simulation and analysis of sensor data from production processes.

Data and Sensor Networks: The study of data and sensor networks used for cloud-based analytics.

Data Analytics: Platforms that ingest data from sensors and IIoT networks in order to measure key performance indicators (KPIs).

Machine Learning Integration: Creation of machine learning algorithms to improve KPIs in industrial systems.

OT Cybersecurity: Research aimed at developing techniques that identify and address security weaknesses and vulnerabilities in production systems.

ERP Integration: Design of a tri-directional link between the manufacturing lab environment, SAP, and Microsoft Azure data layers — enabling the use of analytics to automate laboratory tests.

https://vimeo.com/640326036/6c4116c50f and https://uwm.edu/csi/

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Academia-Industry Eco-system

Community

Examples:
- Museum of Science and Industry
- Discovery World
- Community STEM Centers

Educational Partners

Examples:
- Educational Solution Providers
- Training Companies

Collaboration

Ecosystem

Sustainable

Repeatable

Education

- K-12 school districts
- Community Colleges
- University system

Partner Networks

Examples:
- Manufacturing Extension Partnerships (NIST, DOE)
- Manufacturing USA Institutes'(DOE, DOD)
- Regional Economic Development entities
- Manufacturer alliances
- Apprenticeship office
- Governor Offices-Workforce Committee
- Associations of Commerce

Industry

- Local Industry
  - Employment Opportunities
  - Project Consultants
  - Plant Tours
  - Guest Speakers

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Thank You for Participating

- **Please complete the brief session survey to provide feedback to the presenter(s) and input to future editions of Manufacturing Matters!**

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