Manufacturing Intelligence Solutions

Moving from Industry 3.0 to Industry 4.0 - Digital Transformation

UT-RMC’s MARCON 2023
Introduction
WHAT WE DO

Connect to Everything without Vendor Lock-in

...to Drive True Data-Driven Manufacturing
INDUSTRY 4.0 DEFINITIONS

• “Industry 4.0 refers to a new phase in the Industrial Revolution that focuses heavily on interconnectivity, automation, machine learning, and real-time data. Industry 4.0, which encompasses IIoT and smart manufacturing, marries physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better connected ecosystem for companies that focus on manufacturing and supply chain management.” EPICOR - What is Industry 4.0? | Industrial Internet of Things | Epicor U.S.

• “Industry 4.0 refers to the ‘smart’ and connected production systems that are designed to sense, predict, and interact with the physical world, so as to make decisions that support production in real-time. UNCTAD - What is ‘Industry 4.0’ and what will it mean for developing countries? | UNCTAD

• “Computers are connected and communicate with one another to ultimately make decisions without human involvement. A combination of cyber-physical systems, the Internet of Things and the Internet of Systems make Industry 4.0 possible and the smart factory a reality.” Forbes.com, Bernard Marr - What is Industry 4.0? Here’s A Super Easy Explanation For Anyone (forbes.com)

• The fourth industrial revolution, is the cyber-physical transformation of manufacturing. The name is inspired by Germany's Industrie 4.0, a government initiative to promote connected manufacturing and a digital convergence between industry, businesses and other processes.” TechTarget - What is Industry 4.0? Definition from SearchERP (techtarget.com)

• “The realization of the digital transformation of the field, delivering real-time decision making, enhanced productivity, flexibility and agility.” IBM - What is Industry 4.0 and how does it work? | IBM
MANUFACTURING CHALLENGES

In the Plant:
- Machine Downtime
- Production Throughput
- Quality
- On-Time Delivery
- Recruiting
- Retention
- Revenue & Profit
- Company Valuation

(Near Term Challenges)

Manufacturing and Industry:
- More Competitive
- More Expensive
- Limited Workforce
- Workforce Traits
- Supply Chain Disruptions
- More Orders, Economy Coming Back
- Inflation
- More Demanding Customers

(Long Term Challenges)

Need Data ➔ Deeper Visibility into the Factory Floor

CURRENT STATE

ERP

TYPICAL SETUP

- Discrete connections between many systems
- Difficult/Expensive to change systems
- No standards for data
- Silos of data
- Data trapped in PLCs and machines
- Hidden Factory / Dark Data
DO YOU HAVE THE RIGHT DATA?

Where is the data?

- ERP system
- Paper, Excel
- Small siloed data systems
- PLCs, control systems, robots
- Peoples' brains

How much of that is accessible… in Real-time????

<15%
HOLY GRAIL

Fully Integrated Business Made Up of Digital Factories

• Everything and Everyone is Plugged into Network
• Layers of Business are Integrated and Operate Based on Data and Information from All Other Layers
• Stakeholders Know the State of the Business in Real-Time
• Stakeholders Know the Future State of the Business in Real-Time

Become a Data-Driven Manufacturer
DIGITAL TRANSFORMATION

Current State
Manual Data and Systems, Disconnected, Struggling
Data Hungry
Industry 3.0

Automated machines

Future State
Automated, Fully Connected, Excelling
Data-Driven
Industry 4.0

Automated business processes
DIGITAL TRANSFORMATION

• Point is Leverage Data Generated Everyday and Otherwise Rarely Consume
• Strategy, Not a Project
• Presenting information:
  • What they need
  • When they need it
  • How they need it
  • Who needs it
• Learn from New Knowledge
• Expand What is Needed Based on New Knowledge
• Major step changes, NOT CI
HOW TO EXECUTE

Education
- Enable
- Educate
- Innovate

Strategy and Architecture
- Digital Strategy
- Roadmap
- Architecture
- Technologies

Solving Problems
- Valuable Use Case for PoC
- Agile Approach
- Do…Learn Loop
"We use accurate digital data and information to drive decision making, quickly, and in real-time."

"We use accurate digital data and information to drive decision making, quickly, and in real-time. We leverage an infrastructure that treats all producers and consumers of data and information as nodes in an eco-system that interact with one another through a Unified Namespace."
MINIMUM TECHNICAL REQUIREMENTS

- Lightweight
- Report by Exception
- Edge Driven
- Open Architecture
ARCHITECTURE

Unified Namespace
- Enterprise
  - Site
    - Area
      - Line
        - Cell

Unified Namespace
- Coca Cola
  - Pittsburgh
    - ERP
      - Work Order
      - Routing
      - Schedule
    - Bottling
      - Line 1
        - Process Control
        - PLC 1
          - PLC Tags
      - MES
        - OEE
        - Downtime
Namespace - a system to identify and uniquely refer to related concepts or objects
HOW TO EXECUTE

Iterative Process
ARCHITECTURE OPTIONS

Industry 3.0

- Level 1 – PLC/Edge
- Level 2 – SCADA/HMI
- Level 3 – MES
- Level 4 – ERP
- Level 5 – Cloud

Discrete Connections, Solution Centric

Industry 4.0

- Open
- Secure
- Flexible
- Scalable
- Affordable

• Enterprise
• Site
• Area
• Line
• Cell

UNS, MQTT, Technology Centric

COST DIFFERENCES

Solution Centric Implementations Require:

• Extra security from Purdue model
• Min 2X additional engineering effort

Total Additional Costs for Industry 3.0

2X – 5X Cost of Industry 4.0
PILOT ARCHITECTURE

MQTT SpB

Werma

Filler

PLC

Capper

Ignition

SCADA/MES

Subscribe

Subscribe

canary

 UNS

Historian

Axiom

PLANT EXAMPLE

Level 4 – ERP

Level 3 – MES

Level 2 – SCADA/HMI

Level 1 – PLC/Edge

Level 0 – Sensor/Machine
ARCHITECTURE EXAMPLE
HOW IS IT POSSIBLE

Digital Strategy  Unified Namespace  Open Tech & MTR  Kaikaku  Agile

OPTIONS TO SOLVE

Monolithic Architecture and MES
- Big fees up front
- High Risk
- Slow time-to-value
- Short Term value

Point Solutions Off the Shelf
- Less expensive, less value
- Limiting to connect other systems
- Faster time-to-value
- Short Term value

Built for You
- Limit risk and early cash spend
- Shortest time to value
- Faster time-to-value
- Long Term value