Industry 4.0: Increasing Visibility and Decreasing Complexity with Learning, Data Science and IoT Technologies

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November 29, 2017
Today’s discussion

**Research.**
Industry 4.0 maturity index and framework

Future proof: learning and communication through data science and critical thinking

**IIoT in Practice.**
Industrial IoT through facilities energy management

Remote asset predictive maintenance

**IIoT Strategy and Practice.**
Industry 4.0 journey

Electronic process audits
Industry 4.0: Beyond the POC… the time to scale is upon us

Industry 4.0 integrates the physical and virtual worlds through technology enablers, which brings the fungibility and speed of software to manufacturing operations. The potential value created by Industry 4.0 vastly exceeds the low-single-digit cost savings that many manufacturers pursue today (acatech, Infosys, BCG, McKinsey, et al).

Disruptive technology enablers for Industry 4.0 are at a tipping point

- 25B connected things forecasted to ship by 2020.*
- 250M connected vehicles are forecasted to have some form of wireless network connection by 2020.*
- $493B in digital revenue gains per annum
- $421B in cost and efficiency gains per annum
- $907B in annual digital investments
- 100x disruptive digital innovation is 100x faster than physical disruption*

*McKinsey, acatech, Infosys, BCG research
Industry 4.0: Global study conducted on operations efficiency as a driver for competitiveness

Vast majority (82%) of companies are aware of the high potential in implementing Industry 4.0 concepts. 46% want to implement Industry 4.0 solutions systematically for enhanced asset efficiency by 2022. Only 30% have implemented data-driven or intelligent services.

Directional findings:
- 2017: Systematically implemented 15%, Potential recognized 35%, Partly implemented 32%, No awareness 4%
- 2022: Systematically implemented 18%, Potential recognized 32%, Partly implemented 32%, No awareness 4%

The opportunity:
- Industry 4.0 announced at Hannover Messe 2011, but systematic implementation still only 18%
- Current speed of implementation places the 2022 goal of 46% at risk
- Reason: data hurdles and piecemeal POC approach – unclear path

Approach to overcome barriers:
1. Evaluate your digital maturity
2. Proof of concepts to demonstrate business value, then scaled action
3. Set clear targets
4. Prioritize measures that will bring the most value to business
5. Demonstrate courage, persistence

Source: Infosys and Institute for Industrial Management (FIR) at RWTH Aachen study conducted in 2015 and updated in 2017. Sample size: 433 executives across industrial manufacturing sectors from China, France, Germany, UK and USA
Industry 4.0: Maturity drives significant efficiency improvement

- **Near-Term**
  - Up to date digital model (Digital Shadow) to understand root causes
  - Big Data analytics to understand root causes

- **Long-Term**
  - Advanced analytics for simulation & identification of most likely scenarios
  - Automated decision making and actions

**Development Path**

- **Visibility**
  - **Understanding**
    - Why does it happen?
    - “Seeing”
  - Business applications connected to each other

- **Connectivity**
  - “Being Prepared”
    - What will happen?

- **Computerization**
  - E.g. CNC milling machine but not connected

- **Industrie 4.0**
  - How can autonomous reaction take place?
    - “Self-optimizing”

- **Industrie 3.0**
  - towards Industrie 4.0

**Business Value**

- **Adaptability**
  - Predictability
  - Transparency
  - Visibility

**Computerization**

- Electronic Commerce
The Industry 4.0 model uses maturity levels and structural areas to identify and measure capabilities.

Four structural areas:
- Resources
- Information Systems
- Organization Structure
- Culture

From inside out: Six levels characterize the Industrie 4.0 maturity

1. Tasks are supported by data processing systems. Employees are relieved from repetitive manual activities.
2. Data processing systems are structured and linked. Core business processes are reflected in IT systems.
3. Companies have a digital shadow. The management takes data-based decisions.
4. Companies understand why events happen. Knowledge is discovered through recognition.
5. Companies know what will happen in the future. Decisions are made on the basis of future scenarios.
6. Companies react autonomously on conditions. The system controls itself autonomously and is fully viable.
The acatech model allows each structural area to be plotted according to maturity level and in a single view.
Industry 4.0 maturity is about more than the technology

A survey by PayScale Inc., an online pay and benefits researcher, showed 50% of employers complain that college graduates they hire aren’t ready for the workplace.

Source: UTD research study December 2017 and PayScale Inc., 2016

Their No. 1 complaint?

Poor critical-reasoning skills
Step 1: Evaluate overall maturity using acatech model

1. St. Gallen Management Model to identify the functions and process types

2. List down the sub-processes and identify the process(es) for maturity assessment

Overall maturity indexing based on the structuring forces and the dimensions of assessment

- Result of assessment: High performance in structuring force Information Flow
- Result of assessment: Low performance in structuring force Organization

Analysis of assessment between sub-processes

Reference circle representing aspired maturity level
Maturity assessment outcomes

1. Identify key performance indicators

2. Identify digital initiatives

3. Prioritize improvement opportunities

4. Estimate tangible business outcomes

ILLUSTRATIVE
Industrial Examples
Industrial IoT aids energy optimization in Infosys campuses

**Business Need**
Sustainability initiative at Infosys and implementation using IIoT solution

**Large Campuses**
80 million+ square feet

**Assets Managed**
- Chillers
- HVAC
- Generators
- Elevators
- Sewage Treatment plants
- Solar power plants

**Solution Approach**
- Central Command Center
- Demand Management
- Digital Twin and Optimum Operating Conditions
- Predictive Maintenance

**Business Benefit**
- 46% reduction in per-capita energy consumption over 8 years
- $100 million savings over 3 years
Visibility

Centralized command center for real-time visibility

Real-time data acquisition

Visibility to key operating parameters
Transparency

Analyzing performance – As Designed vs As Installed vs As Operated

Plot of Critical Performance Parameters
- Condenser Water Delta (leaving temp – entering temp)
- Chiller Water Delta (leaving temp – entering temp)
- Evaporator Small Temp Diff (Ref. Sat temp– Chiller Water leaving temp)
- Condenser Small Temp Diff (Ref. Sat temp– Condenser Water leaving temp)
- Chiller Working Hours

Digital Model

Study operating conditions, trends and performance
Predictability

Implemented advanced analytics on Chiller data for event detection and prognostics

- Identification of key performance indicators
- Exploratory analysis and visualization of data
- Event detection – Hotelling’s T-squared and quartile-based method
- Prognostics – ARIMA model with xreg variable
- Knowledge model development
Cost reduction and improved service performance using predictive maintenance

**Business Context**
- Financial services major with 150K ATMs globally
- Offer “ATM as a Service” with high availability

**Opportunity**
- Sensor information (component health) is analysed to predict failure
- Prediction allows “staged calls” for lower cost and higher availability

**Benefits**
- 14.3% efficiency increase [from 3.5 → 4 service calls per technician per day]

**Predictive Maintenance Use Cases**
- Predictive Analytics
- Chronic Identification

**Predictive Analytics Dashboard**
- Advanced analytics provides a geospatial prediction of faults for ATMs across geographies
- Interfaces with scheduling system to stage preventive calls

**Big Data Platform**
- Big data platform allows rapid calculations: generates prediction for 4,000 ATMs based on sensor incidents and transactions [over 2.5 M records] in seconds

**Benefits**
- 18% cost reduction from increasing mix to 40% staged calls

**Field Service Operations Use Cases:**
- Scheduling Advisor
- Dynamic Knowledge Tree

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$46M loss of business annually for downtime of just 1.6 hours per week

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How is Adient implementing Industry 4.0?
The largest global automotive seating supplier, supporting all major automakers in the differentiation of their vehicles through superior quality, technology and performance.

**FY 2016**

- **$17B** Consolidated revenue
- **$7B** Unconsolidated seating revenue
- **$8B** Unconsolidated interiors revenue

**Revenue by geography**

- Europe / Africa: 35%
- Americas: 29%
- Asia / Pacific: 30%
- China: 7%

**#1**

Global leader in the $60 billion automotive seating market

**1/3**

Supply one out of every three automotive seats worldwide

**Global locations**

- 230+ facilities
- 33 countries

**Global employees**

- 75,000+

*Source: IHS Automotive and management estimates; consolidated and unconsolidated revenue*
Current Digital focus is Industry 4.0: Improve operational processes

Customer Experience
- Customer understanding
- Top line growth
- Customer touch points

Operational Processes
- Process digitization
- Worker enablement
- Performance management

Business Models
- Digitally-modified business
- New digital business
- Digital globalization

Run Strong
operational excellence through effective execution

Drive ROI
continuous improvement of our core

Race Ahead
deployment of innovative solutions

- Reliability
- Availability
- Maintainability
- Security
- Major projects on core technologies
- Continuous improvement
- Remain current (N-1)
- Value stream based architecture roadmaps
- Security upfront
- Rationalization of technologies and applications
- New to Adient
- New capabilities and products
- New processes
- New technologies
- New locations and markets
- New methodologies
- New skills

* Adient 2017
Digital is changing the IT delivery model... increased focus on customer, more proofs of concepts, faster delivery

Innovation often doesn’t come from linear thinking. It requires a more creative, exponential approach that combines iterative and experimental approaches. Follow a three-phase approach:

- **Design Thinking** sessions and tactics are used to understand the customer and define the real need
- **Lean Startup** provides opportunities to create prototypes and conduct proof of concepts to experiment and demonstrate idea feasibility
- Use **Agile** practices to implement the solution in smaller segments for more control and allow flexibility
Digital team identifies business opportunities and applies technology to solve

**8** Design thinking workshops
- North America training
- Shanghai training
- Europe training
- Detroit IT leadership exposure
- Recaro aftermarket
- GBS automation
- Program launch
- Warren operations

**179** business problems captured
- Program launch
- Machine utilization
- SMRR mobility
- Non-connected employees
- Help desk chat bot
- Rockenhausen RFID on containers
- More in process

**43** Digital proofs of concepts (POCs)
- Digital boardroom
- Fabrics quality defects
- Inventory pick list
- Foam pump analytics
- Exchange rate update
- Automate legal entity creation
- Dig4IT work streams
- iApprove app

**15+** Projects in production
- Container tracking RFID
- eLPA app on tablets
- Vehicle content
- Program translator
- Infosys NIA
- PPA IoT for Recaro
- Accounts Receivable dashboard
- Various IT enhancements
- Cloud apps
Example: Electronic Layered Process Audit: 78 sites live

**Problem Statement**

- Manual and time consuming
- 30 to 40 people performing audits in average plant.
- Significant time is spent on audit planning, audit execution, documentation, corrective action planning and reporting.
- Lack of visibility to audit data and findings
- High overhead of a manual process results in lack of compliance - plants are not performing audits.

**Business Benefits**

- COPQ reduction
- Potential savings of 220 hours saved per plant per month
- Increased compliance
- Increased visibility

**Digital Enabler**

- Mobile capability
- Applications

**Benefits of the electronic layered process audit software**

- BOS and ICMS compliance
  - The software was developed based on Johnson Controls work instructions and forms.

- No paperwork needed anymore
  - Audits are executed with a tablet. This makes the process more efficient, as paperwork is not needed anymore. In the past, collecting findings from paper checklists was time-consuming. Now, the findings are in the system as soon as the tablet has wireless local area network (WLAN) connection.

- Automatic scheduling of audits
  - Once eLPA is set up, it can propose an audit schedule by layer. When the administrator accepts the proposal, eLPA will send Microsoft Outlook invitations to the auditors and track if the audit was done.

- Central questionnaire
  - In eLPA, it is possible to add mandatory questions to the plant questionnaire. Of course, the plant is also able to add its own questions and map them to single workstations.

- Email reminders
Continuing the conversation….

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