Digitalizing Manufacturing processes
Online Remote Monitoring (Internet of Things – IoT) and enterprise software
ABB Ability MOM and ABB Ability CALM
Digitalization
General Overview

Asset Management
ABB Ability™ Ellipse CALM Overview

Control System
ABB Ability™ System 800xA Overview

Live Demo
Digitalization

Key Drivers

Internet of Things  Wireless Communication  Information & Big Data Analytics  Visualization  Cloud

Mobility  Artificial intelligence, machine learning  Processing power  Price  Collaborative Robots

Anything Can Be Connected, Will Be Connected
What is “Digital” and Why Digital matters

- **Digital** means different thing to different people. In ABB, it is about customer focus, data driven, close the loop of people, process, asset, with technology.

- The advancement of technology means very soon,
  - Almost any “thing” that can be connected – will be connected.

- Connected devices will change how the industry works,
  - Will disrupt the current business and enable new business models

- Digital topics are driving customer benefits in:
  - Decision Making
  - Innovation
  - Growth
  - Efficiency
What can we do with LOTS of Digital Data?

- There is basically unlimited amount of data available, some digitally collected, but…
  ... it is useless if they make no sense ...

- How to create knowledge from the unknown:
  - Digitally collect data into Unified Data Storage
  - Visualization of information
  - Closing the loop of manufacturing operations
  - Algorithms approach (predictive analysis, machine learning, advanced statistics etc)
  - Prioritize data collection with domain knowledge
  - Prioritize action items using newly acquired knowledge!
ABB Ability™ Powered Data Analytics
Analytics Enhanced by ABB Knowledge

Less data to process saves cost and improves accuracy.

Plant → Unified Data Set → Filter Out: Processes Control Programs known by ABB → Faster Big Data Analytics → Find New Insights Like customer demands and production trends
ABB Proposition & Digital Strategy

**Business Planning & Logistics**
- Business Analytics, Advanced Visualization, Enterprise Asset Management Strategy, Operation Optimization, Service Strategy, ...

**Manufacturing Operations**
- Dispatching Production, Quality Management, Materials, Track & Trace, Production Scheduling, Reliability Assurance, ...

**Plant Wide Extended Automation & Lifecycle Management**
- Process & Production Control, Electrical, Safety, Cybersecurity, Lifecycle Support, ...

Inter-cloud

**ABB Ability™ Cloud Platform**

Apps on cloud

Apps on premise

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April 1, 2019
Slide 7
Global Multi Site Operations
Dashboard
Global Multi Site Operations

Energy Monitoring Dashboard
Global Multi Site Operations

Interactive instant reports and analysis
Remote Monitoring on your mobile

Operator

OEE

Material Consumption

6.5 % Availability

26.3 % Performance

46.7 % Quality

46.7 % Quality

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Target</th>
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<tr>
<td>M-211-02</td>
<td>Output Gear</td>
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Materials Consumed
Overview

Scalable and modular suite:
- Process intelligence
- Manufacturing execution
- Production intelligence
- Production optimization

Enables the various stakeholders effective decision-making and production execution with fully integrated operations

Platform Independent encompassing core common services
Digitally Enabled Automation Systems

Enabling new values through Digital

Level 1: Instrumentation
- IoTSP enabled
- Local I/O
- Remote I/O
- Intelligent devices

Level 2: Control & Operation
- IoTSP enabled
- DCS
- SCADA
- Production data
- Control & Protection

Level 3: Production Planning & Optimization
- Maintenance Management
- Historical data
- Service Center
- 3rd party data
- Condition monitoring data
- Installed base data
- Common object models and communication protocols targeting Industrie 4.0 compliance

Level 4: Enterprise Resource Management
- IT / Office Floor
- Historical data
- Condition monitoring data
- Condition monitoring data
- Common object models and communication protocols targeting Industrie 4.0 compliance

OT / Shop Floor
- IoTSP enabled
- System server
- MES
- IT Security

Cloud/Off Site
- IoTSP enabled
- ABB IoTSP platform
- IT Security
- OfficeFloor
- Shop Floor
- MES
- IT Security
- Cloud/Off Site

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April 1, 2019
ABB Ability™ Manufacturing Operations Management

ABB Ability™ System 800xA

**Operator Effectiveness**
- Full scope and features set including optimal collaborative environment through control room design based on human factors best practices

**Electrical Integration**
- Combines process and power automation in a common infrastructure for improved operations, maintenance and collaboration

**Enterprise Asset Management**
- Full scope asset monitoring that helps operators, maintenance and manufacturing operations management streamline procedures and become more predictive

**Integrated Safety**
- Combines basic process control and high integrity applications for improved control strategies and improved safety

Plant-wide consolidation, collaboration, and optimization!
System 800xA
Extended Automation

- Operations
- History
- Batch
- Cyber Sec
- Notification (SMS)
- Reporting
- Calculations
- Alarm Mgt.
- Video Integration
- Public Address
- Document Mgt.
- CMMS Integration
- Asset Condition Monitoring
- Loop Performance

See www.abb.com/800xA for more information!
ABB Ability™ Manufacturing Operations Management

Improve operating procedures, integrate existing plant equipment and control end-to-end production process

Production management
Plan, respond and change on demand: order and production buffers, workflow management, automatic mapping of routing from ERP

Labor management
Accurate management and tracking of staff attended hours (Join/Leave) and activities on a given product against defined production time

Material management
Tracking, tracing individual parts, lots, batches, assemblies. Material identification, real-time reporting of material consumed and produced, material compatibility and availability

Quality management
Quality data collection, test certificates, in-process quality control, automatic tolerance validation, non-conformities reporting, checklists

ERP / Business Systems

ABB Ability™ Manufacturing Operations Management
Process intelligence Manufacturing execution Production intelligence Production optimization Connectivity Data Storage Common Services UX Reporting

Downtime management
Real-time downtime info to make immediate improvements, long-term data collection for investigation of production process problems

Equipment maintenance management
Plan, create and execute equipment maintenance with support of instructions, checklists and task tracking

PLC/SCADA/DCS

Warehouse Management
Control storage locations & levels, movement within warehouses, compatibility, manage silos and containers, integrate with external warehouses / inventory management systems

Overall Equipment Effectiveness (OEE)
Out-of-the-box software based on the standardized method of measuring and improving productivity

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Genealogy
Comprehensive track and trace capabilities from raw material, intermediates to finished product

Weigh and dispense
Improve productivity, safety and accuracy of weighing, integrate scales, bar code scanning and label generation

Enterprise connectivity
Seamless integration of ERP, SCM, MES, databases, applications, various production equipment and control systems from different vendors
Evolution of digital business and analytics

Need for operational improvement steers analytics from descriptive to predictive

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<thead>
<tr>
<th>Data</th>
<th>Analytics</th>
<th>Human input</th>
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<tr>
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<td>Descriptive</td>
<td>Decision</td>
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<td></td>
<td>Why did it happen?</td>
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<td>Predictive</td>
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<td>Prescriptive</td>
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<td></td>
<td>What should I do?</td>
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</table>

Action

Decision support

Decision automation

Source: Gartner (February 2015)
The dynamic digital world requires dynamic business operations
Continuous Improvement

Simple process, superb solution, extraordinary value

Connect / collect

All data sources:
• Sensors
• Historian
• Databases
• EAM

Analyze / predict

Expert models (ABB, third party)
Statistical models (Azure Machine Learning)

Inform

Advanced operational business intelligence

Continuous optimization and improvement

Track

Enterprise asset and work management

Act
Leveraging digital transformation in asset management

ABB Ability™ Ellipse® – Connected Asset Lifecycle Management

The solution for next-generation asset management

- Unifies award-winning\(^1\) functionality for asset performance management, enterprise asset management and workforce management
- Provides unprecedented orchestration of priority, process & people
- Proactively predicts, prescribes and prioritizes maintenance
- Enables planning based on risk of failure and operational criticality
- Utilizes expert data modeling for continual improvement
- Leverages real-time operations data for improved efficiencies
- Improves responsiveness by delivering the right work at the right time to the right people

\(^1\)Navigant Research Leaderboard Report: Asset Performance Management, 2017 Assessment of Strategy and Execution for 10 Leading Vendors of APM Solutions for Utilities
Connected Asset Lifecycle Management

Example Scenario

Combining data from different sources to drive work based on asset condition
Effective Asset Management Requires Engineering, Maintenance, and Operations Working Together
ABB Ability Ellipse APM (UI)

Asset risk

Issues

Analytics

Assets by Type

Spatial view

Most important issues

Issue with pump cooling system
PUMP.200 - P.200

Issue with pump cooling system
PUMP.100 - P.100

Subsystem Mechanical Alert
CBK.GLD142825 - GLD142825

Subsystem Dielectric Alert
CBK.GLD142825 - GLD142825

Subsystem Accessory Alert

Key risk changes

Increased
CBK.200 - 5205652
Pontiac, Illinois, United States / Circuit Breaker

Decreased
ABB Ability Ellipse APM (UI)

Assets Summary / 98 items

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<thead>
<tr>
<th>Organization</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
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Assets by Age

- 0 - 10 years: 12, 15, 21
- 11 - 20 years: 4, 11, 6
- 21 - 50 years: 3, 9, 1
- 51 - 80 years: 4, 1, 1
- > 80 years: 4, 3

Assets by Organization

- Illinois: 21, 32, 15, 2
- Indiana: 4, 5, 9, 0
- Wisconsin: 2, 2, 3, 0

Assets by Type

- Transformer: 11, 15, 3
- Circuit Breaker: 0, 15, 14
- Battery: 2, 4, 4
- Capacitor Bank: 1, 2, 2
- Fan: 3, 3, 3
- GIL Circuit Breaker: 1, 1, 1
- Instrument Transformer: 2, 2, 2
- Pump: 1, 1, 1
- T-Line: 1, 1, 1
- Turbine: 1, 1, 1
- Wind Turbine: 1, 1, 5

Assets by Voltage Class

- 0 - 44 kV: 5, 3, 0, 2
- 45 - 66 kV: 2, 3, 2
- 67 - 110 kV: 2, 2, 2
- 111 - 220 kV: 7, 15, 15
- <= 221 kV: 7, 11, 3

Last update: 23 hours ago
### Issues / 92 items

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</table>
Manual Inspection Results -> APM

Measurements gathered in the field can be used as inputs to asset performance models.
### ABB Ability Ellipse EAM
A complete Asset management Solution

| Assets | - Capital and expense projects  
| - Construction works management  
| - Maintenance strategy  
| - Equipment costing & performance |
| Materials | - Requirements determination  
| - Vendor management  
| - Inventory management  
| - Contracts & procurement |
| People | - Organization & people management  
| - Time, attendance & payroll  
| - Training  
| - Health, safety, security and environment (HSSE) |
| Work | - Plan, schedule  
| - Execute, complete  
| - Job & project costing / analysis |
| Finance | - Budgeting and forecasting  
| - Project costing  
| - AR / AP  
| - CPR / fixed assets |
| Analytics | - Asset & operations insight  
| - Construction through operations  
| - Informed decision making  
| - Improves outcomes |
Work -> Mobile Execution

Schedule and Assign Work Orders -> Release Updates to Field Technicians
Work -> Mobile Execution

Field Work Execution via Mobile Application
Work -> Mobile Execution

Work Order Updates from the Field

Completion Details

Attach Photographs

Defect Request

WORK ORDER RESULTS ARE STORED IN THE EAM SYSTEM
WFM and the RealWear HMT-1: Hands Free Work in the Field

ABB Ability WFM
FieldWorker HFI

Order Details  Live Chat  Work Notes

Task
Task Description  Turbine Rotor Check
Priority  P3
Job Instructions  1. Remove casing and visually inspect gearbox. 2. Perform Acoustic analysis. Ensuring the tower entrance door is completely closed with no interference from any extraneous noise or wind, a fifteen second real-time sound recording can be captured at the base of the tower via a microphone using a sophisticated Sound Level Meter, with FFT (fast Fourier transfer) functionality and an onboard recording module. This reading enables us...
Use Cases

**Today**

- Remote Mentoring/Collaboration
- View Order Details

**Coming in 2H 2018**

- Form Completion
- View Schematics
- Chatbot Order Creation
Digitalization
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ABB Ability™ MOM

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Live Demo Scenario

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Apps on cloud

Apps on premise

ABB Ability™

Ellipse EAM

ABB Freelance

OPC DB

Freelance

The Hybrid Process Control System