ABB IN PULP AND PAPER

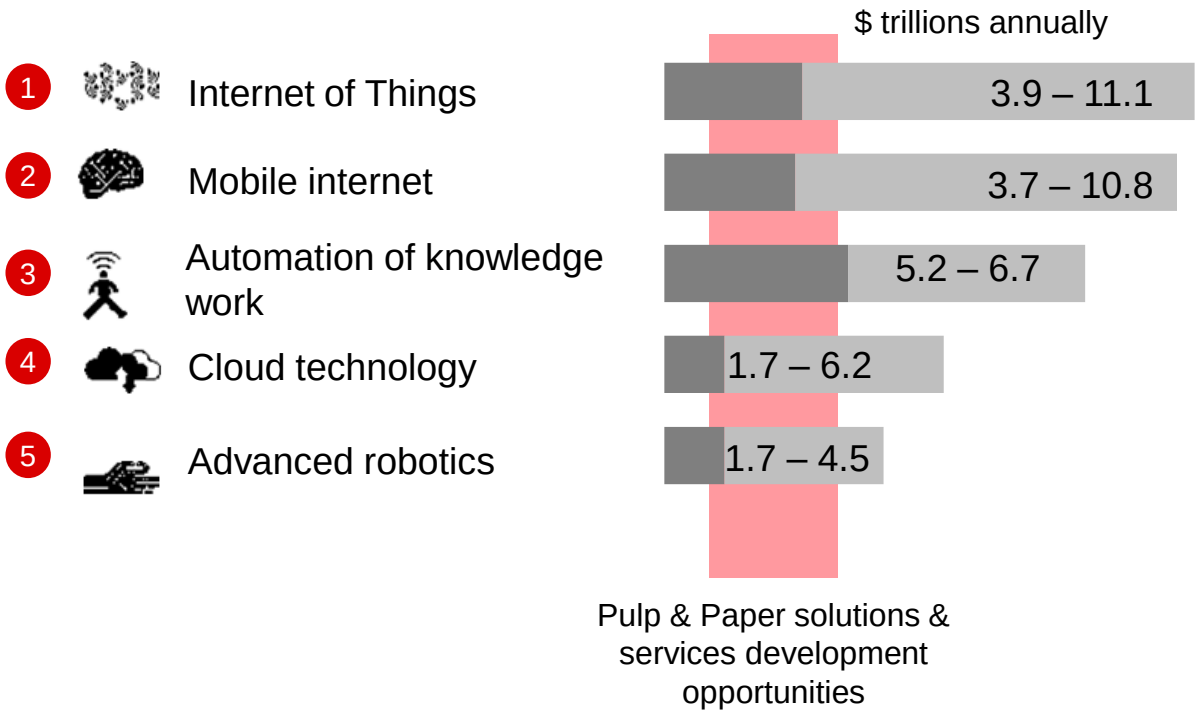
Collaborate Operations for performance improvement in the Pulp and Paper Industry

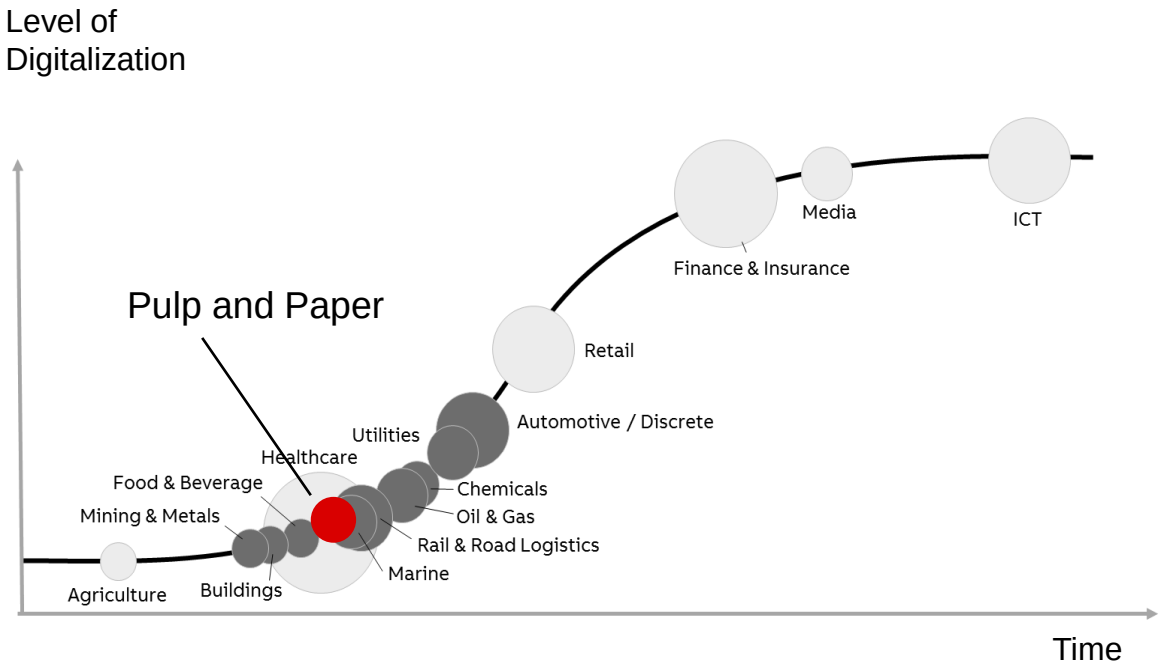
November 2018

Disruptive trends impacting industries

Opportunities lay in integrating different technologies

Economic impact of most significant technologies





Pulp and Paper Industry challenges

- Attracting and retaining key talent, and utilizing them effectively
- Operational transparency, flexibility and innovation across the enterprise
- Leveraging the knowledge of suppliers and other contributors
- Operating leanly at competitive cost levels

Pulp and Paper Industry Digital transformation

Journey towards value chain optimization

Partly Automated

Islands of Connected Devices & Sensor

Islands of Automation

Islands of Electrification

Local Automated

Pulp/Paper Mill automation

Asset Condition Monitoring

Section based optimization e.g. Fiber line

Connected & optimized

Locally connected and optimized pulp/paper mill

Process Optimization

Predictive maintenance

On-premise optimization+ on-demand remote connections

Collaborative & mobile

ABB Ability™ Integrated collaborative Pulp and Paper solutions

Collaborative and Remote Operation Centers

IT & OT integration & analytics

Seamless data and process integration

Real time production planning & scheduling

ABB Ability™ Cloud based services

Cloud-based asset & production performance monitoring & Optimization

Management control and visibility Augmented Reality

Autonomous & economic optimization

Optimized productivity and availability across value chain – Utilizing Artificial Intelligence

Autonomous Operations

Machine learning for predictive maintenance & advanced process control

Value chain optimization applications

Economic Process Control

Digital twins

IT and OT Convergence

Pulp and Paper (IT/OT) Solutions Landscape

Enterprise Solutions

- Analytics and Visualization
- Overall Equipment Efficiency (OEE)
- Energy Management
- Decision Support (Power BI)
- ERP (Connectivity)

IT

Plant MES Solutions

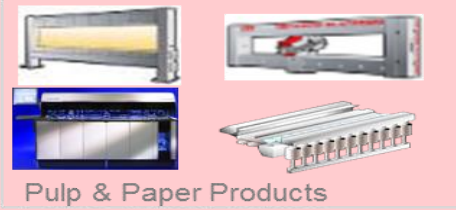
- Warehouse and Logistic Management
- Order Management System
- Production Planning
- Production Management
- Quality Management

Blending together

Automation Control (800xA)

- Optimization (APC)
- Process Information Management System
- Power Management System
- PM Drives(PMC800) Controls
- Process Controls (DCS, QCS)
- Machine Controls (MCS, Actuators)

Devices and Sensors



OT

ABB in Digital

Uniquely qualified

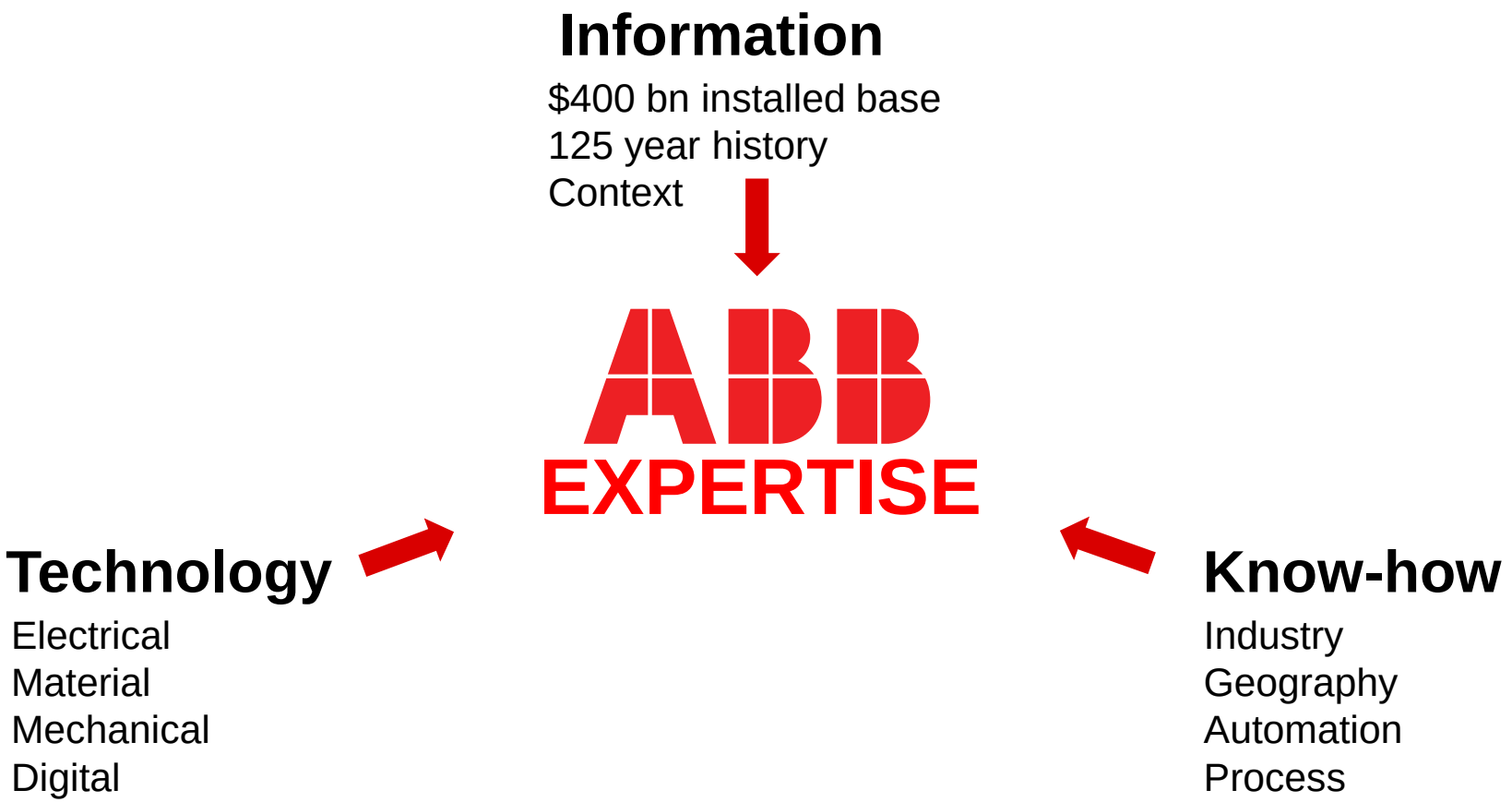


ABB Ability™ solutions & platform

Utilities **Industry** **Transportation & infrastructure**

ABB Ability™

Digital solution | Digital solution | Digital solution | Digital solution | Digital solution

Platform
(common technologies for device, edge, and cloud)

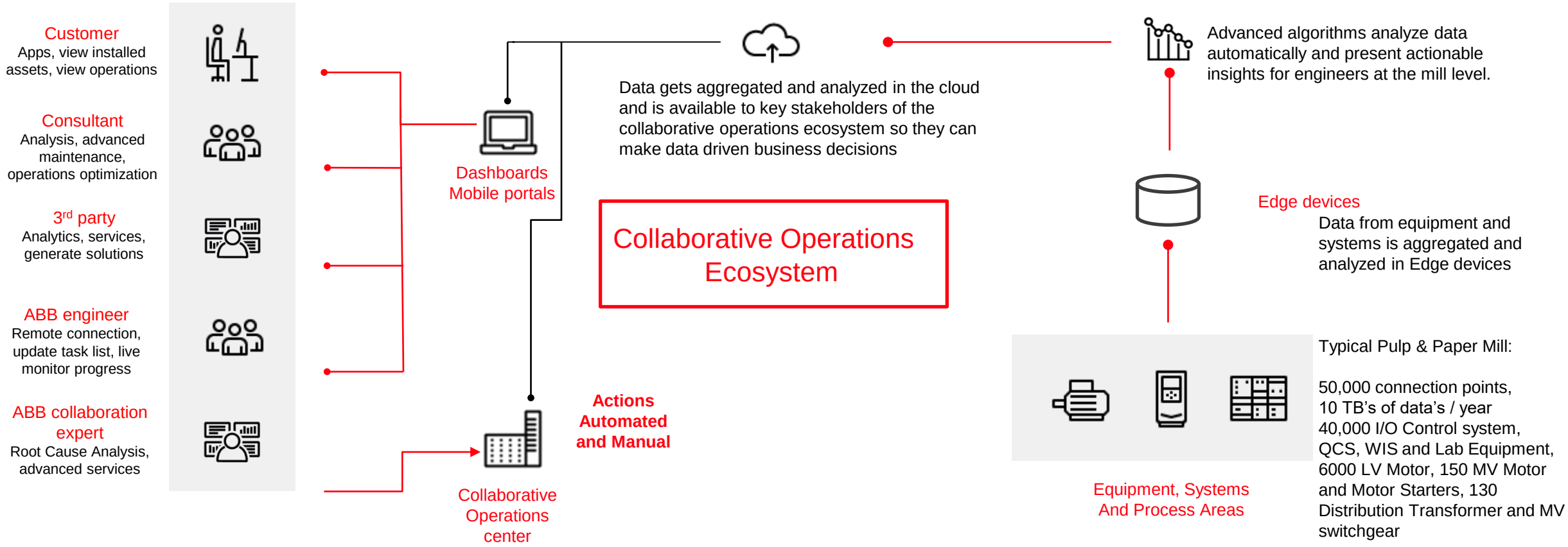
Microsoft Microsoft Azure

What Delivers customer benefit (uptime, speed, yield…)

How Provides ABB with efficiency and scale

Collaboration in data-driven ecosystem

People make the difference



Leading solutions for collaborative operations

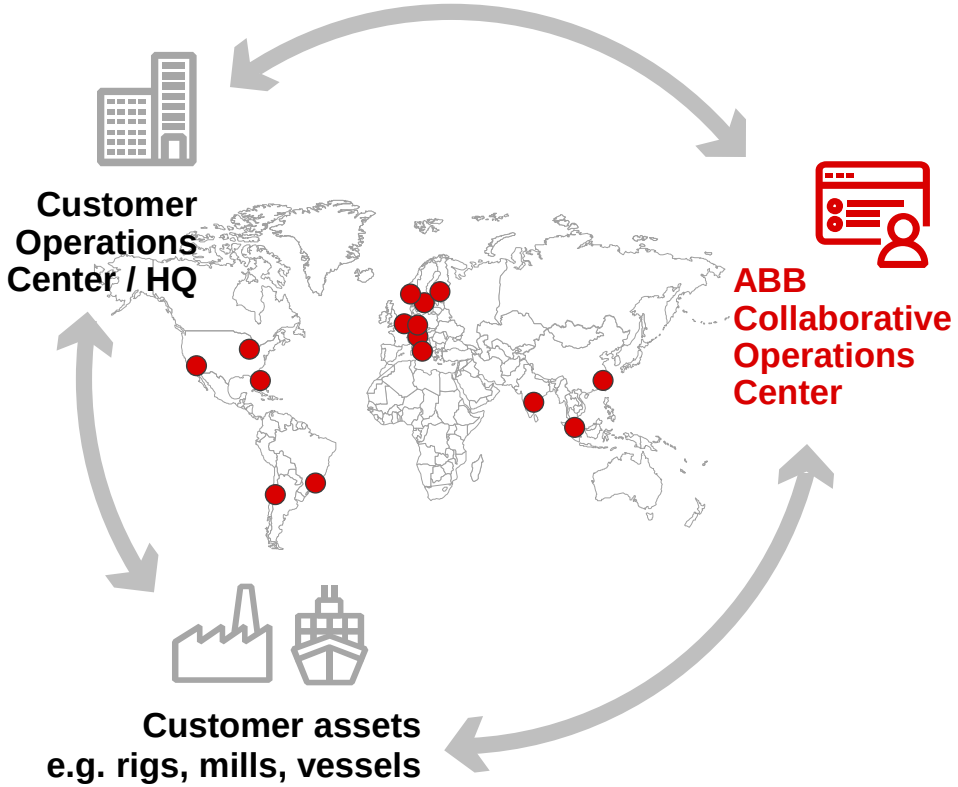
ABB Ability™ Collaborative Operations turns data into profitability at single plants & across enterprises

Analytics

- Visualization
- Data Analytics

Ops support

- Remote support



Predictive maintenance

- Condition monitoring
- Asset Health
- Maintenance Planning

Optimization

- Energy optimization
- Process optimization

Cyber and Safety

- Cyber security
- Safety management
- Alarm management

Transformation

- Control centers
- Infrastructure
- Consulting

Optimizing operations throughout the value chain

ABB Ability ™

Integrated Data Visualization - Insights

Integrated Data Analytics - Knowledge

Order Management	Production Planning	Production Management	Operational Performance	Cost Efficiency	Inventory Optimization	Distribution Proficiency
– Order tracking – Lead time reduction – Cash flow improvement – Optimal pricing	– Minimize grade change costs – Minimize trim losses – Less material in process – Slot optimally	– Reduce working capital – Avoid under / over production – Roll-Set optimization / rebate reductions	– Monitor production – Maximize automation (Control, robotics, artificial intelligence) – Increase equipment availability – Optimize throughput – Improve quality	– Energy management – Raw material target optimization – Maintenance efficiency	– Minimize inventory	– On-time delivery – Roll specific production data

Collaborative Operations

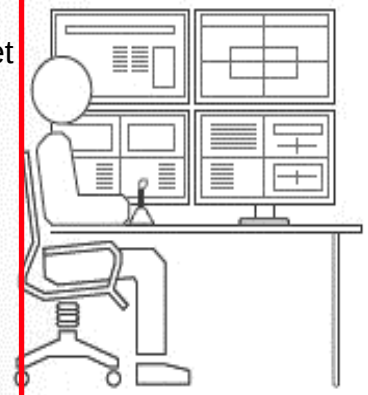
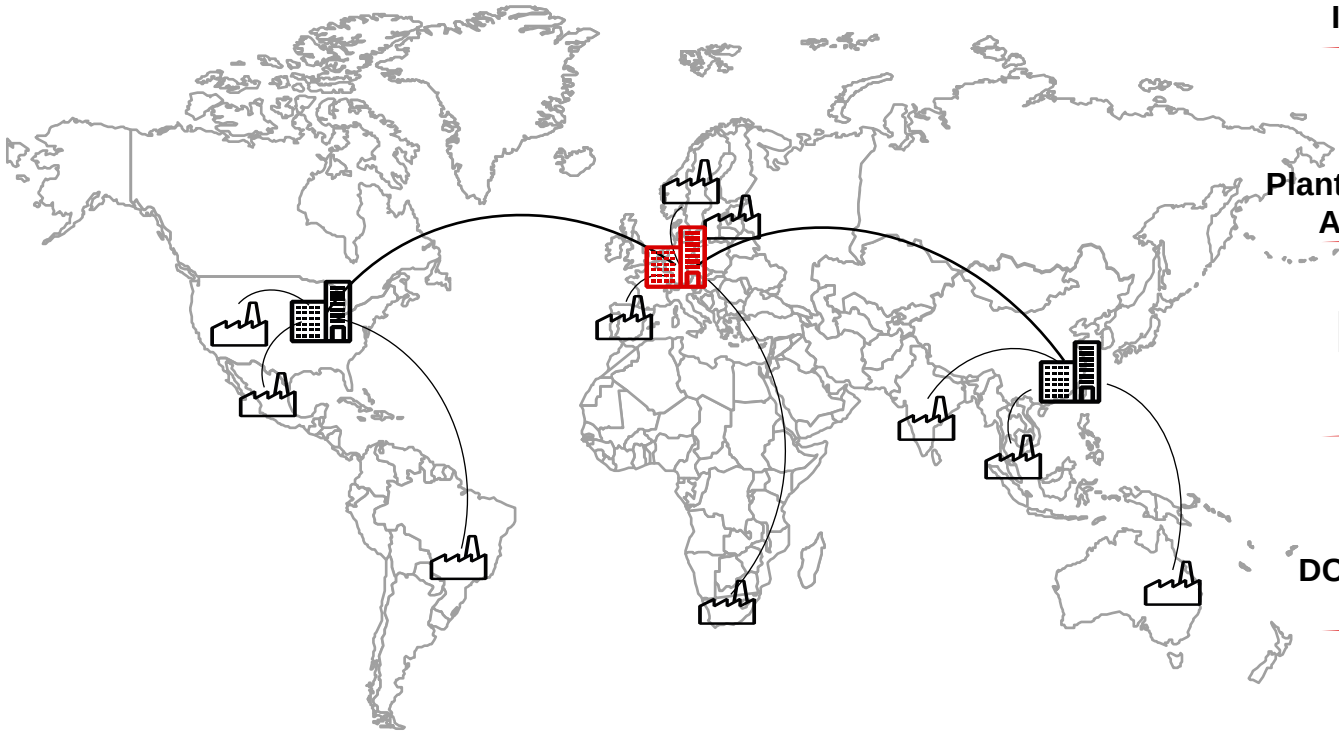


ABB Ability™ for your enterprise

Optimization for all enterprise levels

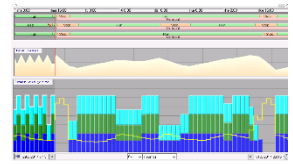


Enterprise Insights

- With ABB Ability **Analytics and Visualization** Services the plant and enterprise status, KPI dashboards and other essential performance metrics are calculated and visualized automatically and in real-time

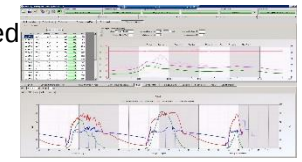
Plant/Enterprise Analytics

- **Advanced analytics** and expert support for **optimization** in your operations
- Energy and production optimization based on production needs and energy prices to optimize profits



MES

- **Production optimization** based on continuously collected data analyzed by special tools and experts
- 30% reduction in opex and improved safety due to increased transparency and real-time decision-making

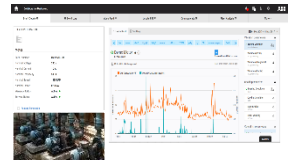


DCS/SCADA

- **Operational improvement** from world-class experts with best tools available
- Annual operational savings of $5 million and up to 50% energy savings in mining

Device

- **Condition monitoring and predictive maintenance** of critical assets like automation system, drives, motors, electrical distribution and generation, valves, and actuators. ABB and non-ABB assets



Collaborative Operations Centers across the world for many industries

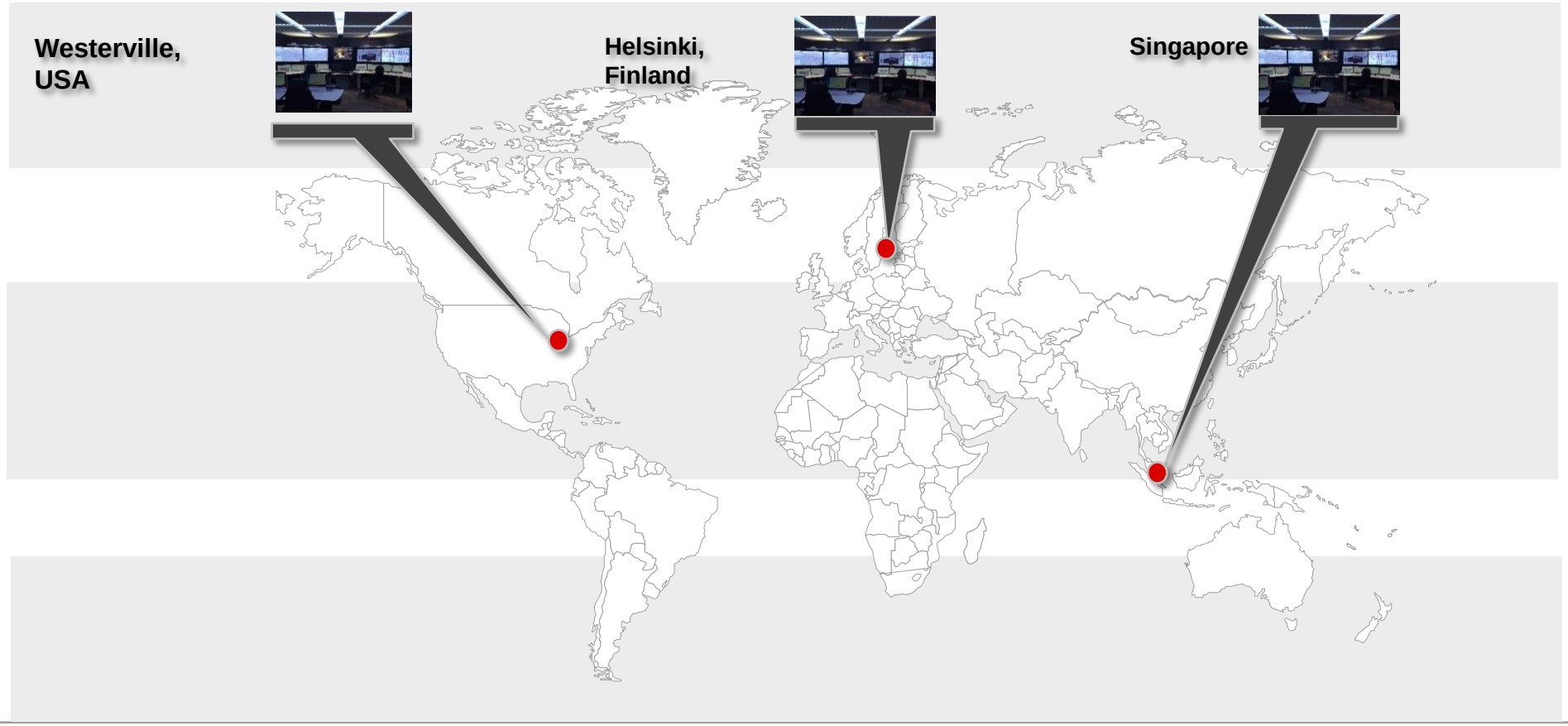
ABB is aggressively investing in Collaborative Operations Centers globally

Strategic locations for 24x7 operations

Americas	Asia	Europe
Sao Paolo, Brazil	Bengaluru, India	Billingstad, Norway
Houston, Texas, USA	Shanghai, China	Dattwil, Switzerland
Miami, Florida, USA	Singapore, Asia	Genoa, Italy
Westerville, OH, USA		Helsinki, Finland
		Oslo, Norway
		Vasteras, Sweden

Collaborative Operation Centers for Pulp and Paper

Follow-the-sun strategy for pulp and paper customers



Monitor and measure KPIs

Measuring benefits

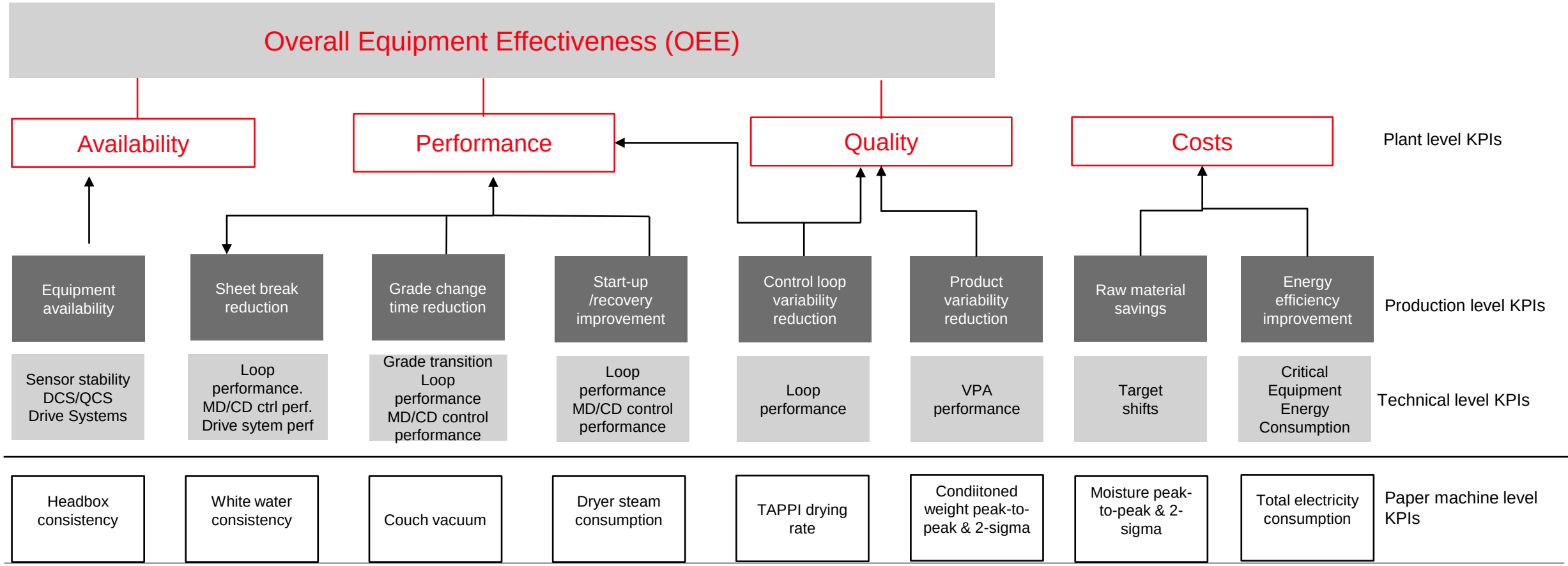


ABB Ability™ Collaborative Operations

Analytics and Visualization – ABB and Microsoft Partnership

Analytics and Visualization

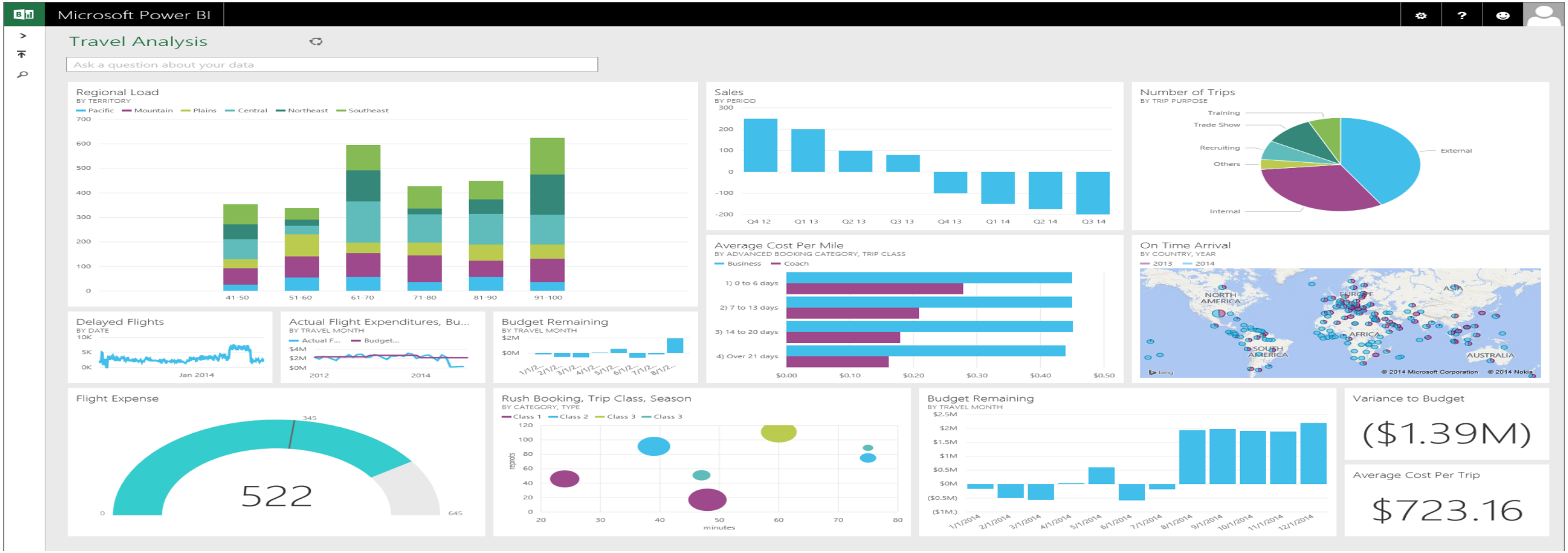
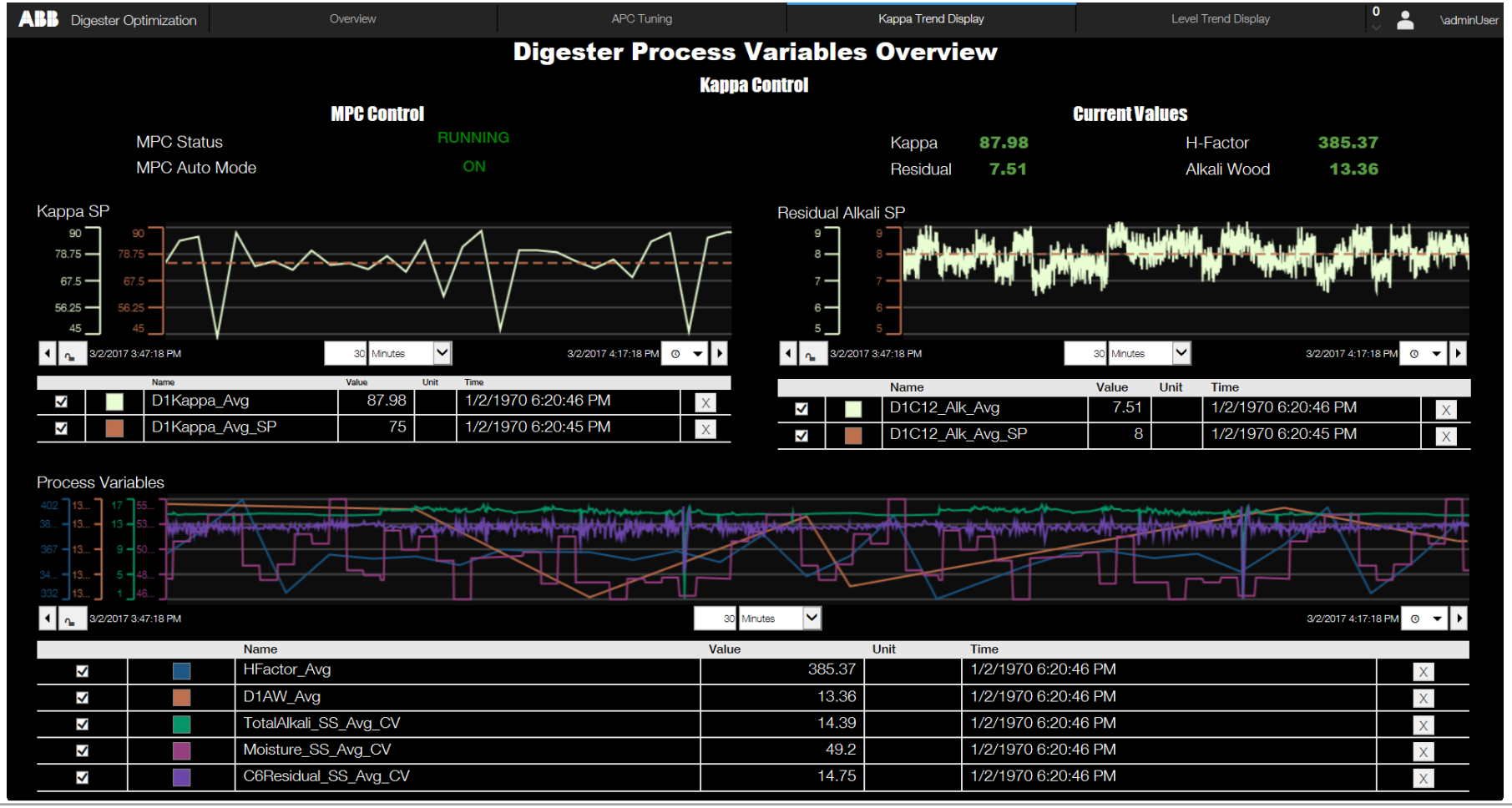


ABB Ability™ Collaborative Operations

Analytics and Visualization



Analytics and Visualization

ABB Ability™ Collaborative Operations

Process Performance - Pulp Mill

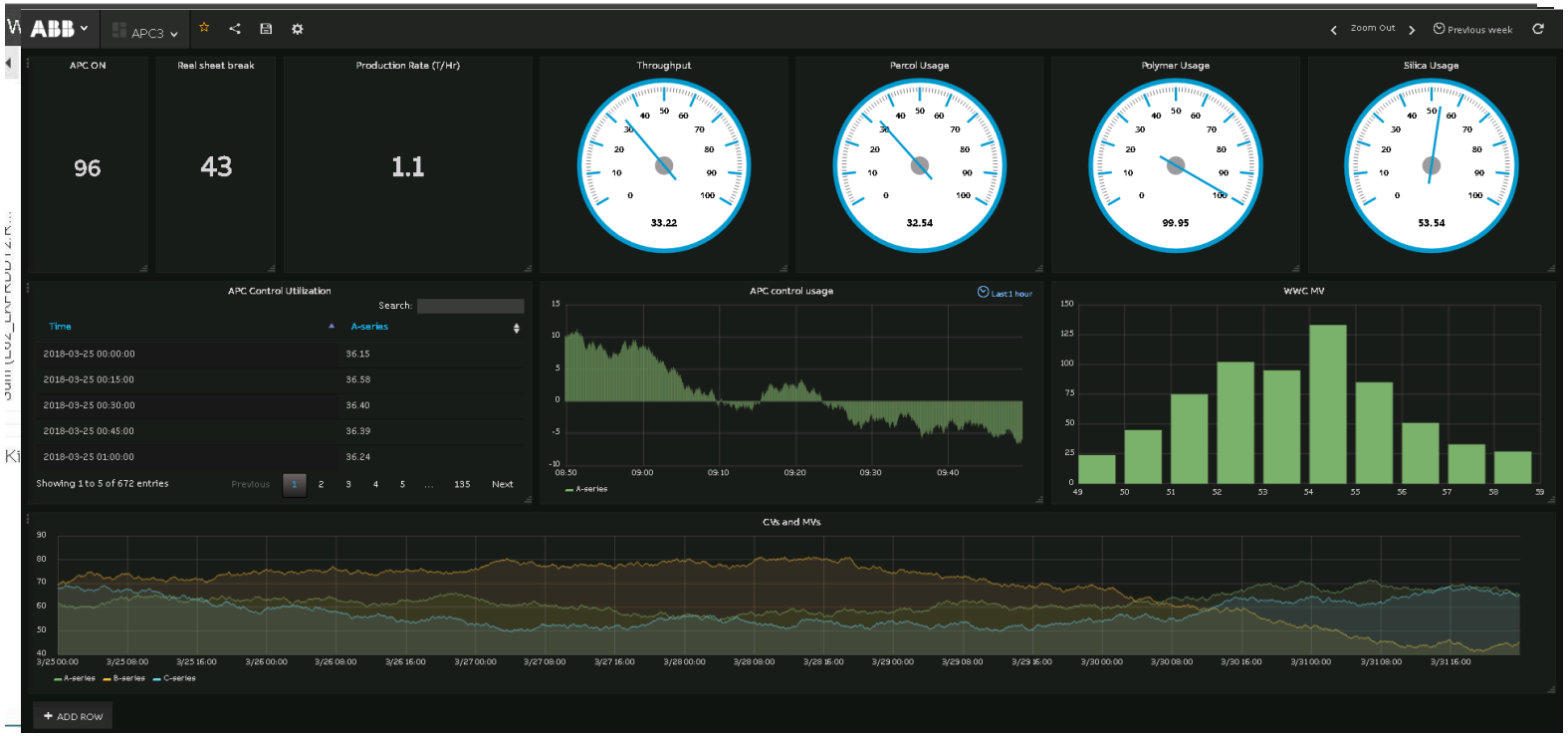
ABB Ability™ Pulp Mill Performance

Pulp Mill Process Optimization (including APC) Deliverables

- Predictable production throughput utilizing advanced analytics (APC) to improve pulp mill process performance and operations
- Targeted quality by improved control performance and optimized process variability.

Pilot:

- Lime Kiln process performance optimization (APC) installed at site and commissioned. Initial results showed technical issues - investigation in-progress
- Analysis: Process performance KPI's are defined and configured in Ability for P&P architecture,
- Visualization: implementation of process performance displays at site - in progress
- Infrastructure: Ability Edge server installed, data collection of APC data (via OPC DA) is under testing



* Ability for P&P architecture is defined as the technology and methods used to collect, transport, analyze and visualize data from a customer site.

ABB Ability™ Collaborative Operations

Features, Benefits & Business Impact

Paper Machine Performance

Features

- OEE monitoring
- PM/Technical KPI optimization
- Daily performance check
- Action recommendation and execution

Benefits

- Start-up time reduction
- Quality improvement
- Sheet break reduction

Expected business impact: **500 KUSD+ / year**

Grade Change Improvement

Features

- Grade change performance monitoring
- KPI checks
- Data analytics- root cause identification
- Action recommendation and execution

Benefit

- Grade change loss reduction

Expected business impact: **200 KUSD+ / year**

ABB Ability™ Collaborative Operations

Features, benefits and business impact

QCS Sensor Performance

Features

- Continuous analysis of Sensor KPIs
- Daily performance check
- On demand analysis
- Action recommendation and execution

Benefits

- Improved paper quality

Est. Business Impact: **200 KUSD+ /year**

Control System Availability

Features

- Continuous analysis of System KPIs
- Cyber security KPIs monitoring
- Daily performance check
- On-demand analysis
- Action recommendation and execution

Benefits

Improve system performance

Est. business impact: **Risk reduction**

Drive System Availability

Features

- Continuous analysis of drives
- Daily performance check
- On demand analysis
- Action recommendation and execution

Benefits

Reduced unplanned downtime

Reduced sheet breaks

Est. business impact: **300 KUSD / year**

Active contracts for ABB Ability Collaborative Operations

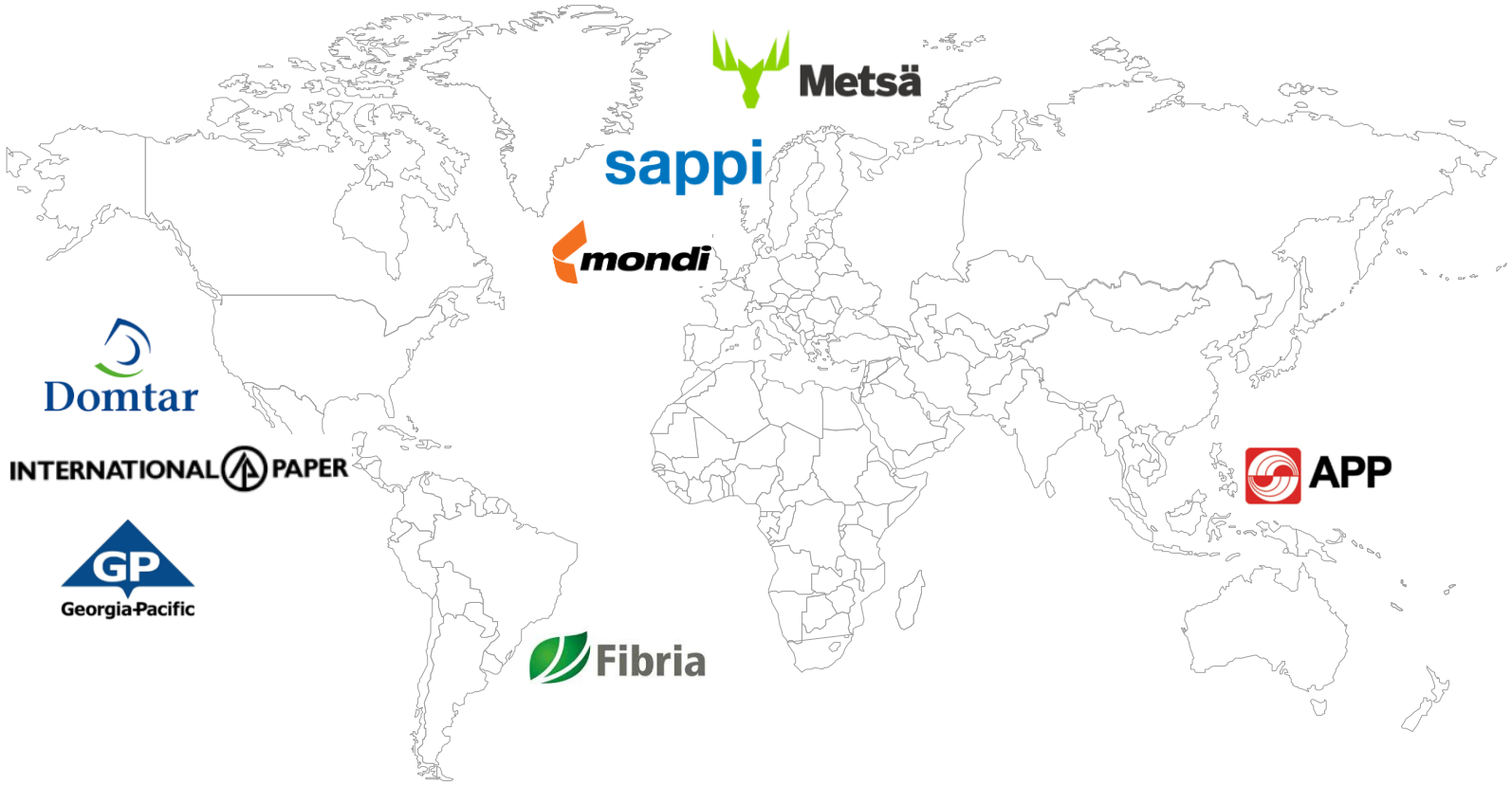
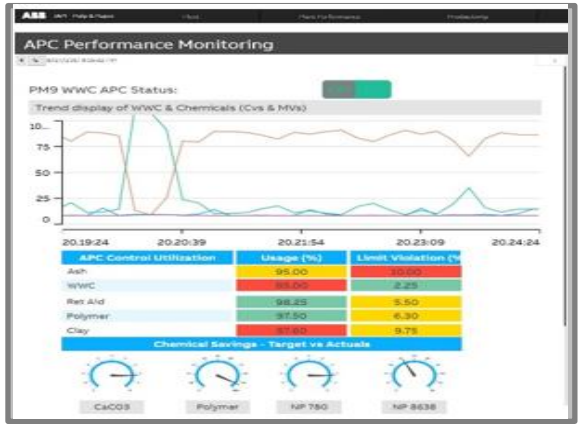


ABB Collobration Operation improves paper machine productivity, quality and cost

Subscription Service to improve paper machine perfromance



Customer challenges

- Paper production limited by sheet break challenges
- Paper machine process variability
- High cost of raw material, chemical and energy per ton of paper

Solution

- **Advance Process Control for wet end** to improve runnability
- **Grade change** implementation
- **ServicePORT** for sustaining results

Customer benefits

- ✓ **Sheet break and grade change improvement (25 %)**
- ✓ **Chemical consumption reduction (5 %)**
- ✓ **Process variability improvement (Ash MDL reduction by 15%)**

Business Model: Performance based, fixed Subscription base fee
ROI: 6-8 Months, **Date:** 2017

Paper Mill in Indonesia

Customer segment:

✓ Pulp and Paper Industry

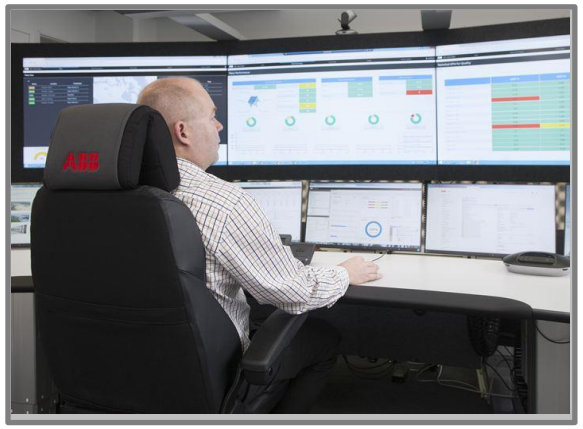
ABB Ability™ solutions:

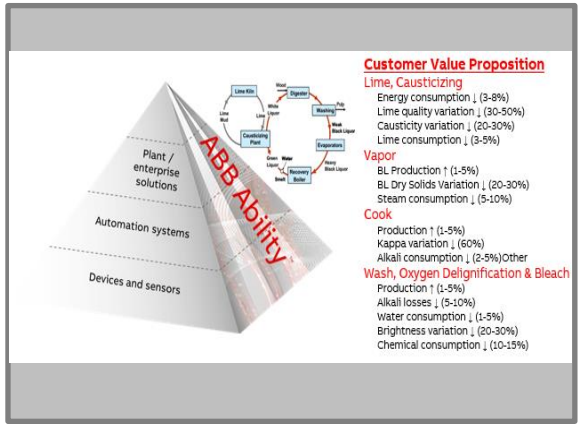
✓ Collaboration Operation
✓ APC
✓ ServicePORT
✓ Paper Machine Performance

Delivery in progress

ABB Collobration Operation improves pulp mill productivity, quality and energy

Subscription Service to improve pulp mill perfromance





Customer challenges	– Paper production limited by Pulp Mill Productivity Challenges – Pulp Mill process variability and long process delays – High cost of raw material, chemical and energy
Solution	– **Predictable production throughput** utilizing advanced analytics (APC) to improve pulp mill process performance and operations – **Targeted quality** by improved control performance and optimized process variability. – **Cost reduction** by reducing raw material, chemical and energy costs
Customer benefits	✓ **Increase in Lime Availability (2 %)** ✓ **Reduced Fuel Savings (5 %)** ✓ **Decrease Make-up Lime Consumption (6 %)** ✓ **Potential increase Lime Prod Capacity (4%)**

Business Model: Performance based, fixed Subscription base fee + Bonus/ Penalty
ROI: 8 - 12 Months, **Date:** Dec, 2017

Pulp Mill in Sweden

Customer segment:

✓ Pulp and Paper Industry

ABB Ability™ solutions:

✓ Collaboration Operation

✓ APC

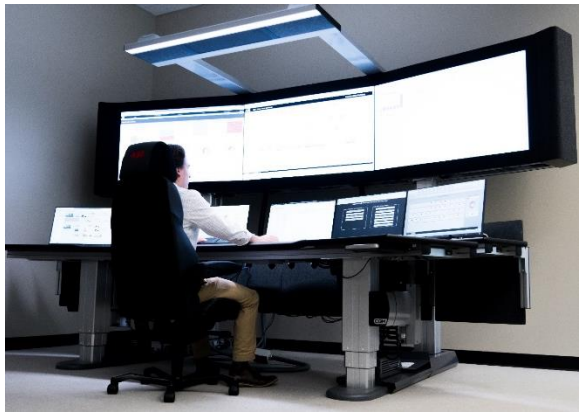
✓ ServicePORT

✓ Pulp Mill (Lime Klin) Performance

Delivery in progress

ABB Collobration Operation improves paper machine productivity, quality and cost

Subscription Service to improve paper machine performance



Customer challenges

- Significant paper losses during frequent grade changes
- Paper production limited by sheet break challenges
- High cost of raw material, chemical and energy per ton of paper

Solution

- **Predictable production throughput** utilizing advanced analytics and collaborative operations to improve paper machine process performance and operations
- **Targeted quality** by improved control performance and optimized process variability
- **Cost reduction** by reducing raw material, chemical and energy costs

Customer benefits

- ✓ **Sheet break and grade change improvement (10 %)**
- ✓ **Raw material savings ($2/ton)**
- ✓ **Process variability improvement (Up to 20%)**

Business Model: fixed Subscription base fee,
ROI: 12 Months, **Date:** Aug, 2017

Paper Mill in USA

Customer segment:

✓ Pulp and Paper Industry

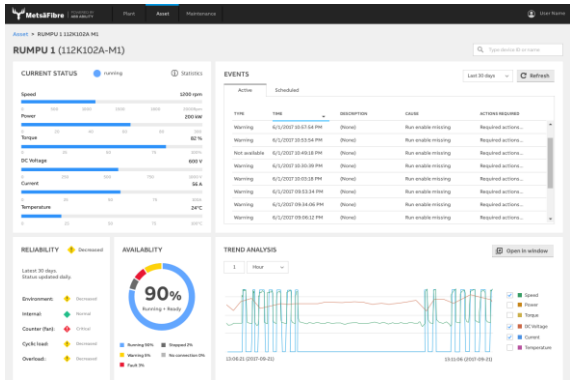
ABB Ability™ solutions:

✓ Collaboration Operation
✓ ServicePORT
✓ Paper Machine Performance
✓ Grade Change Improvement

Delivery in progress

ABB Collobration Operation improves plant reliability, availability and lifecycle costs

Subscription Service to improve pulp mill availability



Customer challenges

- **Customer strongly emphasized reliability, availability and lifecycle costs** of the electrical distribution

Solution

- **Ability platform** for data collection, RTDB-based
- **Condition monitoring applications** for HV/ MV- distribution, transformer, UPS, drives and LV breakers
- **Remote Assistance Agreement for Drives**

Customer benefits

- ✓ **Less maintenance cost, improved asset management**
- ✓ **Less down time , faster trouble shooting**
- ✓ **Improved reliability**

Business Model: Ability as project, Ability maintenance and Remote Assistance as annual agreement, **ROI:** Long term, **Date:** 2017

Metsä

Äänekoski, Finland

Customer segment:

✓ Pulp and Paper Industry

ABB Ability™ solutions:

✓ Ability platform

✓ Electrical Condition Monitoring Solutions

✓ Drives Remote Assistance - Collaboration Operation

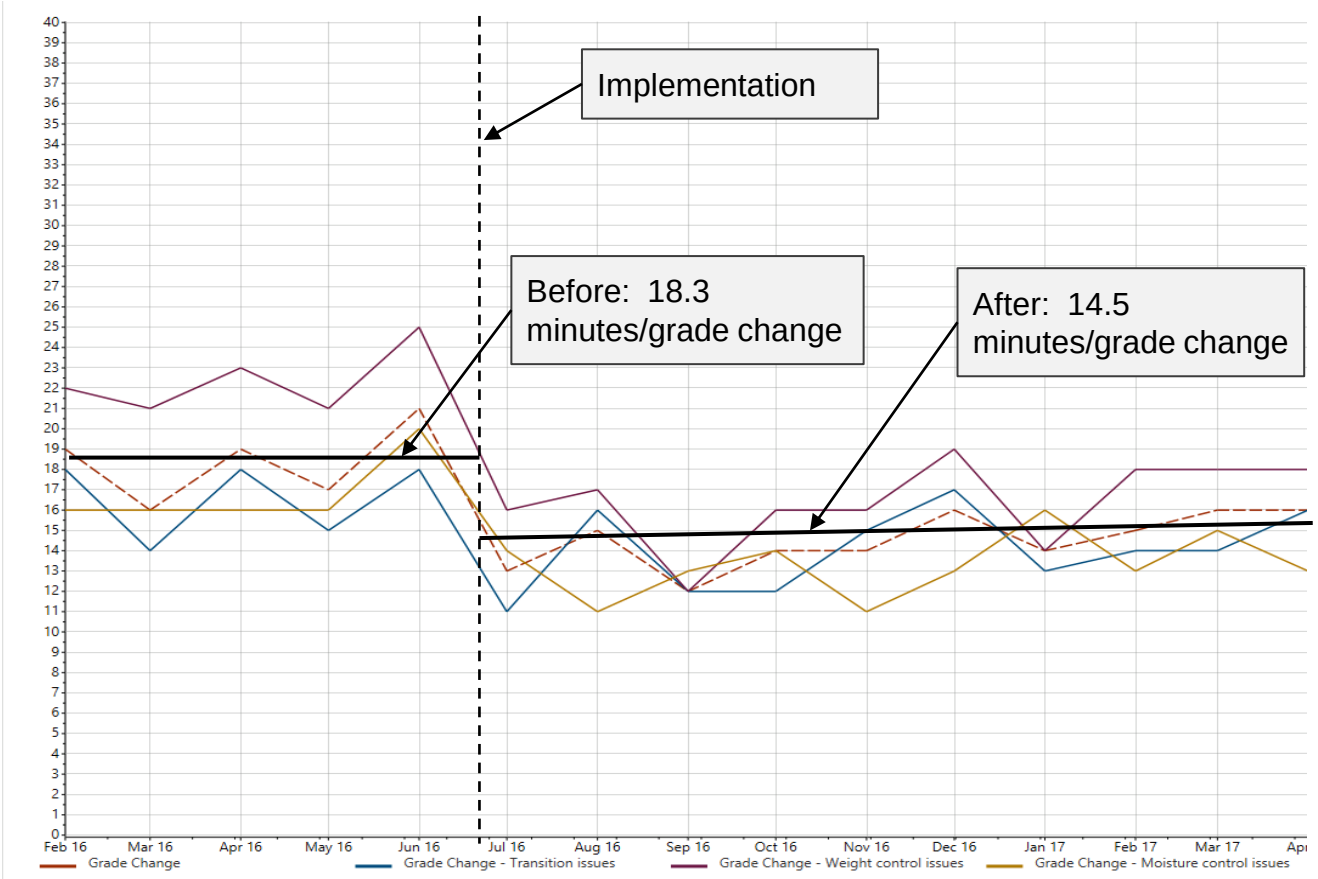
Simple use case of analytics + collaboration – grade change optimization

Digital Enablers

- Edge computing
- Advanced analytics
- Collaboration

Benefit

- 4.5 minute grade change time reduction
- $300,000 annual profit increase



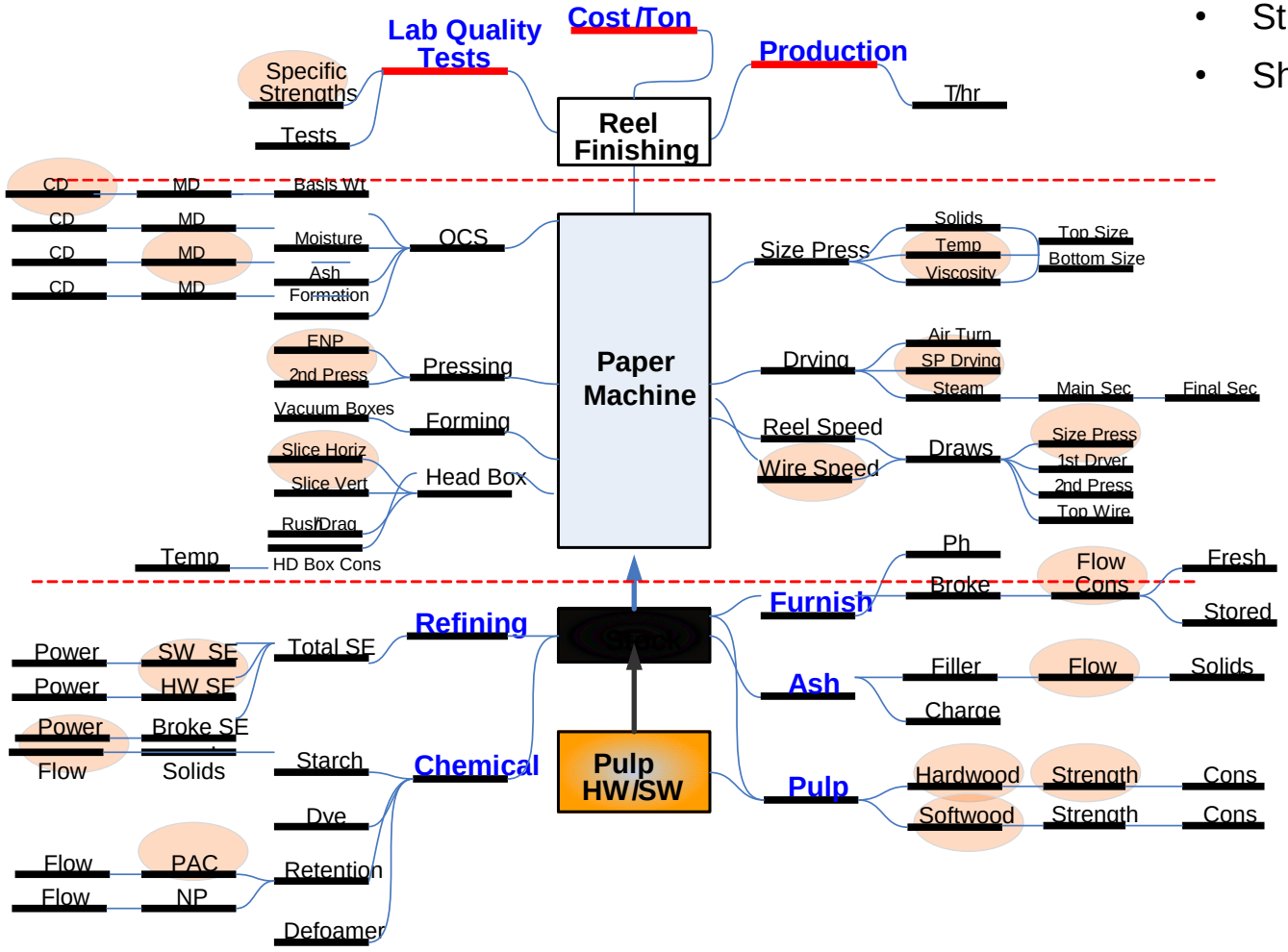
Analytics in complex use cases

Digital Enablers

- Edge computing
- Domain Expertise
- Data Science
- Advanced analytics
- Collaboration

Benefit

- Cost reduction
- Runnability improvement
- Increased production
- Business efficiency
- $M's annual business impact



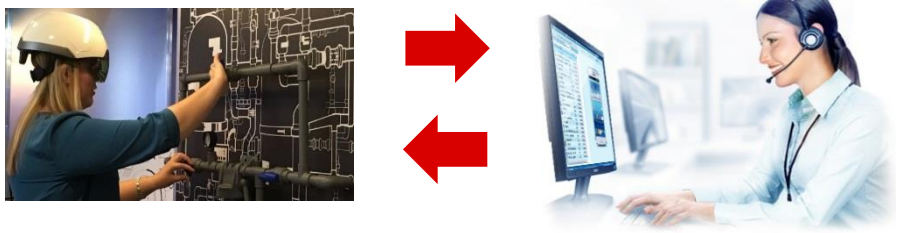
Focus Areas

- Strength prediction
- Sheet break prediction

Digital Twin and Augmented Reality Concept

Remote expert for typical and non-typical service tasks

Hardware Platforms

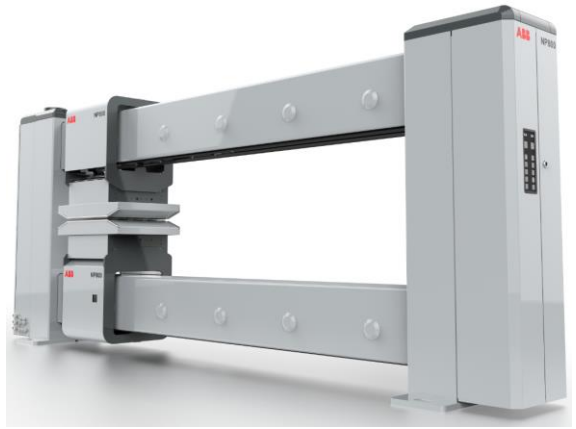


Software Platforms

PTC Vuforia Chalk
Skype
(Skype for Business)
(Microsoft Teams)
etc.

Concept

Digital twin is superimposed on physical objects to aid in usage or service



Digital Twin

Extensions beyond own equipment

Process simulation	-Leveraging DCS and QCS built-in process simulation, and external optimization models
Value chain simulation	-Leveraging MES “order to cash” experience
Collaborative design-build	-Leveraging experience in optimal design contributions, for example in electrification

ABB strategic focus for digital in pulp and paper

- Practical solutions that can be implemented for results now, with opex approaches
- Leveraging our global footprint of key talent to contribute to customers anywhere
- Co-imagining the future with customer thought leaders (ex. AR or control room of the future)
- Building the “near-future” of this evolution with analytics, learning, augmented reality, etc.