Paper Industry 4.0
The Digital Revolution in Papermaking?

München, 2018-02-28 – Jürgen Käser, Voith Digital Solutions

The world’s most valuable resource today is data
Industry 4.0:
Focussing on production processes

Internet of Things (IoT):
Enables new business models and services.
Information & communication technologies for consumer markets enter the industrial space

Mobile World Congress 2016

Is the paper industry 4.0 ready?

Is the paper industry 4.0 ready?

Major investment required?

- New Automation Systems
- New Sensor technology
- Smart Aggregates
- Long term data storage?

4.0 ready

Paper industry is well prepared to enter the 1st phase of Industrie 4.0

No!

Basis is set!

- Interfaces are available
- Automation level is high
- Gradual increase possible
- No data – No big data
Evolution of Papermaking 4.0 solutions with IoT

The path to the Digital Twin

PM 4.0 industry solutions

Industrial cloud with Digital Twin and next-gen solutions

Optimization and visualization

Integration, enhanced visualization, and knowledge capture

Digital Twin and machine-learning

Time line

Available now

Description (not exhaustive)

- (Virtual) sensors
- Data analytics and real-time process control
- Condition monitoring
- Visualization

Customer value

- Optimization of operations with significant monetary benefits
- Capturing process knowledge in software

2018

- Cross-site and cross-solution access to data for reporting and advanced analytics
- Enhanced visualization

- Transparency of operations and capturing of knowledge across mills
- Enabling overarching controlling and management
- Future-proof setup

Continuous development

- Continuous evolution of solutions – selection
- Predictive maintenance
- Self-learning optimization
- Digital Twin
- Seamless integration of customers and suppliers

- Direct additional business value from (cloud) industry solutions

New functionality and solutions become continuously available

Our Goal – Digital Twin

Utilize structured and cross-linked information in the cloud

Benefits

+ simulate
e.g. rebuilds

+ predict
e.g. mechanical failures

+ optimize
e.g. production process

+ test
e.g. process changes

+ recognize
e.g. saving potentials

+ plan
e.g. logistics
Papermaking 4.0 & IoT
Solution bundles increase value

Benefits:
- Future-ready PM 4.0 concepts
- Data is transformed into information
- Interoperability and scalability give flexibility
- Best practice implementation and cross-site learning
- Increased transparency, time and cost savings as well as productivity gains

Get unlimited possibilities with Voith IoT

FOR THE CUSTOMER
Voith’s IoT offering takes the unknowns out of the process, replacing it with science and analytics. By doing so, Voith’s IoT provides complete machine operational transparency leading to improved machine efficiency, quality, and economic performance.

FOR THE USER
Voith’s IoT offering is a fully integrated customized experience for all users based on their needs by delivering intuitive and easy to understand information, analysis, and control options relevant to the user’s role.
Papermaking 4.0 – Targets

- 50% less Unplanned Downtime
- 50% less Off-Spec Production
- 50% less Break & Change Time
- Up to 10% higher Productivity
- 7% less Fiber
- 10% less Labor
- 10% less Energy
- 10% less Maintenance Cost
- 50% less Materials
- 50% less Unplanned Downtime
- 50% less Off-Spec Production
- 50% less Break & Change Time

Up to 10% lower operating costs

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Papermaking 4.0 Solution Portfolio
The sum of three big talents

**OnEfficiency**: The modular solution to visualise, stabilise & optimise

**OnCare**: Intelligent condition based, predictive maintenance

**SmartService**: The service you need before you know it

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OnCall Video – PILOT PHASE
When help is needed at the machine...you can get it immediately!

Main features
• **Availability**: OnCall Video enables virtual expert support where it is needed
• **Collaboration**: Find solutions together with an expert online
• **Interactive**: See and redline the same picture in real-time synchronization
• **Leverage**: Save time to come to the right decision
• **Secured Network (optional)**: Local wireless, security standards, firewalls, VPN connection

OnCare AM & OnCare MEx
Success story: Linerboard 200,000 tons per yr.

Main features
• **Prepopulated system**
• **“Best practice” maintenance processes**
• **Complete transparency** – automatic KPI tracking & multi-mill integration
• **Availability on any device**
• **Full integration** with OnCare CM & compatible with all ERP systems

Key benefits
- Expert collaboration
- Implementation < 4 months
- Future-ready
- External support

**Achievements**

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
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<tbody>
<tr>
<td><strong>Net efficiency [%]</strong></td>
<td>92</td>
<td>95.4%</td>
</tr>
<tr>
<td><strong>Maintenance cost [$/ton]</strong></td>
<td>37</td>
<td>&lt; 31</td>
</tr>
</tbody>
</table>
OnCare AM – Transparency

Function: Enables as frontend or standalone a transparent Asset Management including the full practical functionality of a computerized maintenance management system (CMMS).

Main features:
• User friendly with graphical navigation
• Predefined and uniform plant breakdown structure
• Full transparency with automated KPI tracking for optimized Performance Management
• Pre-programmed best practice processes for request and work order management
• Mobility all information on smart phone or tablet (work orders, instructions, drawings,...)
• Condition Monitoring & Process Control communication integrated enabling advanced analytics – PdM
• Augmented Reality
• Easy internal benchmarking with multi-mill integration
• Compatible to any ERP system
• Prepopulated preventive maintenance plans

OnCare AM – Mobility

Function: As part of operators and technicians standard equipment, this will increase the efficiency of a maintenance operation by reducing waste (time, information quality,...).

Main features:
• Full functionality on hand-held device including work order management
• Instructions and documents available at the machine, in workshop and in warehouse
• Documentation of defects or failures can be stored directly in the system
• Feedback of personnel can be made instantly
Mobile Inventory:
• Real-time inventory and cross-check of parts availability and storage
OnCare CM

Main features
• Stationary and/or mobile condition monitoring
• Automatic sensor health check
• Event tracking
• Extended analysis functions
• Modular for stepwise integration
• Integration to OnCare AM
  • Automatic workorder generation
  • Automatic asset data update – e.g. defect frequencies

Key benefits
- Increased transparency
- Root cause identification
- Safe decision-making
- Time savings
- Continuous improvements
- Stable process

OnCare CM – Predictive Maintenance

Analyzing Software
• preconfigured measuring points enable bulk analyses
• event tracking – automatic alarm generation
• remote expert support for condition and technology analyzes
• technology monitoring

Hardwired stationary system
• modular concept – easy to roll out and expand

Handheld mobile data collection
• mobile data evaluation IOS & Android on the spot
• easy to use with predefined routs

Integrated in Asset Management system
• interface process control systems
• enabler of advanced analytics and machine learning
OnCare MEx – Consulting

**OnCare MEx – Maintenance360™**

The Voith Maintenance Performance assessment will give the production facility a good picture how the maintenance organization is performing compared to the benchmark including GAP’s and Saving potential the audit is focusing on key components in maintenance management for instance:

- Organization Efficiency
- Cost Control & Down Time Management
- Notification and Work Order Process
- Planning and Scheduling Process
- Maintenance Management Information System & KPI’s

**OnCare MEx – Maintenance Management Coaching**

The experienced Maintenance Consultants from Voith will help and coach the customer to optimize or redesign the maintenance processes in order increase efficiency and reduce cost. For example:

- Planning and Scheduling Process
- RCM & TPM concept design and implementation support
- CMMS plant structure design and implementation support
- Preventive Maintenance Process design
- Maintenance strategy
- Specific Expert Training

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**eDocumentation – available Q1 2018**

**Main features**

- Make use of OnCare AR – Industrial Augmented Reality (tablet version or HoloLens version)
- Structure data and provide object-oriented information
- Reduce searching times
- Real-time data availability
- Information security
- Improved user experience

**Key benefits**

- Improved version
- Knowledge capture & sharing
- Security
- Paper-free office

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OnEfficiency Strength
Success story: Double ply board 450,000 tons per yr.

Main features
- **Virtual Sensors** to predict strength properties in real time
- Automatic control of strength
- Cost based controller adjustment
- Various combinations possible
- Stable product quality at minimum cost

Key benefits
- Optimum quality
- Lower cost of ownership
- Process optimization
- Stable process
- Continuous improvements

Savings
Total 1.32M €/yr.

Virtual Sensor
Real time measurement without “physical sensor”
Virtual Sensors – Eliminating delay times
Knowing what the lab is going to measure in 1.5 h

Correlation of the model

Burst

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No of samples</td>
<td>3336</td>
</tr>
<tr>
<td>Time period</td>
<td>2016-05 to 2016-11</td>
</tr>
<tr>
<td>R² correlation P1</td>
<td>0.94</td>
</tr>
<tr>
<td>No of parameters</td>
<td>20</td>
</tr>
</tbody>
</table>

Typical accuracy: 98 out of 100 predictions are within ±5% of the measuring value

A high number of paper properties can be predicted with virtual sensors

Currently build models

<table>
<thead>
<tr>
<th>Quality general</th>
<th>Paper strength</th>
<th>Printability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis weight</td>
<td>SCT</td>
<td>Porosity</td>
</tr>
<tr>
<td>Ash content</td>
<td>CMT</td>
<td>Mottling</td>
</tr>
<tr>
<td>Moisture</td>
<td>Burst</td>
<td>Color</td>
</tr>
<tr>
<td>Thickness</td>
<td>Tensile MD/CD</td>
<td>Roughness</td>
</tr>
<tr>
<td>Density</td>
<td>STFI</td>
<td></td>
</tr>
<tr>
<td>Curl (MD/CD)</td>
<td>Mullen</td>
<td></td>
</tr>
<tr>
<td>Stiffness</td>
<td>Ply Bond</td>
<td></td>
</tr>
<tr>
<td>Ring Crush</td>
<td>Fold crack resistance</td>
<td></td>
</tr>
</tbody>
</table>
OnEfficiency Strength
Layout for triple ply board  350,000 tons p.a.

OnE Strength
Results

Main results:
• Decreased off-spec production
• Reduced fibre consumption
• Reduced energy consumption
• Dry content stabilization
• Reduction of process chemicals (starch)

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OnEfficiency DIP
Success story: Newsprint 170,000 tons DIP per yr.

Main features
• Controls the final quality of a DIP plant automatically
• Adjusts flotation cells and bleaching stages based on cost
• Loss optimized brightness gain
• High variety of target settings
• Integrated PM QCS brightness as lead constant

Key benefits
• Optimum quality
• Lower cost of ownership
• Process optimization
• Stable process
• Continuous improvements

Savings
Total 2 M €/yr.

OnE DIP
Advanced DIP Process Control

Resources prices

Final Set Point
• Ash
• Brightness

Set Point Ash
Set Point Brightness
Set Point Ash
Set Point Brightness
Set Point Ash
Set Point Brightness
Set Point Ash
Set Point Brightness

VOITH
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Ash sensor
Brightness sensor

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Modules to create value

Case Study: OnE DIP Mill 350,000 t/y, Europe

Savings/year

Yield (ash balance) 1.54 Mio €
Energy flotation pumps 0.37 Mio €
Chemicals/Additives 1.24 Mio €
Faster grade change 0.40 Mio €
Total 3.55 Mio €/year

ROI < 6 months
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