SAP Digital Manufacturing Strategy

Carlos Portillo
EMEA Center of Excellence – Digital Supply Chain
Industry 4.0, Manufacturing, Asset Management & Sustainability
## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>Topic</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:30 – 10:00</td>
<td>30 min</td>
<td>Registration</td>
<td></td>
</tr>
<tr>
<td>10:00 – 10:25</td>
<td>25 min</td>
<td>Welcome / Introduction - SAP IoT &amp; Digital Supply Chain Strategy SAP Leonardo</td>
<td>Omar Moursli</td>
</tr>
<tr>
<td>10:55 – 11:15</td>
<td>20 min</td>
<td>Break</td>
<td>All</td>
</tr>
<tr>
<td>11:15 – 11:50</td>
<td>35 min</td>
<td>Gain Real Time Insight and Increase Manufacturing Operations Performance with SAP Manufacturing Integration &amp; Intelligence&lt;br&gt;Including SAP MII live sensors demo</td>
<td>Carlos Portillo</td>
</tr>
<tr>
<td>11:50 – 12:25</td>
<td>35 min</td>
<td>Enable Paperless Shop-Floor Execution and Gain Full Visibility in Each Product As-Build-Report with SAP Manufacturing Execution</td>
<td>Eric Thieren</td>
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<tr>
<td>12:25 – 13:25</td>
<td>60 min</td>
<td>Lunch</td>
<td>All</td>
</tr>
<tr>
<td>13:25 – 14:05</td>
<td>40 min</td>
<td>Success Story of SAP MII implementation at Datwyler: Business case, Pitfalls, Lessons learned, Best practices</td>
<td>Stepan Picka</td>
</tr>
<tr>
<td>14:35 – 14:50</td>
<td>15 min</td>
<td>SAP Asset Intelligence Network Demo</td>
<td>Dane Hermse</td>
</tr>
<tr>
<td>14:50 – 15:00</td>
<td>10 min</td>
<td>Closing</td>
<td>Jan de Winne / Omar Moursli</td>
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Business Reality

Business Needs

- Increase production efficiency and reduce overall manufacturing costs
- Increase efficiencies in energy consumption and the use of materials
- Minimize wastage and scrap
- Reduced machine failure / error rates and maintenance costs
- Increase quality & product compliance
- End-to-end product traceability
- Highly customizable, on-demand manufacturing
- Enhanced communication with the consumer base

Current Challenges

-Disconnected operation technology from business technology
- Siloes systems
- Paper logs
- Manual data collection
- Manual creation and maintenance of KPIs
- Lack of visibility into shop floor operations
- Reactive decisions
- Non-integrated cross LoB processes
‘Better Outcomes’ – The real reason for IoT projects

<table>
<thead>
<tr>
<th>Lower cost</th>
<th>Increased Uptime</th>
<th>New Products &amp; Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimized Productivity</td>
<td>Less Waste</td>
<td>Improved Turnarounds</td>
</tr>
<tr>
<td>New Revenue</td>
<td>Faster Deliveries</td>
<td>Usage – Based Pricing</td>
</tr>
<tr>
<td>Greater Capacity</td>
<td>Better Efficiency</td>
<td>New Business Models</td>
</tr>
</tbody>
</table>
Connecting Things with People and Processes

LoB Digital Supply Chain
(Business Process View)
- Digital Business Planning
- Digital Response & Supply
- Digital Logistics
- Digital Product Innovation
- Digital Manufacturing
- Digital Operations

SAP Leonardo
("Things" View)
- Connected Products
- Connected Assets
- Connected Fleet
- Connected Infrastructure
- Connected Markets
- Connected People

SAP Leonardo Portfolio

Industry view

Line of Business view

Technology view
Trends Impacting Digital Manufacturing
Internet of Things and Industry 4.0

SAP Digital Manufacturing runs industrial IoT with Industry 4.0 scenarios

**Internet of Things**

- **Industrie 4.0**
  - Manufacturing industries
  - OT-IT convergence
  - Systems, things, and devices on the shop floor

- **All industries**
- **All things and devices**
- **Ubiquitous**
- **Personalized**

**THINGS & DEVICES**

**Machine Layer**
- SCADA / HMI

**MES**

**ERP (PLM, PP)**

**SMART Industrial**

**Internal INDUSTRIAL scenario**

**External scenario**
Accelerate the Enterprise Success
Higher Productivity due to Simplification

How to accelerate and grow productivity and profitability in complex business environment? How to run business and production seamlessly integrated?

Need for **SMART SIMPLIFICATION**

1. **Top Floor to Shop Floor**
2. **Customer to Operations**
   - SIMPLIFY
   - HARMONIZE
   - REDUCE

Consumer/customer
- SAP ERP
- SAP IBP

Business Networks
- SAP MES
- SAP PCo to Automation
Envisioned Future Themes of Digital Transformation

View for Manufacturing

- **TOUCHLESS**
  - Automated PDC (Plant Data Collection)
  - Automated order execution
  - Innovative hardware converges with software

- **TRANSPARENT**
  - Continuous KPI analytics, like order and execution status, performance, etc.
  - eDHR (electronic Device History Record)
  - OEE (Overall Equipment Effectiveness)

- **CONNECTED**
  - Connect Customer with Automation floor
  - Vertical and horizontal integration
  - ERP to Shop floor interoperability

- **REAL-TIME**
  - Real-time reporting
  - Alerting framework
  - Direct update of order confirmation and inventory stocks

- **SCALABLE**
  - Standard SAP platform, also leveraging HANA
  - On premise, private cloud
  - Central, regional, decentral deployment
SAP Connected Manufacturing Industrial IoT

- Multiple vendors
- Multiple machines, makes, models
- ONE single point of integration

Corporate

Shop Floor

Connected Manufacturing
- SAP ME
- SAP MII
- SAP PCo

Vendor Logos:
- SAP
- Ariba
- Stratasys
- Distributed Manufacturing Network
- S/4 HANA
- Enterprise Management
- Asset Intelligence Network
- OEM Cloud
- Siemens
- Beckhoff
- ABB
- Yaskawa
- Motoman Robotics
- BOSCH
- GE
- EATON
- KUKA
- Rockwell Automation
SAP Shop Floor to Top Floor Architecture
The Connected Operations in the Extended Supply Chain

Digital Manufacturing Insight (MONITOR)

DESIGN
- SAP ERP or S/4HANA
  - Plant Maintenance
  - Production Planning
  - Quality Management
  - Material Management, etc.

PLAN
- SAP MES
  - Real Time Operations
  - Manufacturing Execution
  - Enterprise Manufacturing Intelligence
  - Energy Monitoring, etc.

PRODUCE
- SAP PCo
  - Integration to Automation
  - Agents
  - Automatic Machine Set-up

OPERATE
- OT / Automation / Machine / Batch Systems, etc.
  - Historians
  - SCADAS
  - DCS, OPC, HMI
  - LIMS, etc.

DELIVER
- After Sales Services
  - Maintenance Notifications
  - Production Notifications
  - Quality Notifications
  - Any other ERP Notification

AFTER SALES SERVICES
- Real Time Performance Management
- Real-Time Condition Based Maintenance
- Automatic Actions based on Events
- Etc.

- Integration to Automation
- Agents
- Real Time Automation Data into SAP

- Tags
- Alarms
- Process Parameters
- Machine Status, Failure Codes, etc.
Digital Manufacturing Portfolio

Real-time Network Insights
- Demand
- Logistics
- Scheduling
- Order Fulfillment

SAP Business Suite powered by SAP HANA
- Production Planning
- Materials Management
- Quality Management
- Plant Maintenance
- Human Resources

Digital Manufacturing Portfolio
- Global Batch Traceability
- Manufacturing Execution for Discrete Industries
- Manufacturing Integration & Intelligence
- Plant Connectivity
- Digital Manufacturing Insight**
- Distributed Manufacturing**
- Quality Issue Management
- 3D Visual Enterprise

Connected Products
- Connected Assets
- Public Cloud
- Private Cloud

Automation
- DCS
- MES
- Plant DB
- Plant Data Collection
- Plant Historian
- Wireless Integration
- LIMS
- SCADA / HMI
- Environmental Building Management
- Sensors

** Future Solutions to be released in Q3 2017
### SAP Digital Manufacturing

#### Examples of Process Industries

<table>
<thead>
<tr>
<th>Consumer Products</th>
<th>O&amp;G / Chem</th>
<th>Life Sciences</th>
<th>Mill Products and Mining</th>
<th>Utilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>PepsiCo</td>
<td>Chevron</td>
<td>Novartis</td>
<td>Vale Inco</td>
<td>P&amp;G</td>
</tr>
<tr>
<td>Arla</td>
<td>Sasol</td>
<td>BD</td>
<td>Smurfit Kappa</td>
<td>CenterPoint Energy</td>
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<tr>
<td>Unilever</td>
<td>FMC</td>
<td>AstraZeneca</td>
<td>JSL</td>
<td>SOUTHERN CALIFORNIA EDISON</td>
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<tr>
<td>Kelloggs</td>
<td>Valero Energy Corporation</td>
<td>Dow Corning</td>
<td>JSI Stainless Steel</td>
<td>Hawaiian Electric, Maui Electric, Hawaii Electric Light</td>
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<td>Cargill</td>
<td>PEMEX</td>
<td>Dade Behring</td>
<td>Jaypee Group</td>
<td>Eskom</td>
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<tr>
<td>Colgate-Palmolive Company</td>
<td>Gazprom</td>
<td>Norwich</td>
<td>Lonmin</td>
<td>e.on</td>
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<tr>
<td>Hershey’s</td>
<td>ConocoPhillips</td>
<td>EMS</td>
<td>Joriside</td>
<td>CEMIG</td>
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<tr>
<td>São Martinho</td>
<td>IPT Petrobras</td>
<td>Merck</td>
<td>Voestalpine</td>
<td>origin</td>
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<tr>
<td>Granini</td>
<td>Repsol</td>
<td>Perrigo</td>
<td>Sappi</td>
<td>Tata Power</td>
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<tr>
<td>Pringles</td>
<td>Air Products</td>
<td>Johnson &amp; Johnson</td>
<td>Kloeber Paper Group</td>
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<tr>
<td>Ferrero</td>
<td>Celanese</td>
<td>AMGen</td>
<td>Mondi</td>
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<td>Sanitarium</td>
<td></td>
<td>Medtronic</td>
<td>USINAS</td>
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<td>Rexam</td>
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<td>KRKA</td>
<td>Sterlite</td>
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<td>sweet oocations</td>
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<td>BHP Billiton</td>
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SAP Digital Manufacturing
Examples of Discrete Industries

Aerospace Defense
- Goodrich
- MBDA
- Boeing
- Pratt & Whitney Canada
- General Dynamics
- BAE Systems

Automotive
- Harley-Davidson
- NHK
- Harman/Becker
- Goodyear Dunlop
- ZF
- Kostal
- John Deere
- Faurecia
- CAT
- Continental
- Apollo
- Bosch

High Tech
- PCB Technologies
- Nokia Siemens Networks
- TriQuint Semiconductor
- Molex
- Enercon
- RIM
- AT&S
- ABB
- Philips

IM&C
- Lincoln Electric
- Cameron
- Krones
- Greenheck
- Baker Hughes
- EBM Papst
- Stanley
- Heidelberger Druck

Medical Device
- Varian Medical Systems
- Medtronic
- Johnson & Johnson
- Mindray
- Roche
- BD
- Hospira

Examples of Discrete Industries
- Aerospace and Defense
- Automotive
- High Tech
- IM&C
- Medical Device

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# SAP Digital Manufacturing Success Stories Examples

More than 2,000 customers running successful Industry 4.0 projects with SAP Digital Manufacturing

<table>
<thead>
<tr>
<th>Company</th>
<th>Success Stories</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEPSICO</td>
<td>65% to 80%</td>
<td>Increase in OEE</td>
</tr>
<tr>
<td>HARLEY-DAVIDSON</td>
<td>7%</td>
<td>Reduction manufacturing costs</td>
</tr>
<tr>
<td>KLABIN</td>
<td>20%</td>
<td>Reduction in production breakdown</td>
</tr>
<tr>
<td>KLABIN</td>
<td>6.5%</td>
<td>Increase in final product quality</td>
</tr>
<tr>
<td>SCHINDLER</td>
<td>10%</td>
<td>First pass yield</td>
</tr>
<tr>
<td>EBMPAPST</td>
<td>99.5%</td>
<td>Increase in productivity</td>
</tr>
<tr>
<td>EBMPAPST</td>
<td>3%</td>
<td>Manufacturing productivity improvement</td>
</tr>
<tr>
<td>JORISHIDE</td>
<td>50%</td>
<td>Fewer stock corrections</td>
</tr>
<tr>
<td>JORISHIDE</td>
<td>3%</td>
<td>Decrease in scrap (material waste)</td>
</tr>
<tr>
<td>JORISHIDE</td>
<td>15%</td>
<td>Faster production lead time</td>
</tr>
</tbody>
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SAP Manufacturing Execution Suite
Solution Overview

SAP ERP (ECC or S/4HANA)

SAP Manufacturing Execution (SAP ME)
Complete shop floor execution system for discrete manufacturers
- ERP Integration "out of the box"
- Tracking & Tracing on SFC / Serial Number
- Non-conformance Handling
- Interlocking
- Production data acquisition
- Extensibility

SAP Manufacturing Integration & Intelligence (SAP MII):
Strategic platform for interoperability, integration and intelligence for all industries, and execution system for process industries bringing operational data into business context for IT / OT convergence with pre-defined content for scenarios, reporting and analytics and dashboards

SAP MES Solution Recommendations:
- Any Industry: SAP MII, SAP PCo
- Discrete Industries: SAP ME, SAP MII, SAP PCo

Discrete Industries

Production Operator (POD) Shop floor worker UI Machine Entry

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SAP Plant Connectivity
Main Differentiators

SAP Plant Connectivity – What is it?
- Communication gateway and interface allowing for shop floor integration to MES and ERP systems
- Basis for Industrie 4.0 communication patterns: Notifications / Queries / Bidirectional data exchange

Main Differentiators
- Shop floor data can be shown in near real-time on user interface using Web Socket Server technology
- Mass data upload into SAP HANA
- Integration with SAP ERP* / SAP HANA smart data streaming
- Flexible Web Service Orchestration (RESTful*, ODATA, SOAP*)
- High performance connectivity
- Bundling and buffering of data; notification delivery retry
- Remote Configuration of SAP Plant Connectivity centrally from SAP MII
- Customer specific enhancements possible (proprietary protocols and complex processing logic)
SAP Manufacturing Integration and Intelligence – What is it?

- **Extensible** manufacturing platform allowing **rapid adaptation** to any manufacturing process

### Main Differentiators

- **Integration**: Provide interoperability (in)between shop floor solutions and enterprise ERP (i.e. PP, PM, MM, QM, etc.)
- **Intelligence**:
  - Visualize data and include KPIs from any of above sources
    - Provides simple and efficient local user interface and dashboards.
  - Automatic Insight to Action
- **Innovation**: Powerful SOA-enabled business logic to enable customer-specific processes for planning, execution, maintenance and quality
  - Allows fast prototyping to achieve fast ROI
  - Broad and extensive partner network
  - Applicable to all manufacturing industries and utilities
SAP Manufacturing Execution for Discrete Industries
Main Differentiators

SAP Manufacturing Execution – What is it?
• Manufacturing Execution System for the discrete industries

SAP Manufacturing Execution – Main Differentiators
• ERP Integration “out of the box”
• Controls production of every single unit (lot size 1)
• Easy interaction with shop-floor automation layer
• Unit level Tracking & Tracing / Genealogy
   What operation, tool or machine was used, where parts came from, etc.
• Comprehensive nonconformance management including in-line sampling and ability for visual test and repair
• Process Interlocking
• High flexibility and extensibility; pure SOA based architecture
• High usability with browser-based user interface
• Role-specific access and personalized dashboards for operators
• Flexible production process modeling without additional programming
• Active community of partners and customers
SAP Distributed Manufacturing enables collaboration on the SAP Cloud Platform with which manufacturing companies can streamline the entire process of part certification, from design and production of prototypes to mainstream manufacturing and production.

Key Capabilities:

Part Specification and Initial Pricing
- Customer and supplier collaborate on best option to print the part
- Initial pricing for part

Design Collaboration
- Embedded visualization of parts
- Redlining of problems or comments on design with embedded discussions

Quality Collaboration
- Customer shares key characteristics of part
- Results recording and visualization for both customer and supplier

This is the current state of planning and may be changed by SAP at any time.
SAP Digital Manufacturing Insights (DMI)

Insights to Action @ All Levels

- Review Manufacturing Performance, Quality & Complex trends and relationships across large timeframes and locations
- Collaborate across corporate boundaries
- Monitor and Analyze Manufacturing Performance Indicators
- Improved collaboration across business silos
- Continuous improvement of operations
- Real time visibility to manufacturing
- Real time visibility to top issues related to production
- Take actions to correct and improve operations
Enterprise Quality Management with SAP
Total Quality Management plus Integration

Quality Issue Management

- Supplier issues: Workflow, Authorization, Concept, QM Manual
- R&D Deviations: Inventory Mgmt., Batch Mgmt., Change Handling, Document Mgmt.
- Non-Conformances: Quality-Related Costs, Revenues
- Operational Incidents and Deviations: Test Equipment Management, Calibration, Planning & Execution
- Customer Complaints: Test Equipment Management, Calibration, Planning & Execution

Human Resources

- Logistics

Finance & Controlling

Enterprise Asset Management

Enterprise Quality Management

Research & Development

- Stability Study
- Flexible Specifications
- Recipe Management
- Advanced Product Quality Planning (APQP/FMEA)

Procurement

- Inspection Planning
- Supplier Release & CoA
- Goods Receipt Inspection
- Sample Management
- Audit Management
- Source inspection

Production

- In-/Post-Process Control
- SPC-Statistical Process Control
- Interfaces for Measurement Devices
- Deviation Management
- Electronic Batch Record
- Integration with SAP MII

Sales & Distribution

- Certificate of Analysis (CoA)
- Quality Data Exchange
- Billing of Analysis
What Does SAP Quality Issue Management Deliver?

1. Capture and monitor all issues and activities across distributed systems

   - Search
   - Record
   - Monitor & Analyze

   **SAP Quality Issue Management (Global Issue Database)**

   - Multiple SAP systems (e.g., ERP)
   - Multiple third-party systems
   - External collaboration & Mobile

   *Capture and monitor* all kind of issues and activities related to product, process, or service quality. Create global *transparency* of non-conformances through *predefined integration* with SAP ERP, Audit Management, and connectivity with other SAP or non-SAP systems.

2. Process the issue, identify root causes, and define & track required actions

   **Process your issue, identify the root cause of the problem, and define and track all corrective and preventive actions (CAPA) with the help of questions, business rules, and workflows to efficiently and sustainably resolve the problem.**

3. Efficient Reporting and Analysis across multiple sources

   **Efficient issue reporting using Adobe print forms and context-related analytics using side panels and predefined dashboard to issues to create visibility across system borders and allow trend analysis of quality problems on a global basis.**
3D Visual Enterprise

- Visualize and interrogate process plants and the business in 3D
- Visual and Business data is connected to EAM and ERP through asset ID’s and functional location
- Business Data and Operational Data linkage is done in SAP MII

https://video.sap.com/media/t/0_0q0tvdon
https://video.sap.com/media/t/1_4tfp5q0j
Let’s Take the Next Steps Together!

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Industry 4.0, Manufacturing, Asset Management, Sustainability

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