## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>Topic</th>
<th>Speaker</th>
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<tbody>
<tr>
<td>09:30 – 10:00</td>
<td>30 min</td>
<td>Registration</td>
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<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>10:25 – 10:55</td>
<td>30 min</td>
<td>SAP Digital Manufacturing Strategy</td>
<td>Carlos Portillo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAP Manufacturing Strategy Overview - Solution Portfolio Overview – Innovations</td>
<td></td>
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<tr>
<td>10:55 – 11:15</td>
<td>20 min</td>
<td>Break</td>
<td>All</td>
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<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 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>
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<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>14:05 – 14:35</td>
<td>30 min</td>
<td>SAP Digital Operations Strategy</td>
<td>Carlos Portillo</td>
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<tr>
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<td></td>
<td>Enterprise Asset Management - Environment, Health &amp; Safety Management - Solution Portfolio Overview - Innovations</td>
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<tr>
<td>14:35 – 14:50</td>
<td>15 min</td>
<td>SAP Asset Intelligence Network Demo</td>
<td>Dane Hermse</td>
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<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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</tbody>
</table>
SAP Digital Operations Strategy

Carlos Portillo
EMEA Center of Excellence – Digital Supply Chain
Industry 4.0, Manufacturing, Asset Management & Sustainability
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
Excessive Paperwork…

- Work orders can be 100 pages or more!
- Forms are completed manually
- The keyed in by the technician at a PC
  - Doubles the administration
  - Reduces productivity
Excessive Paperwork…

- Paper based manuals, diagrams and parts listings
- Parts consumption is all paper based
- Part numbers look the same
- Components often look the same could lead to significant negative consequences
### NORTH AREA (B)

**Date:** 30/11/14

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<th>Item</th>
<th>Parameter</th>
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</table>
Paper Safety Systems...

- Safety checklist on paper
- Doesn’t enforce the process
- Analysis in hindsight
- No real time situational context
Manual Time Sheets...

- Time sheets filled in at the end of the day… or even at the end of the week!
- Time is rounded up to the nearest hour or half hour
- No accuracy = no optimisation
- Planners and supervisors can’t track progress of in progress maintenance and service requests
Sophisticated Planning Systems…

- Planning process are often manual
- Spreadsheets
- Spreadsheet + magnifying glasses
- Paper based planning
- …Even maintenance files in crates being moved as the status changes!
Hand Written Labels – No Barcodes for Tracking
SAP Operations Process & Solution Overview
End to End Connected Enterprise Asset Management

- How to connect, collect and manage asset related data
  - i.e.: Real-time condition-based maintenance, Real-time asset performance dashboards, andons, reports, Real-time alerts and automatic actions based on events, collect process parameters
  - Typical Personas: Process Engineers, Maintenance Planners
SAP Manufacturing Execution Suite
SAP Manufacturing Integration & Intelligence (SAP MII)

Web-based strategic manufacturing platform to compose intelligent manufacturing applications

OT – IT Convergence

Enterprise Manufacturing Intelligence

Manufacturing & Quality Analytics

Worker UI

Connected Assets / Facility Management

Insight to Outcome
(i.e.: Condition-Based Maintenance)
End to End Connected Enterprise Asset Management

- **How to connect, collect and manage asset related data**
  - i.e.: Real-time condition-based maintenance, Real-time asset performance dashboards, andons, reports, Real-time alerts and automatic actions based on events, collect process parameters
  - Typical Personas: Process Engineers, Maintenance Planners

- **How to analyze asset related data**
  - i.e.: predictive maintenance, machine learning
  - Typical Personas: Data Scientists, Maintenance Managers
SAP Predictive Maintenance & Service
Driving scale – business applications built on modular analytics

SAP Predictive Maintenance and Service, on-premise edition

Predictive maintenance and service

Asset health control center (AHCC)  Asset health fact sheet (AHFS)

Insight provider

Geo-spatial insight provider  Key figure insight provider  2D / 3D charts insight provider  Asset explorer insight provider  Work activities insight provider  Derived signal insight provider  Components insight provider  Remaining useful life prediction  Distance-based failure analysis  Anomaly detection with principal component analysis

Data science services

Data management  Data fusion  Data processing  Data Science

OT (device) integration

Connected assets
- Devices, machines, sensors
- Integration with:
  - SAP Device Management for IoT by Telit
  - SAP MII and PCo
  - SAP IoT Connector by OSIsoft

IoT-based services

Operationalized analytics and data science services

Big Data platform

Integration with:
- SAP Device Management for IoT by Telit
- SAP MII and PCo
- SAP IoT Connector by OSIsoft

SAP HANA  SAP IQ*  SAP Data Services*  SAP ESP*

Storage  Data ingestion

Process automation
- Closed-loop business process integration into PM and MRS

Extendable by additional custom insight provider and custom data services

Intellectual property information

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<table>
<thead>
<tr>
<th>Association Analysis</th>
<th>Cluster Analysis</th>
<th>Probability Distribution</th>
<th>Statistic Functions (Univariate)</th>
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<tr>
<td>Apriori</td>
<td>ABC Classification</td>
<td>Distribution Fit</td>
<td>Mean, Median, Variance, Standard Deviation</td>
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<td>Apriori Lite</td>
<td>DBSCAN</td>
<td>Cumulative Distribution Function</td>
<td>Kurtosis</td>
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<td>FP-Growth</td>
<td>K-Means</td>
<td>Quantile Function</td>
<td>Skewness</td>
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<td>KORD – Top K Rule Discovery</td>
<td>K-Medoid Clustering</td>
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<td>K-Medians</td>
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<td>Kohonen Self Organized Maps</td>
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<td>Agglomerate Hierarchical</td>
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<td>Affinity Propagation</td>
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<td>Gaussian Mixture Model</td>
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<td>Latent Dirichlet Allocation (LDA)</td>
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</table>

| Classification Analysis | Time Series Analysis | Outlier Detection | Link Prediction |
|-------------------------|----------------------|-------------------|-----------------
| CART                    | Single Exponential Smoothing | Inter-Quartile Range Test (Tukey’s Test) | Common Neighbors |
| CHAID Decision Tree Analysis | Double Exponential Smoothing | Variance Test | Jaccard’s Coefficient |
| K Nearest Neighbour    | Triple Exponential Smoothing | Anomaly Detection | Adamic/Adar |
| Logistic Regression    | Forecast Smoothing     | Grubbs Outlier Test | Katzβ |
| Back-Propagation (Neural Network) | ARIMA / Seasonal Arima |                   |                   |
| Naive Bayes            | Brown Exponential Smoothing |                   |                   |
| Support Vector Machine | Croston Method         |                   |                   |
| Confusion Matrix       | Forecast Accuracy Measure |                   |                   |
| Parameter Selection & Model Evaluation | Linear Regression with Damped Trend and Seasonal Adjust |                   |                   |
|                        | Test for White Noise, Trend, Seasonality |                   |                   |

<table>
<thead>
<tr>
<th>Regression</th>
<th>Data Preparation</th>
<th>Statistic Functions (Multivariate)</th>
<th>Other</th>
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<tr>
<td>Multiple Linear Regression</td>
<td>Sampling</td>
<td>Covariance Matrix</td>
<td>Weighted Scores Table</td>
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<td>Random Distribution Sampling</td>
<td>Pearson Correlations Matrix</td>
<td>Substitute Missing Values</td>
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<td>Exponential Regression</td>
<td>Binning</td>
<td>Chi-squared Tests:</td>
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<td>Scaling</td>
<td>- Test of Quality of Fit</td>
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<td>Bi-Variate Logarithmic Regression</td>
<td>Partitioning</td>
<td>- Test of Independence</td>
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<td>Principal Component Analysis (PCA)</td>
<td>- F-test (variance equal test)</td>
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End to End Connected Enterprise Asset Management

- **How to connect, collect and manage asset related data**
  - i.e.: Real-time condition-based maintenance, Real-time asset performance dashboards, andons, reports, Real-time alerts and automatic actions based on events, collect process parameters
  - Typical Personas: Process Engineers, Maintenance Planners

- **How to analyze asset related data**
  - i.e.: predictive maintenance, machine learning
  - Typical Personas: Data Scientists, Maintenance Managers

- **How to plan maintenance related activities**
  - i.e.: preventive maintenance planning, resource allocation, work clearance, risks and safety measures, work order scheduling, operating procedures, audits, control inspections
  - Typical Personas: Maintenance Planners, Health & Safety Planners
SAP Multiresource Scheduling
Resource Allocation & Work Order Scheduling

SAP Applications

DEMAND
- SAP ERP PM/CS
  - Work/Service Order, Notification
- SAP ERP PS Project System
- SAP PPM cProjects
- SAP CRM Service Order

SAP MRS
- Demand
- Supply
- Qualifications
- Assignments

SUPPLY
- HR Resources
  - Business Partner
  - Availability, Qualifications
- Work Centers
  - Groups
  - Crews
- SAP HCM, MM
- Equipment
  - Tools
  - Spare Parts

ANALYTICS
- SAP BW, SAP BusinessObjects, SAP Predictive Analysis

MOBILITY
- SAP Mobile Platform
- SAP Work Manager and Service Manager by Syclo
- GIS Geographical Information system
- Optimizer
  - SAP VSR Vehicle Scheduling & Routing

DEMAND
- SUPPLY
- SAP MRS
- SAP Applications

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Environment, Health, and Safety
SAP solutions for Environment, Health, and Safety

Proactively manage operational risk to protect people and the environment

**Incident Management**
Detect and resolve safety issues and learn from incidents.

**Health & Safety Management**
Reduce risks by taking a proactive approach to health and safety management.

**Environment Management**
Reduce your environmental impact with comprehensive environment management.

**Management of Change**
Manage operational changes with systematic reviews, risk mitigation, and approvals.

**Maintenance Safety and Permit to Work**
Control maintenance work through clearly defined safety instructions and permits.
Maintenance Worker Safety
Risks & Safety Measures

Risk management
Assign risks to maintenance objects
Create risks and responses

Maintenance Work order
Worker safety
Safety plan in SAP EAM
Worker safety in job execution

Work clearance management
Work clearance Management
Hazard Identification and Risk Assessment
Safety Plan in Maintenance Work Order

<table>
<thead>
<tr>
<th>Planned Safety Measures</th>
<th>Relevant Risks</th>
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<td>Safety Measures</td>
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<td>General Safety Measures</td>
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<td>Locked/Tagged</td>
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<td>5-minute risk assessment</td>
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<td>Operations and Safety Measures</td>
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<tr>
<td>Operation 0010</td>
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<tr>
<td>Pair of Leather Gloves</td>
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<td>Object ID: 01</td>
<td>WCM Requirement</td>
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<tr>
<td>Type: Safety Note</td>
<td>Action: applied</td>
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<tr>
<td>Object ID: 0010</td>
<td>Operation</td>
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<td>Type: Material</td>
<td>Action: applied</td>
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<td>Object ID: 2030</td>
<td>Material</td>
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<td>Type: Sign</td>
<td>Action: applied</td>
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- Riske and Safety Measures
  - Electricity: applied
  - Lockout/Tagout
  - Liquids: Chemical Suit, Disposable
  - Welding: Welding Goggles
  - Heat Work Permit
  - Assign Fire Watch
  - Nearby Operations
  - 5-Minute Safety Review: applied
  - 5-Minute risk assessment
  - Sharp Objects
  - Leather Gloves: applied
  - Pair of Leather Gloves
  - Noise Exposure
# Job Card including Risks, Safety Measures, Operating Procedures

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<td>Status</td>
<td>End date</td>
<td></td>
</tr>
<tr>
<td>Fund, location</td>
<td>Equipment</td>
<td>Assembly</td>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>Line: 50 kV, PRT, MANZ PLC, DCTC, LT,</td>
<td>Unit 2 Cooling Tower Pump 1</td>
<td></td>
<td>T1</td>
<td></td>
</tr>
<tr>
<td>1069892</td>
<td>Nozzle: Plant Unit 2 Cooling Towers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM planner</td>
<td>Maintenance plan</td>
<td>Location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>MECHINT 3000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main work center</td>
<td>Mechanical maintenance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mntr. plan item</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 5-minute risk assessment
- performs a mini risk assessment

### Safety Plan

**Relevant Risks**

- **Electrical Hazard**
- **Chemical Liquid**
- **Hot Work**
- **Nearby Operations**

**High Noise Level**

### Planned Safety Measures

Operations and Safety Measures

- **Operation 0110**
  - Pair of Leather Gloves
  - Read and understood
End to End Connected Enterprise Asset Management

- **How to connect, collect and manage asset related data**
  - i.e.: Real-time condition-based maintenance, Real-time asset performance dashboards, andons, reports, Real-time alerts and automatic actions based on events, collect process parameters
  - Typical Personas: Process Engineers, Maintenance Planners

- **How to analyze asset related data**
  - i.e.: predictive maintenance, machine learning
  - Typical Personas: Data Scientists, Maintenance Managers

- **How to plan maintenance related activities**
  - i.e.: resource allocation, work clearance, risks and safety measures, work order scheduling, operating procedures, audits, control inspections
  - Typical Personas: Maintenance Planners, Health & Safety Planners

- **How to execute maintenance work orders**
  - i.e.: mobile, visual work instructions, augmented reality & wearables
  - Typical Personas: Maintenance Technicians
SAP Work Manager

Execution of Maintenance Orders in any Mobile Device
SAP Work Manager

Execution of Maintenance Orders in any Mobile Device
SAP Work Manager
Execution of Maintenance Orders in any Mobile Device
SAP Work Manager

Execution of Maintenance Orders in any Mobile Device
SAP Work Manager
Execution of Maintenance Orders in any Mobile Device
Augmented Reality with SAP AR Service Technician

- **Companion Application to SAP Work Manager**
  - Link to the SAP Work Manager mobile app through a simple QR-code scan
- **Visual Enterprise 3D model visualization and animation**
- **SAP 3D Visual Enterprise steps browsing**
- **Equipment notes**
- **Remote expert calling**
- **Hands-free application**
  - All the application steps can be completed without gestures or touch events
  - Required inputs are managed through voice recognition
End to End Connected Enterprise Asset Management

- **How to connect, collect and manage asset related data**
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  - Typical Personas: Maintenance Technicians

- **How to collaborate asset related data**
  - i.e.: connect with OEM, component suppliers, asset manufacturers, service providers, etc.
  - Typical Personas: Maintenance Manager, Plant Manager, Facility Manager, Asset Manufacturer, Maintenance Service Providers, etc.
Asset Intelligence Network (AIN) : An Asset Network to bring together Business Partners

https://video.sap.com/media/t/1_pnm0k1xc
Asset Intelligence Network (AIN): An Asset Network to change Business Processes

Manage Equipment as a Service

Service Bulletins, Recalls & Warranty

Usage based Design Enhancements

Business Partner Network Services

Shared Model Database

Global Equipment Registry

Visual audit and name plate recognition

Quality, Inspection & Calibration Results Sharing

Analyse Equipment performance

Collaborative work execution & results sharing

MRO Visual Spare Parts content

Business Context for Predictive Maintenance

Global Job Catalogue, Visual Work Instructions
End-to-End SAP Digital Operations Architecture Overview

**Assets in the Field (External Scenarios)**
- Predictive Maintenance
- Asset Health Monitoring
- Machine Learning
- Vibration Analysis
- Virtualization

**Assets in Shop Floor / Operations (Industrial Scenarios)**
- Preventive Planning
- Maintenance Notification
- Maintenance Order Creation
- Measuring Point linked with MII

- Relevant Risks
- Safety Measures
- Work Clearance
- Control Inspections
- Incidents Management

- Real time Asset Performance KPIs
- Condition-Based Maintenance
- Automatic Actions upon events
- Virtualization
- Measuring Point linked from PM
- Energy Monitoring

- Resource Allocation / Scheduling
- WO Scheduling

- Maintenance Order Execution
- Visual work instructions
- Augmented Reality

**Central hub for linking equipment in a collaboration ecosystem**

**Machine / Asset Integration**
- Device / Asset Integration
- Asset Manufacturer
- Service Provider

**IoT Client**
- PdMS
- 3D VE
- S/4 HANA
- LAM

**Virtualization**
- Measuring Point linked from PM
- Measuring Point linked with MII

**Relevant Risks**
- Safety Measures
- Work Clearance
- Control Inspections
- Incidents Management
End-to-End SAP EAM Architecture Overview

**Analyze asset related data**
- SAP PdMS
- SAP 3D VE
- Predictive Maintenance
- Asset Health Monitoring
- Machine Learning
- Vibration Analysis
- Virtualization

**Plan asset related activities**
- SAP S/4 HANA
- SAP LAM
- Preventive Planning
- Maintenance Notification
- Maintenance Order Creation
- Measuring Point linked with MII

**Connect, collect, manage asset related data**
- SAP AIN
- Asset Manufacturer
- Device / Asset Integration
- SAP IoT Client
- Assets in the Field (External Scenarios)

**Collaborate asset related data**
- SAP Service Provider
- Machine / Asset Integration
- SAP PCo
- Assets in Shop Floor / Operations (Industrial Scenarios)

**Execute**
- SAP Work Manager
- Maintenance Order Execution
- Visual work instructions
- Augmented Reality

**SAP MII**
- Real time Asset Performance KPIs
- Condition-Based Maintenance
- Automatic Actions upon events
- Virtualization
- Measuring Point linked from PM
- Energy Monitoring

**SAP EHS**
- Relevant Risks
- Safety Measures
- Work Clearance
- Control Inspections
- Management of Change
- Incidents Management

**SAP WCM**
- Resource Allocation / Scheduling
- WO Scheduling

**SAP LAM**
- Preventive Planning
- Maintenance Notification
- Maintenance Order Creation
- Measuring Point linked with MII

**SAP MoC**
- Connect, collect, manage asset related data

**SAP EAM Architecture Overview**
- Central hub for linking equipment in a collaboration ecosystem
Thank you - Let’s Take the Next Steps Together!

Carlos Portillo  
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Industry 4.0, Manufacturing, Asset Management, Sustainability

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