Hydro Aluminium's Digital Asset Management Strategy

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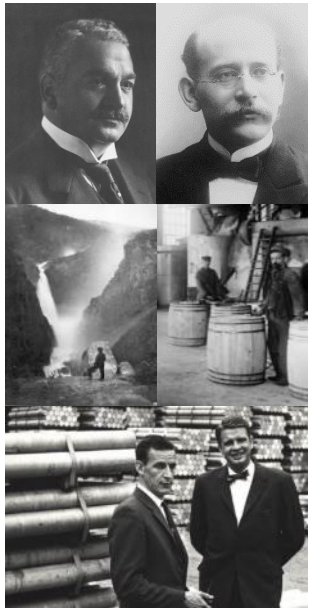
Madrid, September 29th 2022

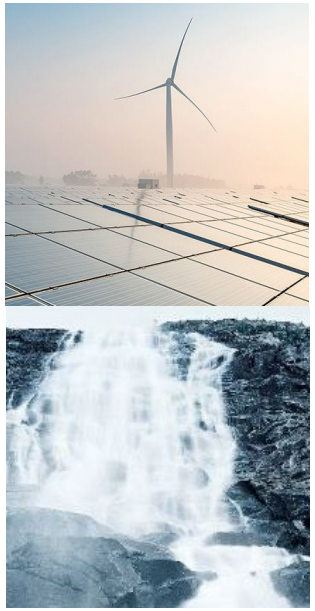
Global aluminium and renewable energy company

Our purpose is to create a more viable society by developing natural resources into products and solutions in innovative and efficient ways

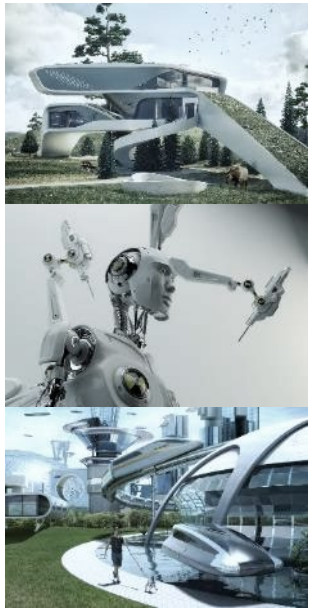
115 years of sustainable industrial development



Infinitely renewable energy



Aluminium – metal of the future



Global reach, local presence

31,000 employees

140 locations

40 countries

Responsible and engaged

wbcsd

THE GLOBAL COMPACT

MEMBER OF Dow Jones Sustainability Indices In Collaboration with RobecoSAM

ICMM International Council on Mining & Metals

GRI

asi

CDP

EITI Extractive Industries Transparency Initiative

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

Hydro Aluminium Metal, Bauxitt and Alumina and Energy

SAP PM data

3500 Users

400 000 notification/year

700 000 work orders/year

7 stand-alone remelters

2 in the U.S.

5 in Europe (UK, Luxembourg, France, Spain and Germany)

Alunorte alumina refinery

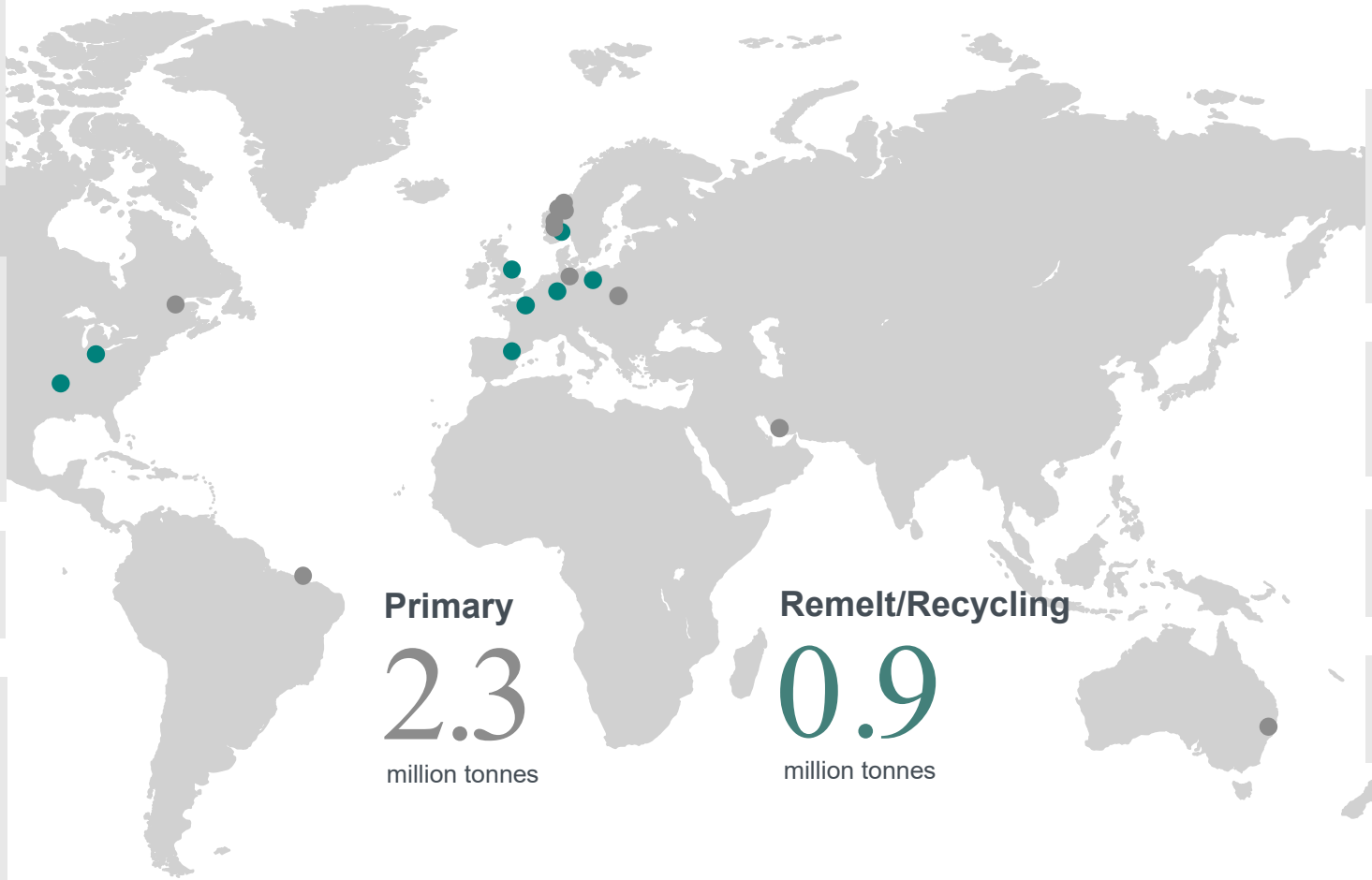
- 6.3 million tonnes

Brazil

Albras (100%): 460,000 tonnes
- Hydro owns 51%

Alunorte alumina refinery
- 6.3 million tonnes

Paragominas bauxite mine
- 9,0 million tonnes



Primary

2.3

million tonnes

Remelt/Recycling

0.9

million tonnes

Norway, 1,125,000 tonnes — 50%
- Sunndal (100%): 405,000 tonnes
- Årdal (100%): 195,000 tonnes
- Karmøy (100%): 270,000 tonnes
- Høyanger (100%): 65,000 tonnes
- Husnes (100%): 190,000 tonnes

Slovakia, 175,000 tonnes — 8%
- Slovalco (100%): 175,000 tonnes
- Hydro owns 55%

Qatar, 305,000 tonnes — 13%
- Qatalum (50%): 305,000 tonnes

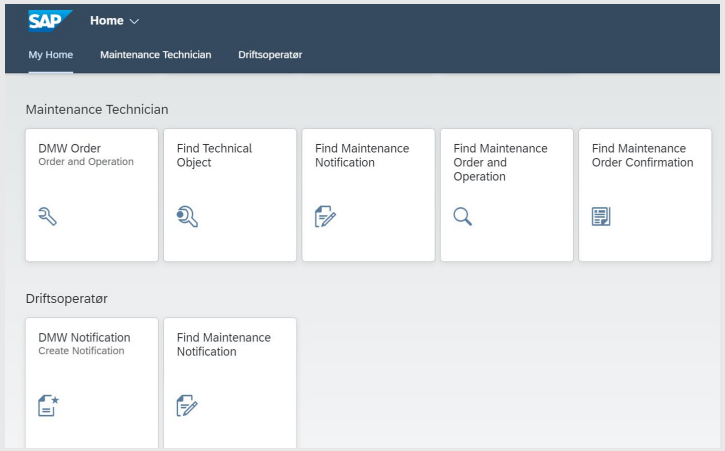
Australia, 75,000 tonnes — 3%
- Tomago (12%): 75,000 tonnes

2.3 million mt is consolidated capacity. Slovalco and Albras are fully consolidated, Tomago and Alouette are proportionally consolidated and Qatalum is equity accounted. Neuss, which is a part of Rolling, is not included. 0.9 million tonnes includes stand-alone remelters, recycling facilities and additional casthouse capacity at primary plants.

Our approach and today's agenda

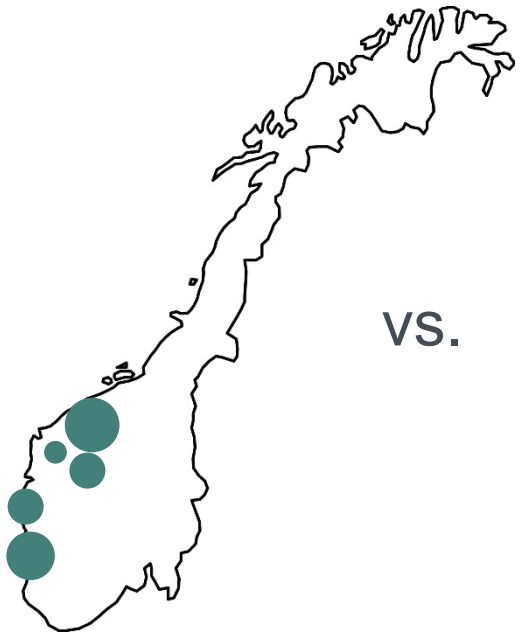
One smelter,
One remelter strategy

Capability

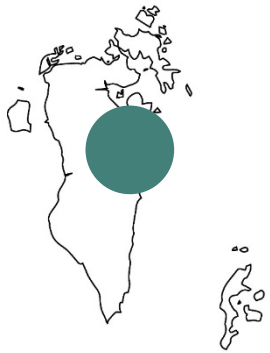


Tools

Unlocking further potentials, creating economy of scale



vs.



Hydro in Norway

1.2 million tonnes/year

Alba

1.5 million tonnes/year

One-smelter system

Standardize to realize scale

Common processes

Common organizational structure

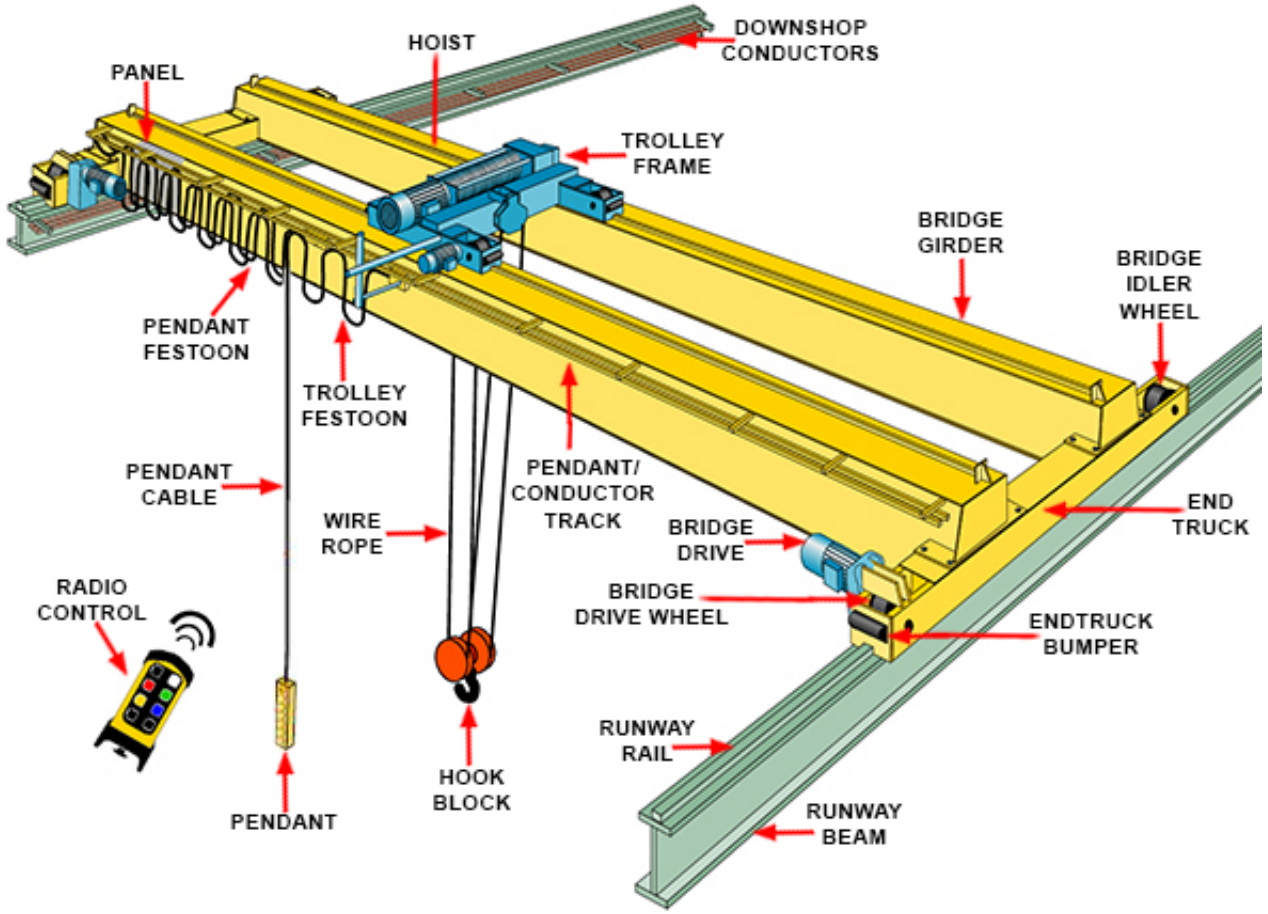
Common roles and responsibilities

Common systems and tools

Great potential in working across the plants in developmer maintenance strategies

- RCM is time consuming and competence intensive activities. But should form the basis of our reliability activities
- **Example** - Hydro in Norway has 150+ overhead cranes
  - The cranes have the same failure modes
  - The cranes should have the same maintenance activities
  - But different context and use makes the risk profile different for each crane

- Standardized master data and common processes is a prerequisite to realizing economy-of-scale benefits



Develop capabilities

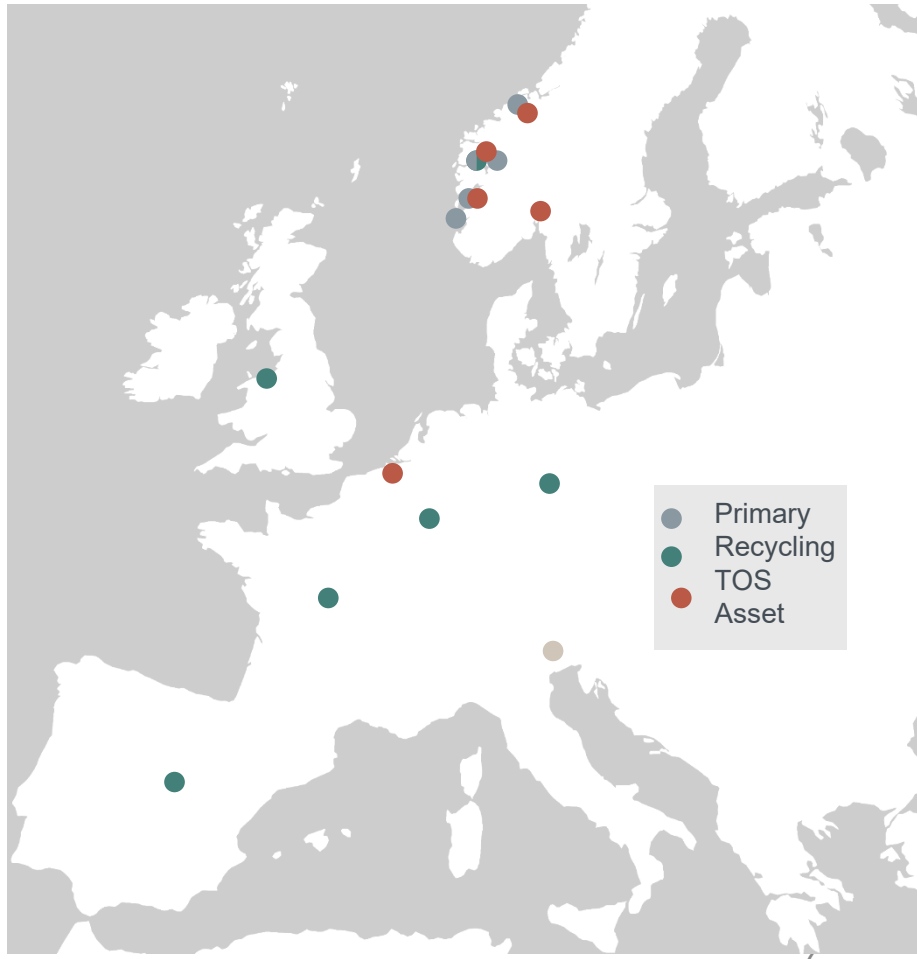
Combination of Subject Matter Experts, RAMS engineers, and SAP PM Master data team in cooperation with Digital Production Support

People

- Senior Subject Matter Experts
  - HV
  - Mechanical infrastructure
  - Crane
  - Automation
- 8 MSc RAMS Engineers
- 8 SAP PM specialist handling Master data across all plants (HAM)

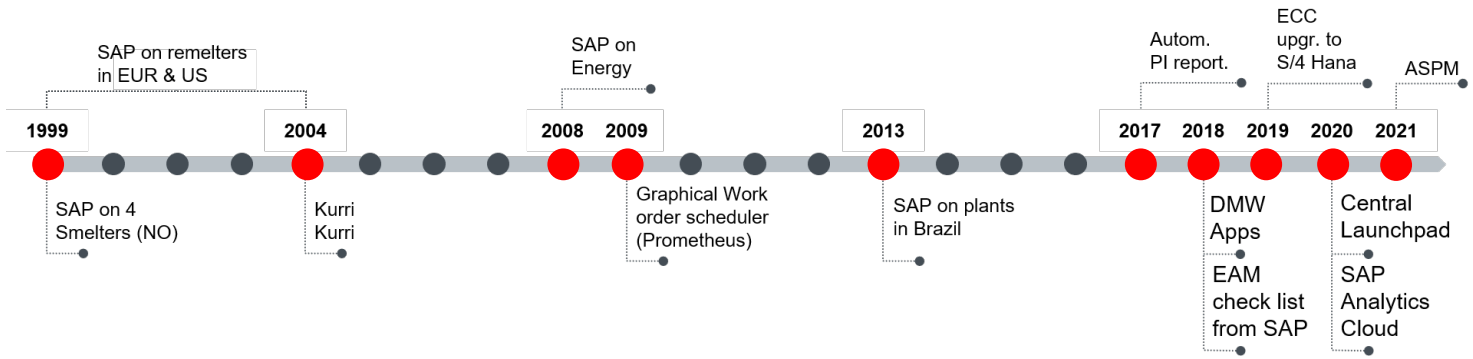
One Smelter Maintenance System Working Approach

- RAMS Engineers and SME's collaborate on maintenance analysis
- RAMS Engineers convert maintenance analysis into preventive maintenance program and adds on elements from Digital Maintenance Toolbox to support PM program with Online Condition-based Maintenance
- SAP-team implements preventive maintenance program with Checklists in DMW-App
- RAMS Engineers create SAC report to follow-up result across all sites
- Roll-out to all sites



SAP development a part of the digital transformation

Increased speed of Industry 4.0 development from 2017

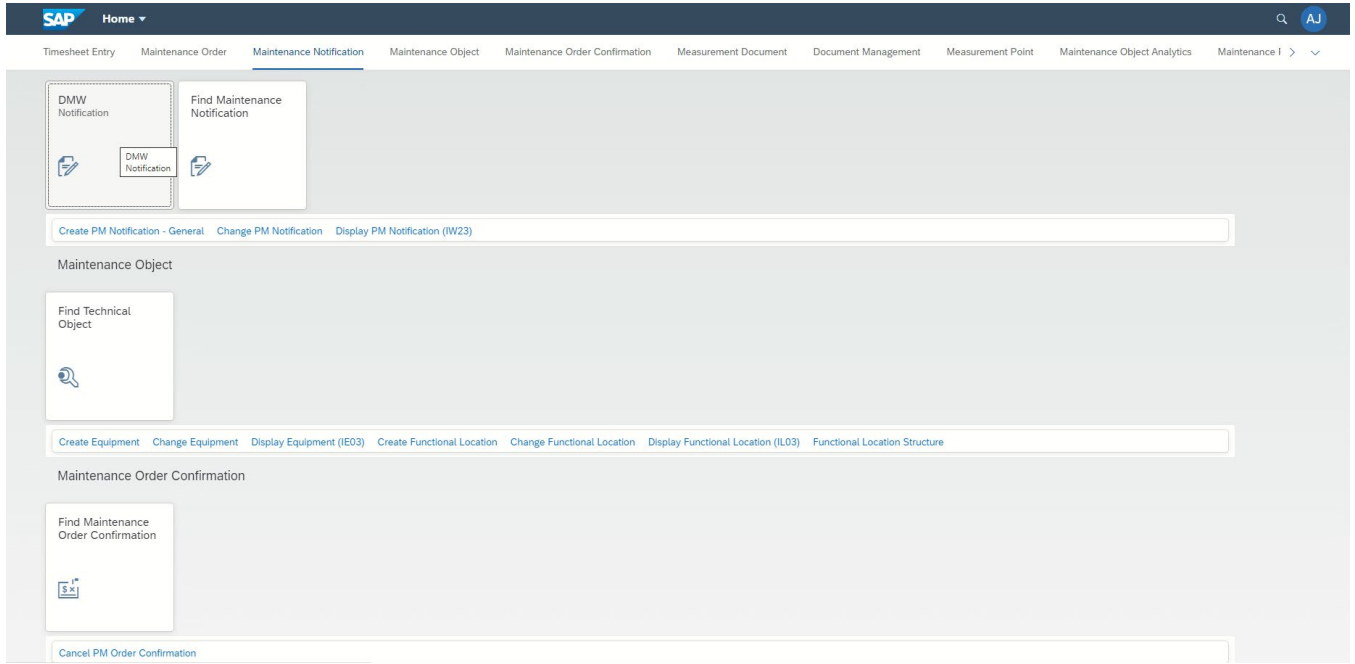


2000 – [illegible] Brazil

- [illegible] easily available
- [illegible]

Easier and more intuitive user interface with Fiori

Transferring from GUI to Fiori



Advantages

- Browser-based
- Mobile-friendly
- Easier to navigate
- Customized to the different roles and users

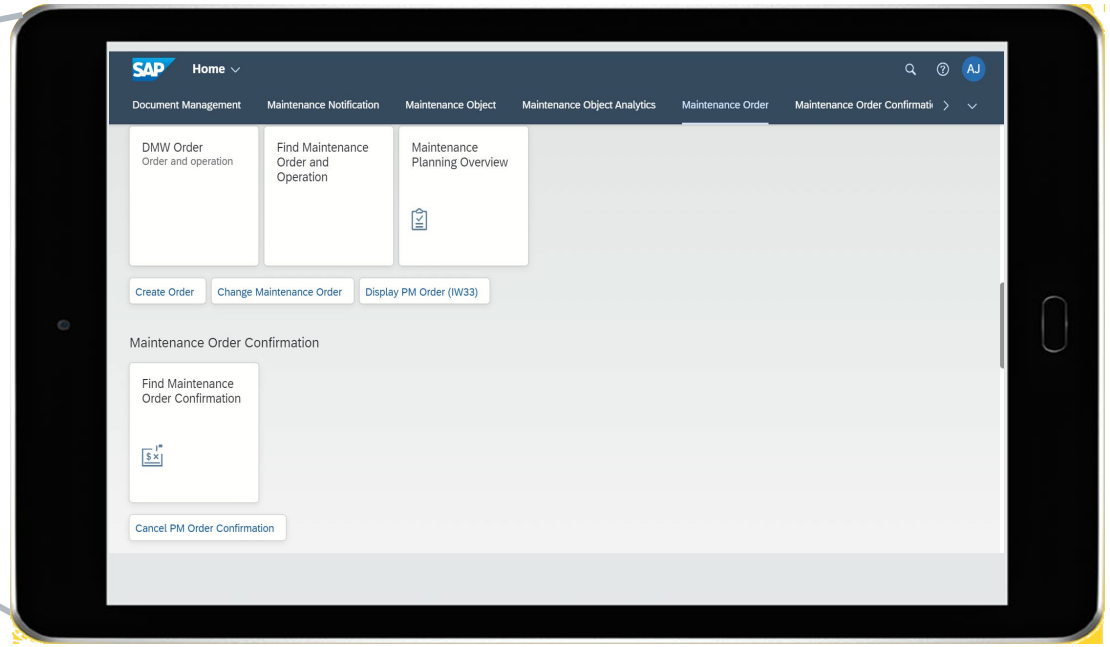
Benefits

- More employees creating notifications
- Better communications between maintenance and operation
- Improved planning process

Increased efficiency through used of mobile solutions

Converting to SAP S/4 Hana and Launchpad increases the possibilities to use more standard but customable APPs

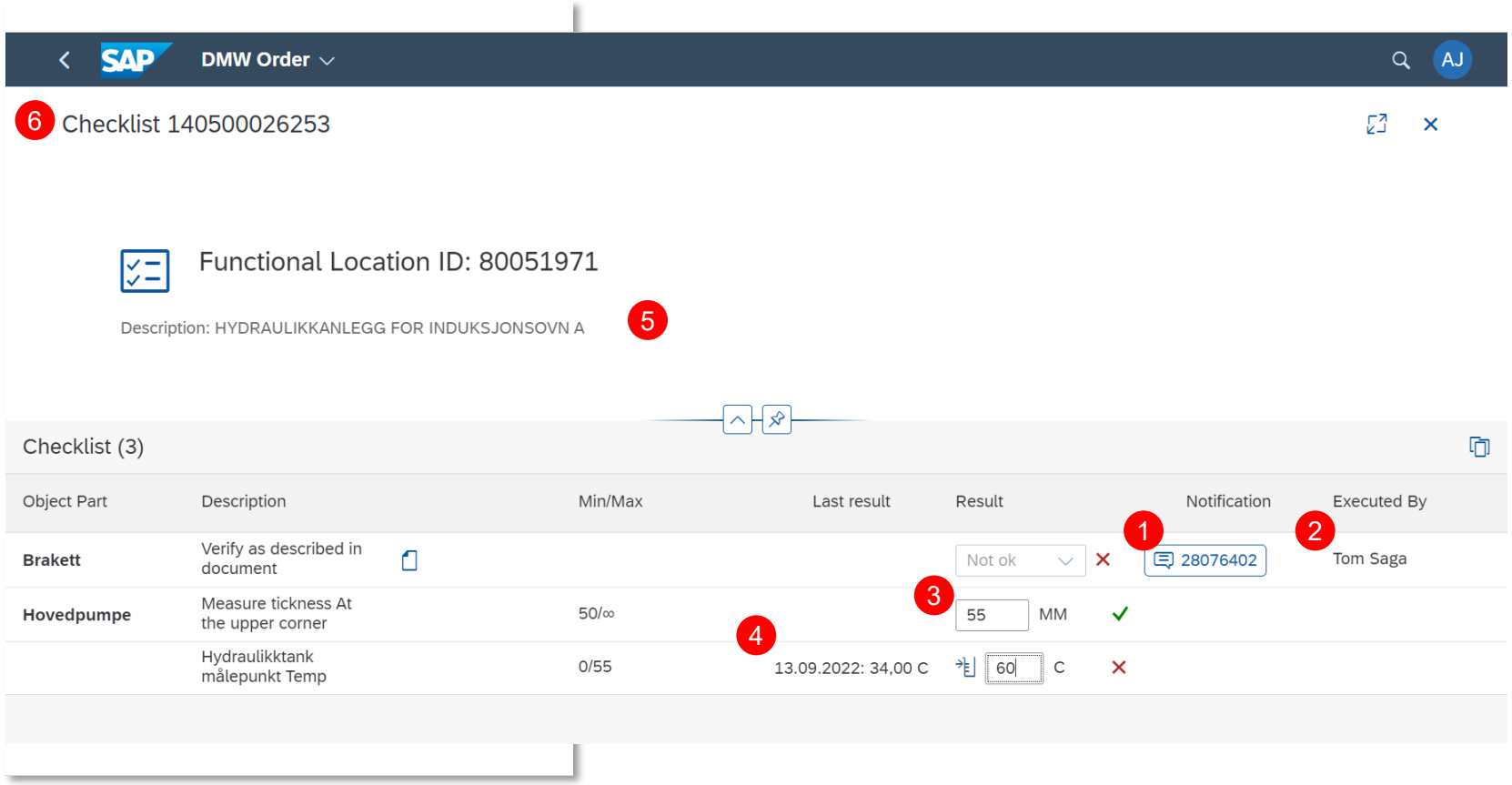
- Easy entry of notifications/maintenance requests
- Work order handling: hour posting and confirmation
- Personalized view of work orders
- Easy access to technical documentation linked to technical object
- Good search engine for spare parts, and material
- Implementation of electronical inspection check list



Using Check list functionally increase the effectiveness an traceability of preventive maintenance

Hydro

From



To

1. Direct link to notification
2. Each inspection point is verified (sign)
3. Recording of measurements
4. Direct access to latest measurements and trends
5. Easy to evaluate preventive maintenance tasks
6. Large potential in common/master checklist

SAC integrates, process, and analyze real-time information and provide valuable insights for all users

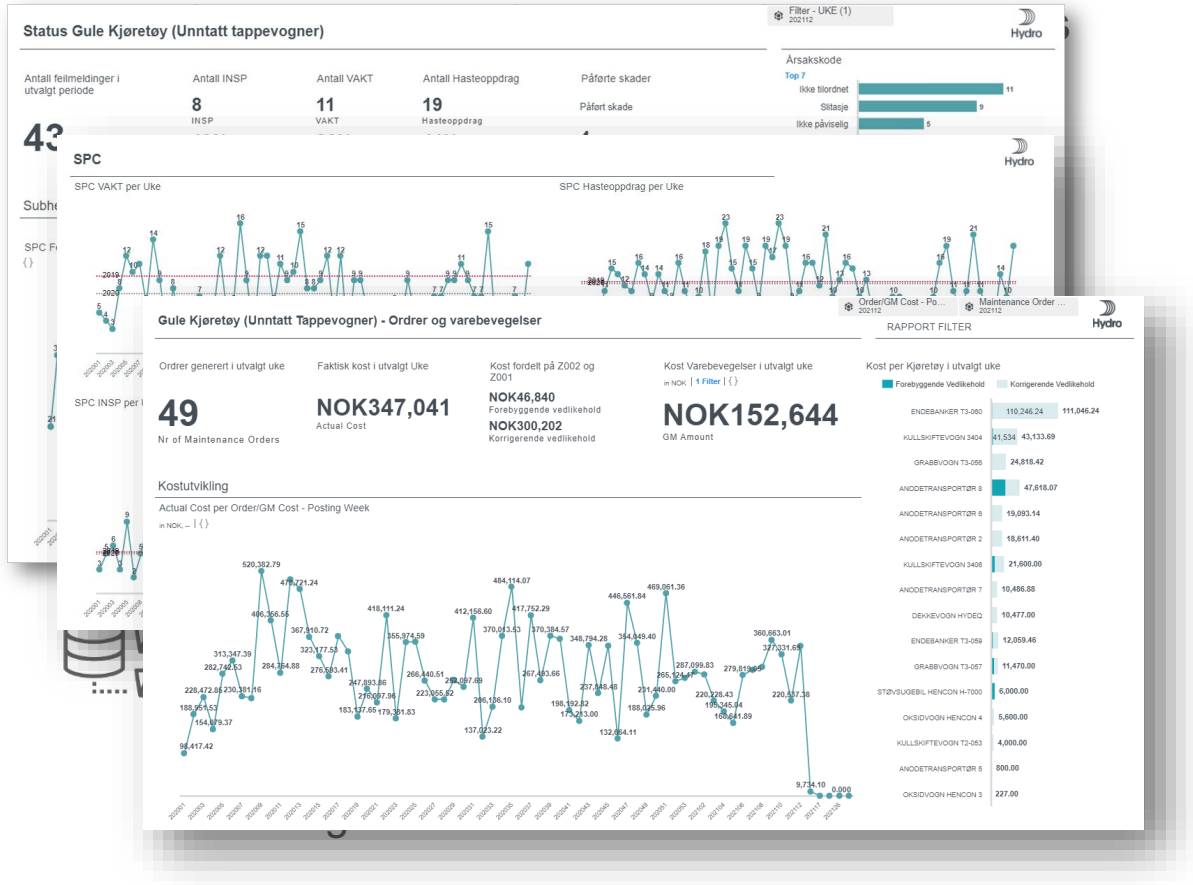
Hydro

Challenges

- Countless spreadsheets
- Time consuming task to update reporting
- Dependent on deep insight into SAP PM to develop reporting.
- Large amount of data unused

The Solution

SAC integrates, process, and analyze real time information and provide valuable insights for all users



Solution / Benefits

Common solution Across sites. Generate reports on standard maintenance activities across common asset

Based on solution we have both an analytic workbench were “all” data is made available but also a standardized information portal.

The analytic workbench gives an “infinite” basis for analysis and new tools.

The information portal with SAC gives larger portion of the organization easy access to prepared reports.

Integrating SAP PM d platform CERES

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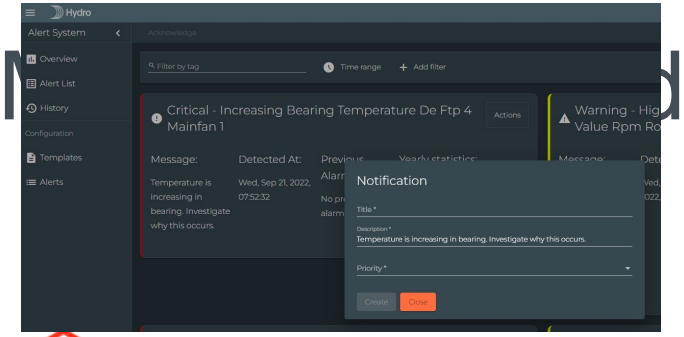
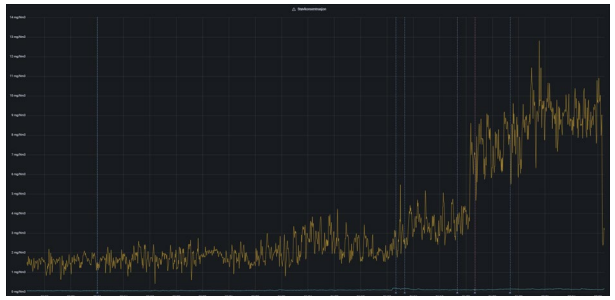
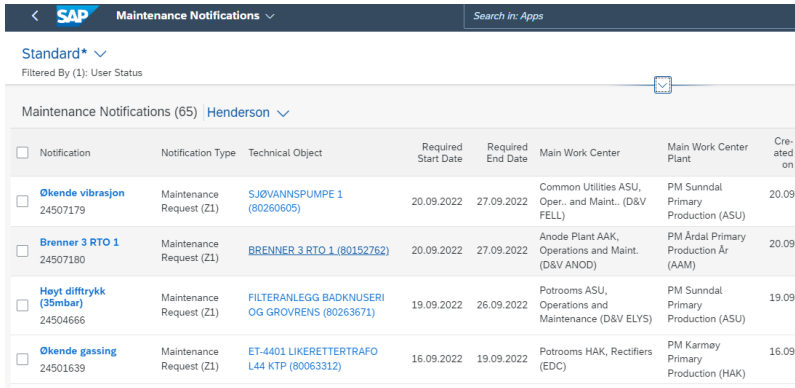




Notifications

Measurement Documents

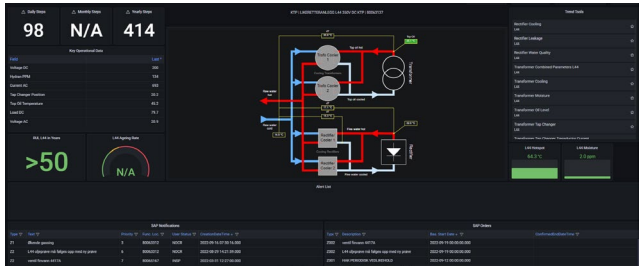


Microsoft Azure

Hydro Ceres

API

SAP PM

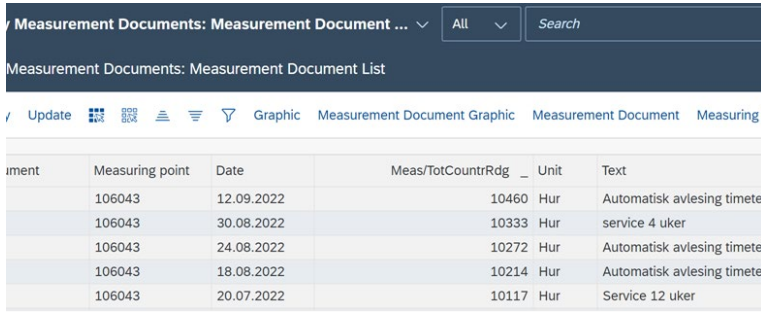


Master Data

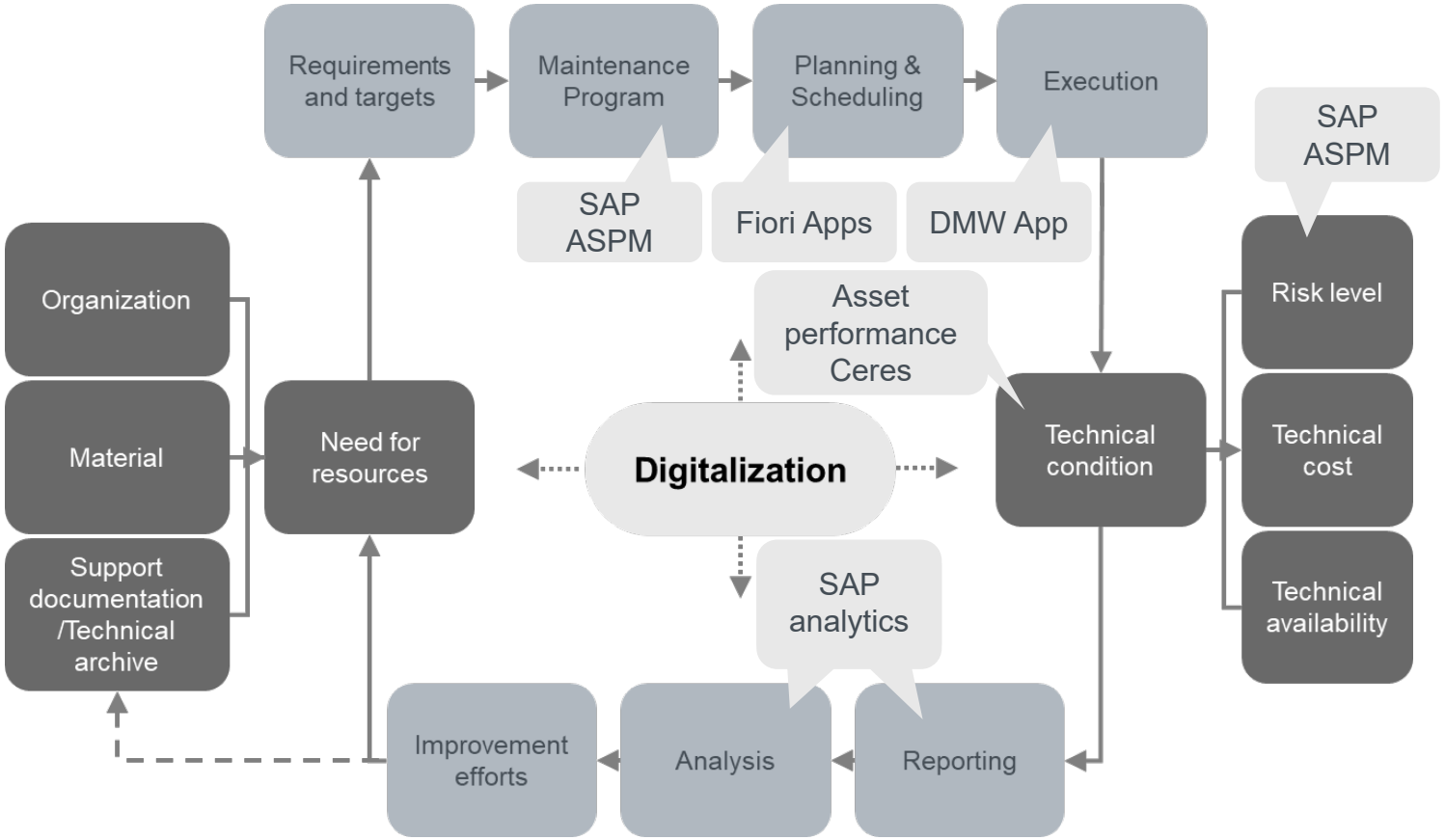
Orders

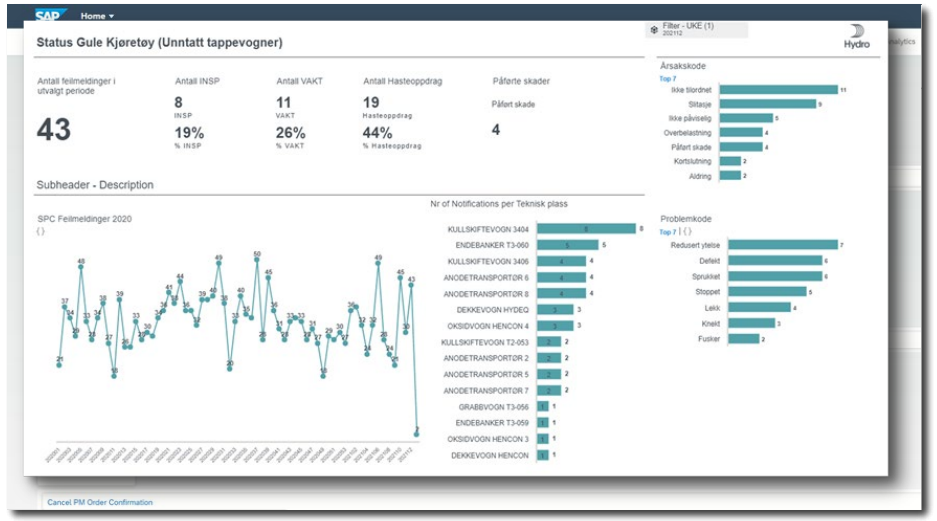
Measurement Documents

Notifications



Digitalization is about using technology to renew, simplify and improve





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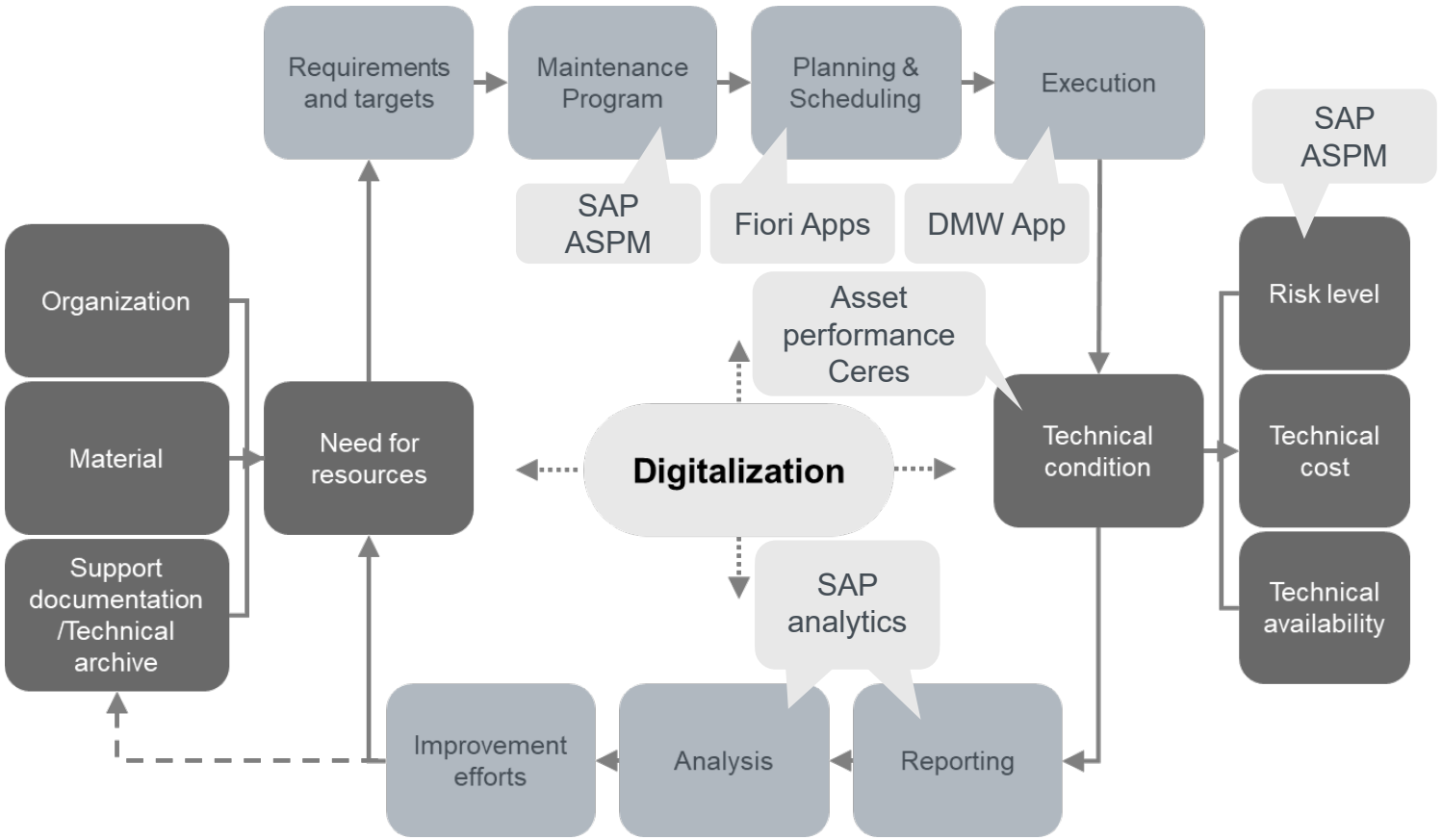


Challenges

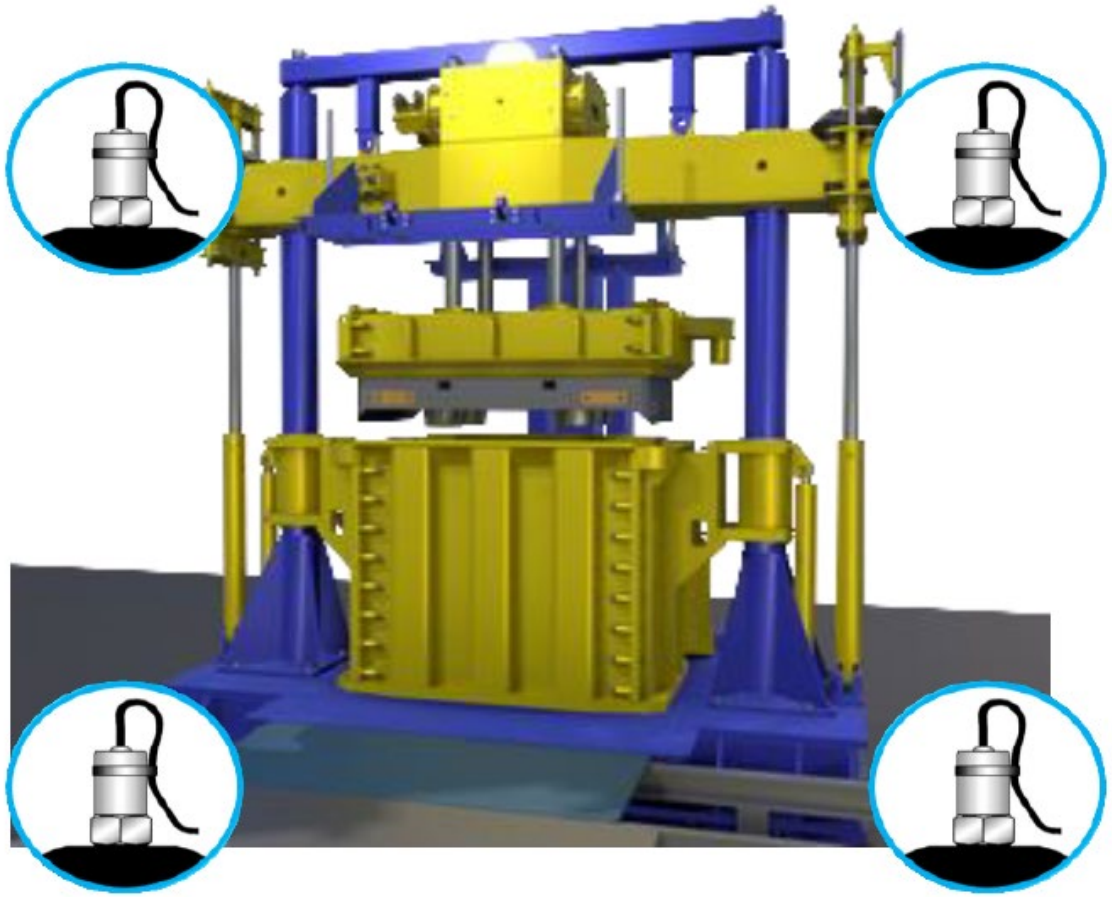
- Variations in maintenance processes across plants and units.
- Some technical WiFi and 4G coverage
- Change management
- To “fast” implementation of checklist
- Make or Buy
- Link developer/owner and users

Challenges RCM and FMECA

One RCM analysis with implementation of maintenance activities on one asset gives little effect

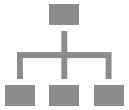
scaling is the key

- Several hundred spreadsheet
- No link to maintenance task in SAP PM
- No updates of initial analysis when updating maintenance plans
- Over time no documentation and link to initial analysis.
- No possibility to scale across equipment and plants



Digital platform for FME(C)A/ RCM analysis

Main digital benefits:



Connect FME(C)A/ RCM analysis across plants and assets.

Make FME(C)A/ RCM analysis more user friendly, structured and facilitate collaboration.

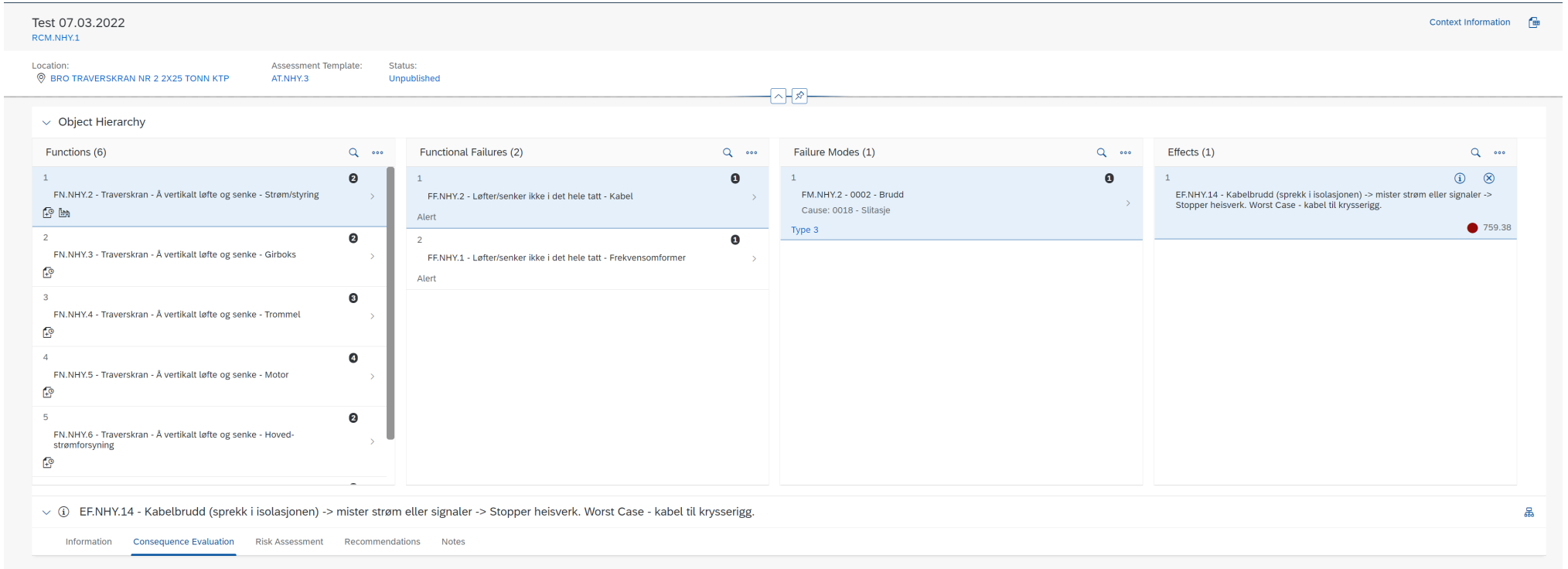
Easier to update with new failure modes, deviations and errors.

A step towards analytics and automatic work order generation when failure modes and maintenance tasks are defined in a digital platform. Analytics can also give information back into FME(C)A/ RCM analysis.

ASPM experience

The solution is a step in the right direction, but for the sole RCM-purpose there are still some improvements needed

- ASPM not synchronized/harmonized with SAP S/4 PM (ie statuses, catalog profile …)
- Make FME(C)A/ RCM analysis more user friendly and structured
- Traceability of the analysis linked to Technical objects, version control,
- Not possible to create templates for maintenance objects with a pre-defined breakdown in functions and failure modes
- With no templates, it is not possible to achieve the scaling on similar equipment across sites



Scale across assets and plant is a key success factor

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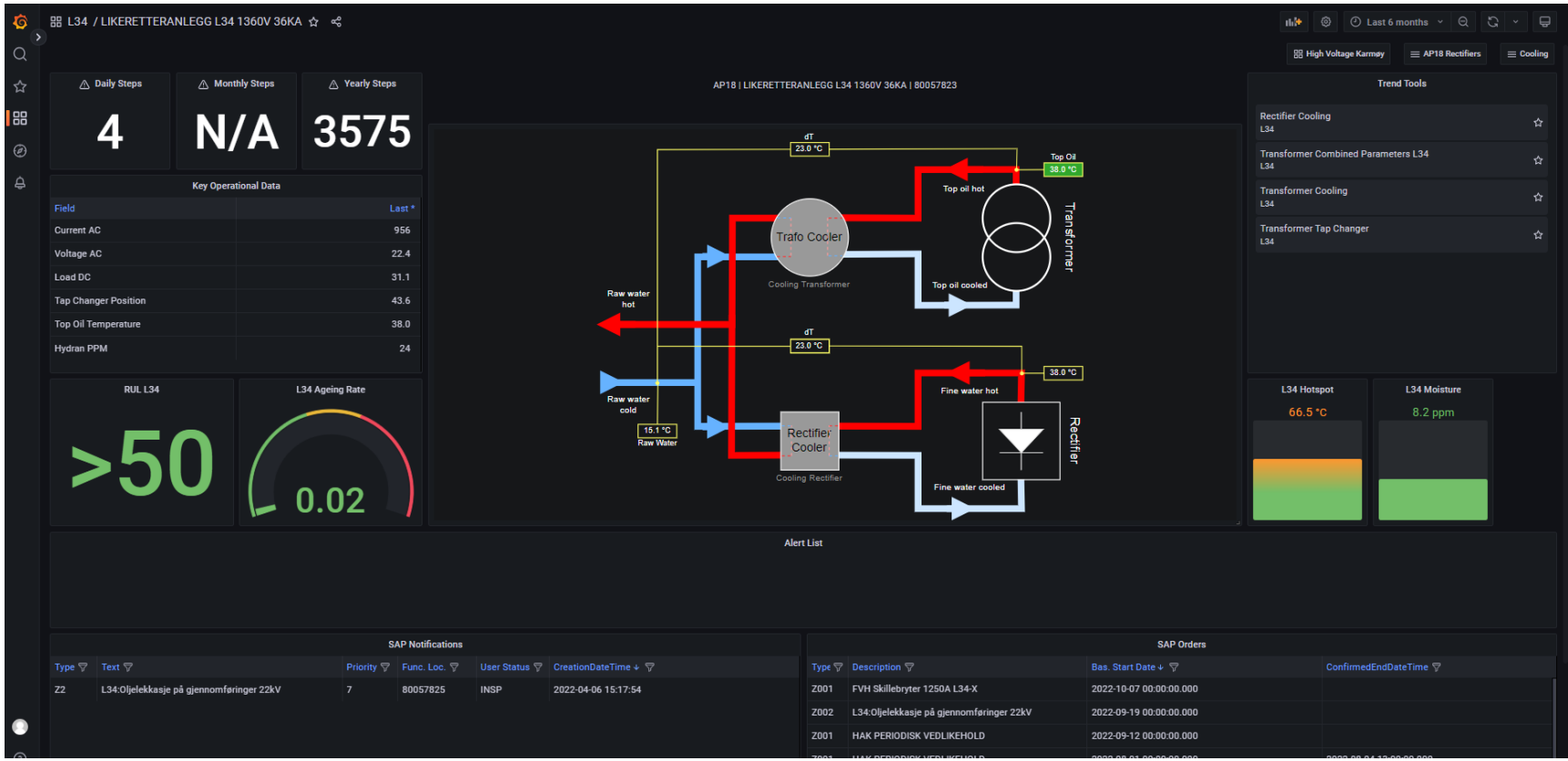
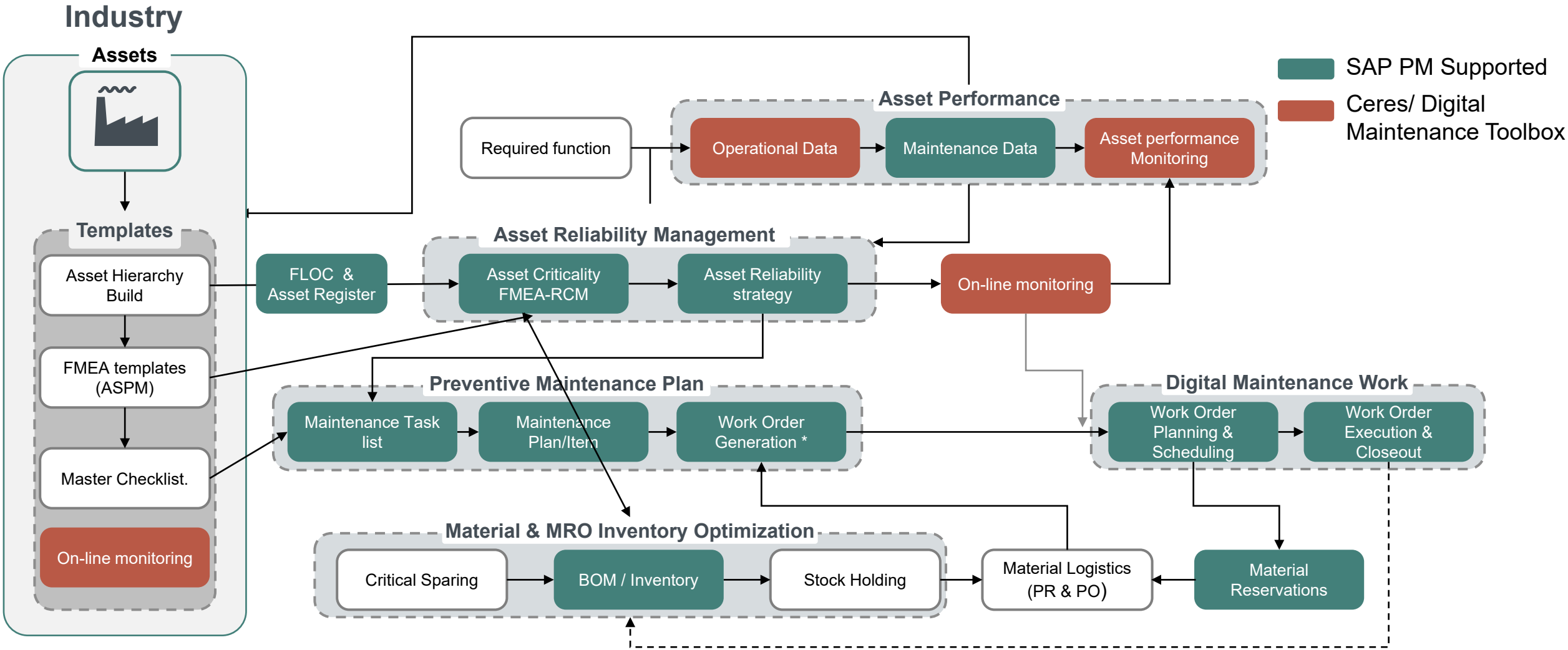
Experience has shown scaling RCM analysis across plants reduces effort significantly

- Template consist of
- Technical object structure
- RCM template
  - Functions
  - Functional Failures
  - Failure Modes
  - Failure Effects
  - Recommended Actions
- Template for monitoring solutions

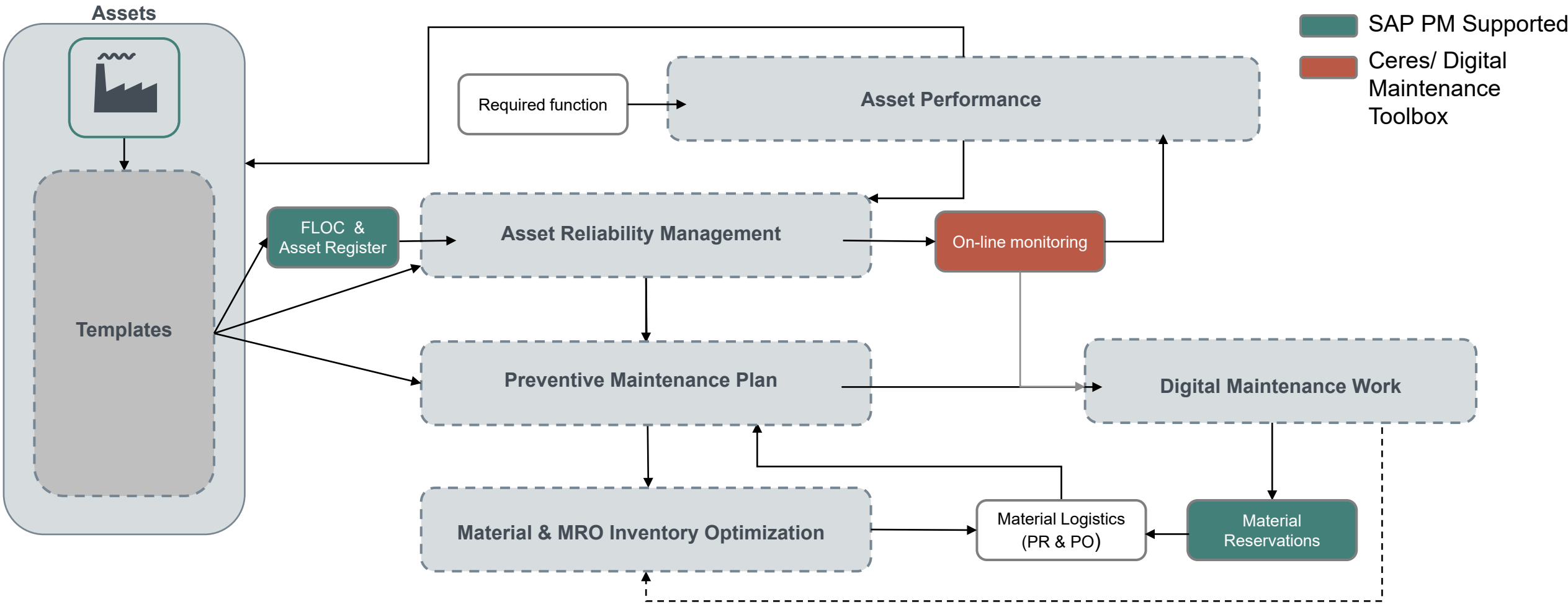


HAM's holistic approach to Asset Management and Digital Transformation



Are we able to close the loop ?

To be continued



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Industries that matter