



Adopting Risk-Based Maintenance: Enabled by SAP Asset Strategy and Performance Management

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About the Speakers

Dean Fitt

- Solution Manager, SAP SE
- Dean is a member of SAP's global Enterprise Asset Management (EAM) solutions team. Dean is based at SAP Global Headquarters in Walldorf, Germany. Dean joined SAP in 1998 as a Plant Maintenance (PM) Consultant with SAP Africa, before moving to Germany in 2001.
- Fun fact: Rode the Cape Argus cycle tour 26 consecutive times

Key Outcomes/Objectives

1. A risk-based maintenance approach enables better decision-making for maintenance planning and reduces the probability of asset failure
2. Minimize environmental and safety risks
3. Enhance asset reliability and availability

Agenda

- SAP Intelligent Asset Management
- Business Background and Drivers
- Solution Overview
- Summary
- Q & A

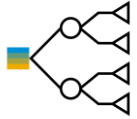
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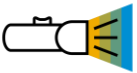
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SAP Enterprise Asset Management Portfolio – Business Capabilities



State-of-the-art business processes

Leverage new technologies to enable new asset management business processes anywhere and anytime.



Real-time insights

Bring together information from operational and business systems using IoT for scalable transparency



Risk-based asset strategies

Adopt risk based approach to determine critical assets driving optimal asset strategies



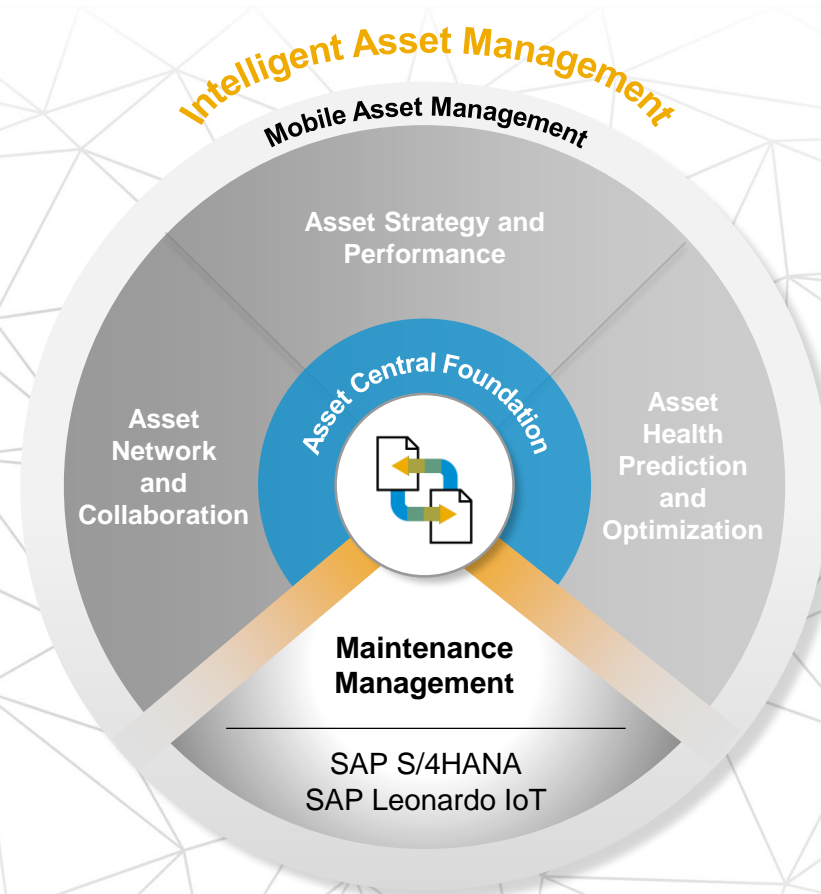
The power of prediction, optimization and simulation

Drive smarter decisions, improve reliability, and reduce outages



Collaboration throughout the asset lifecycle

Share asset information, access one version of the truth, and collaborate on a cloud-based business network with integrated processes



SAP Asset Strategy and Performance Management

Monitor and Improve

Continuously monitor the performance and effectiveness of the maintenance strategies



Define Systems & Assets to Analyze

Asset Central Foundation enables asset information to be modelled utilizing templates based on ISO standards e.g. ISO14224. Models, equipment, locations, systems, groups, spare parts, documents, instructions, failure modes are all included in Asset Central Foundation.



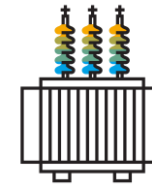
Implement Maintenance Strategies

Implement the recommended actions/tasks in the maintenance management system.



Identify Critical Assets

The Risk and Criticality assessment ranks assets by risk and criticality which can then be used as the basis for further analysis. This is achieved by setting up a matrix of consequence of failure vs probability of failure.



Develop Recommended Actions

The result of the RCM/FMEA will recommend preventive and/or corrective tasks. These tasks can use existing instructions or can trigger a new instruction to be created.



Perform Analysis

Use proven methodologies like Reliability Centred Maintenance (RCM), Failure Modes and Effects Analysis (FMEA), Preventive Maintenance Review* (PMR), Risk Based Inspection** (RBI), Root Cause Analysis* (RCA) or Checklists to identify the optimal maintenance strategies for your assets.



*planned

** partner planned

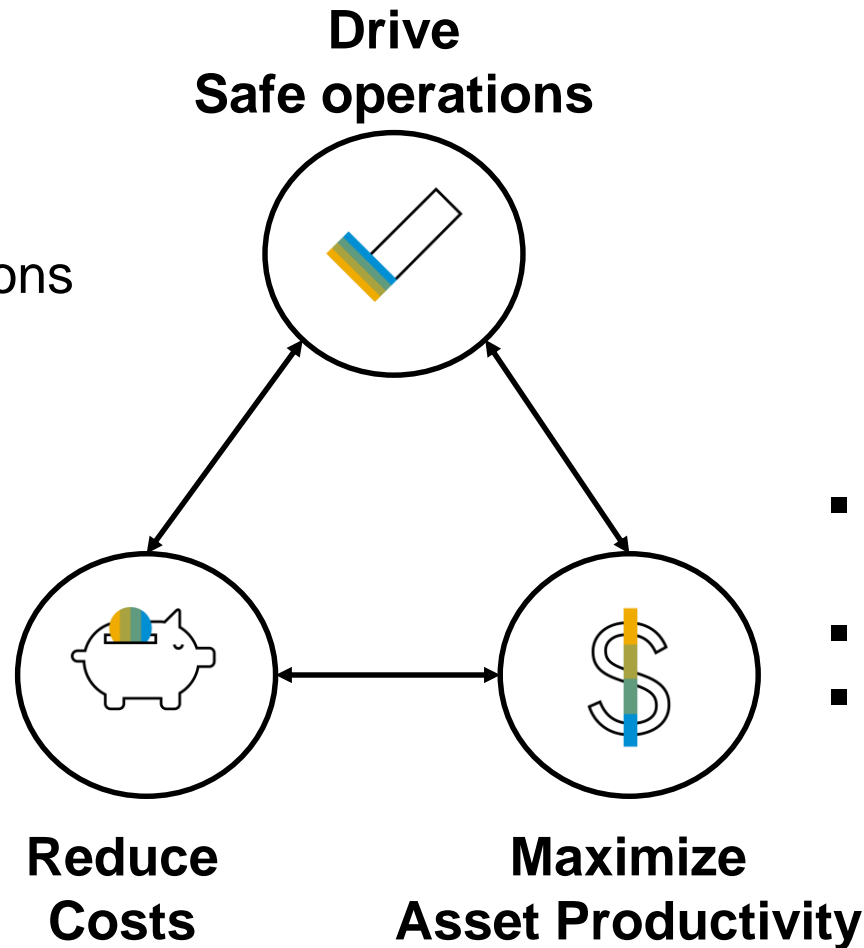
Business Background and Drivers

Good Asset Management

Leads to Improved Business Outcomes

- Reduction in safety incidents
- Reduction in Environmental Incidents
- Adherence to Statutory Regulations

- Reduced Annual service and maintenance cost
- Adherence to Planned maintenance budget vs. actual cost
- Reduced energy and input costs



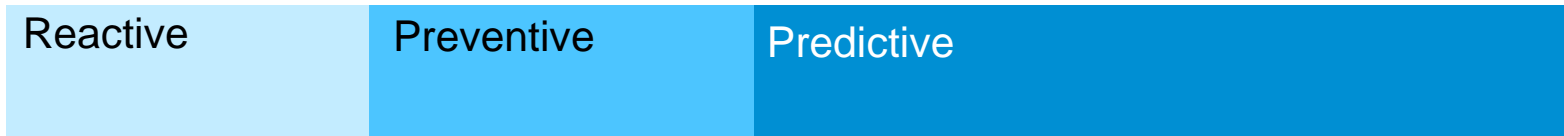
- Increased Overall Equipment Effectiveness
- Increased Return on assets
- Reduction in Unplanned outages

Technology is changing our approach to maintenance

*Use of Maintenance Strategy – **Today**



*Use of Maintenance Strategy – **Future**



Although still relevant, **preventive** maintenance can result in over-maintaining assets and higher costs

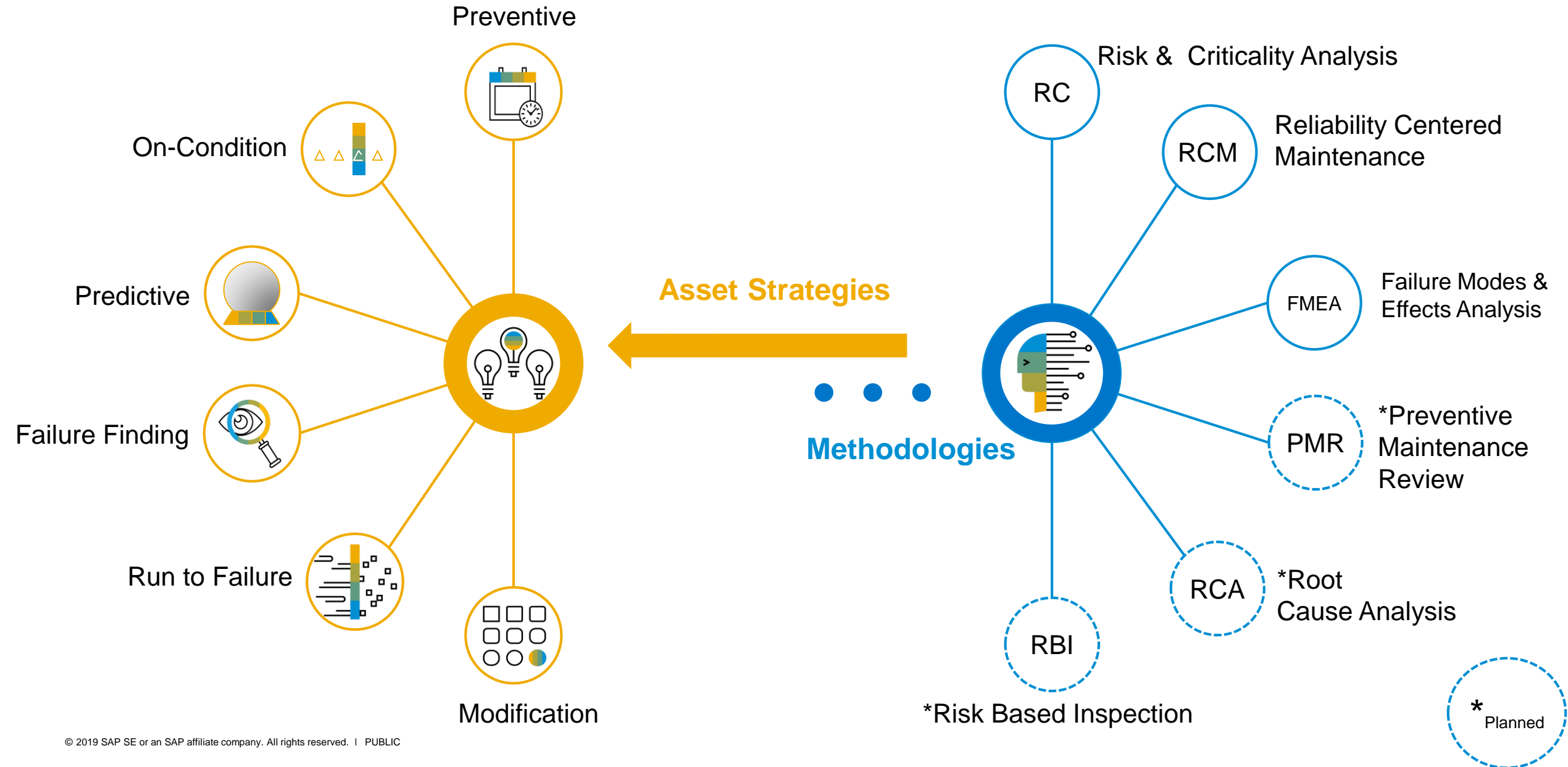
The Internet of Things is leading to increased use of **predictive** maintenance

The goal is to enable more **IT driven** (data science & rules driven) approaches to predictive maintenance in order to reduce unplanned failures and the number of overall maintenance actions

*Proportion of maintenance strategies are for illustration purposes only and will vary based on many factors

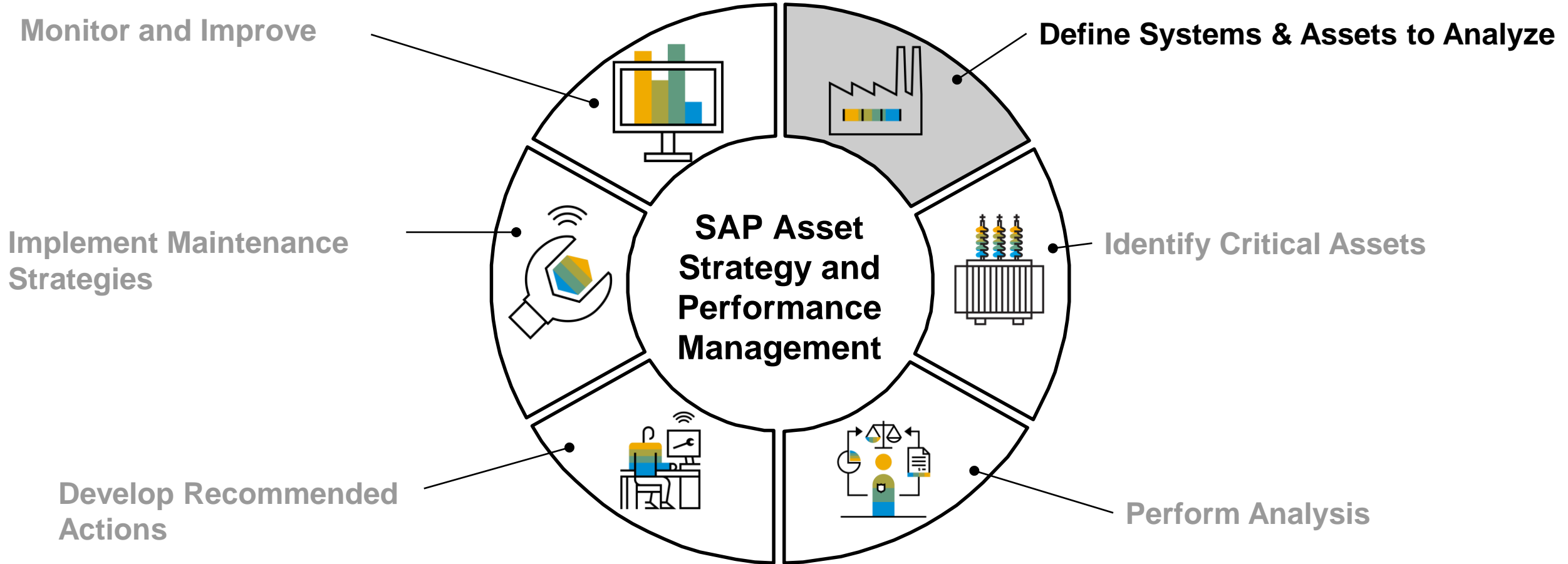
Determining the Correct Maintenance Strategy

Apply industry standard methodologies to determine optimal asset strategies



Solution overview

SAP Asset Strategy and Performance Management



SAP Asset Central Foundation

Next-Generation Master Data Layer

Master Data Layer

Asset Classification

Classes

Subclasses

Asset Modelling

Templates

Models

Attributes

Indicators

Asset Representation

Equipment

Systems

Locations

Groups

Function

Functional Failure

Asset Information

Instructions

Alert Types / Rules

Announcements

Spare Parts

Performance Improvement

Notifications

Documents

Work Orders

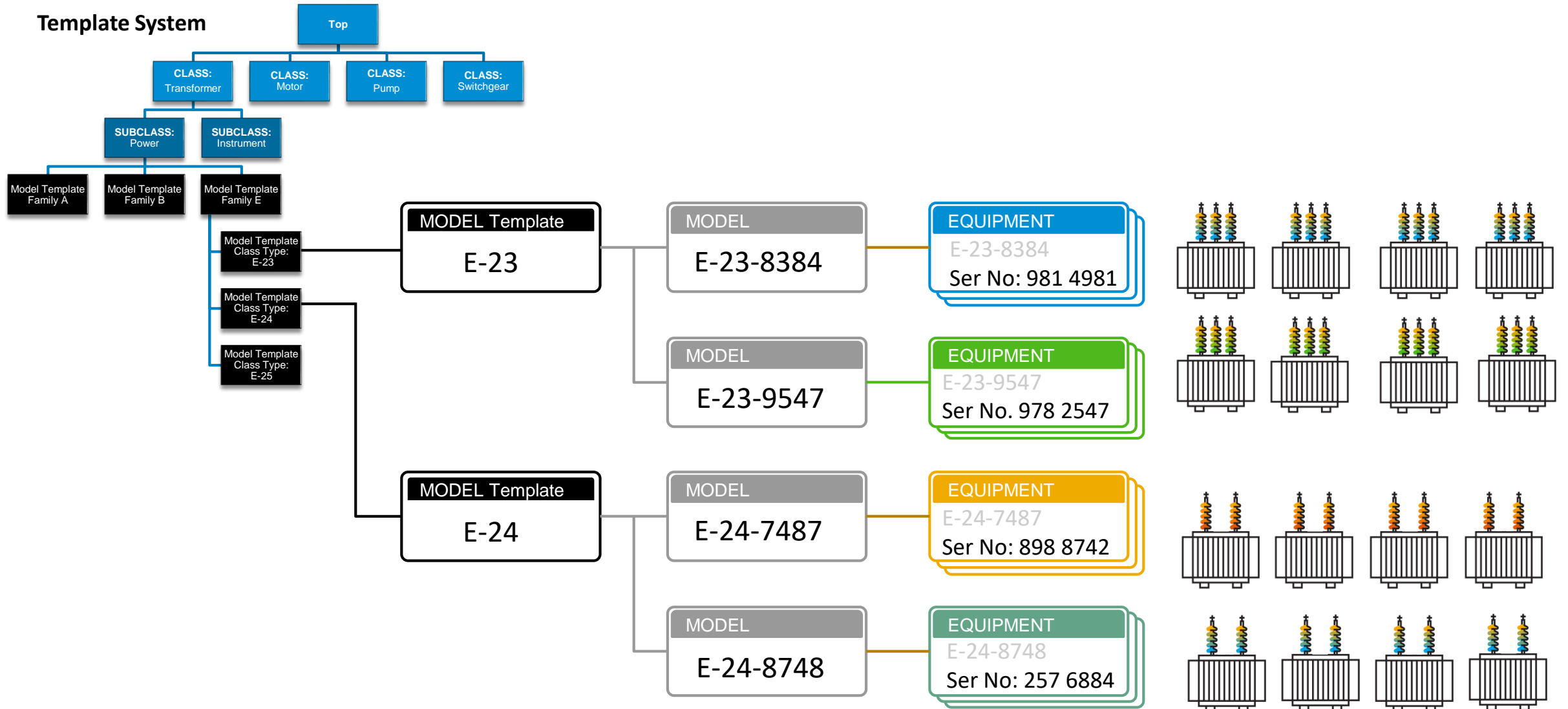
Failure Modes

Organization Representation

Company Profile

IAM


Models and Equipment



SAP Asset Strategy and Performance Management

Equipment: Features

VALVES / PSV-CONVENTIONAL /

 PSV Emerson JOS-E 1010 EQ-1010

Manufacturer: [SAP Manufacturer](#) Location: [20PSV001](#) External IDs Phase: [Planned](#) Status: [Published](#) Risk/Criticality: ● [High](#) Languages: [EN](#)

Shared With: [1 Partners](#)

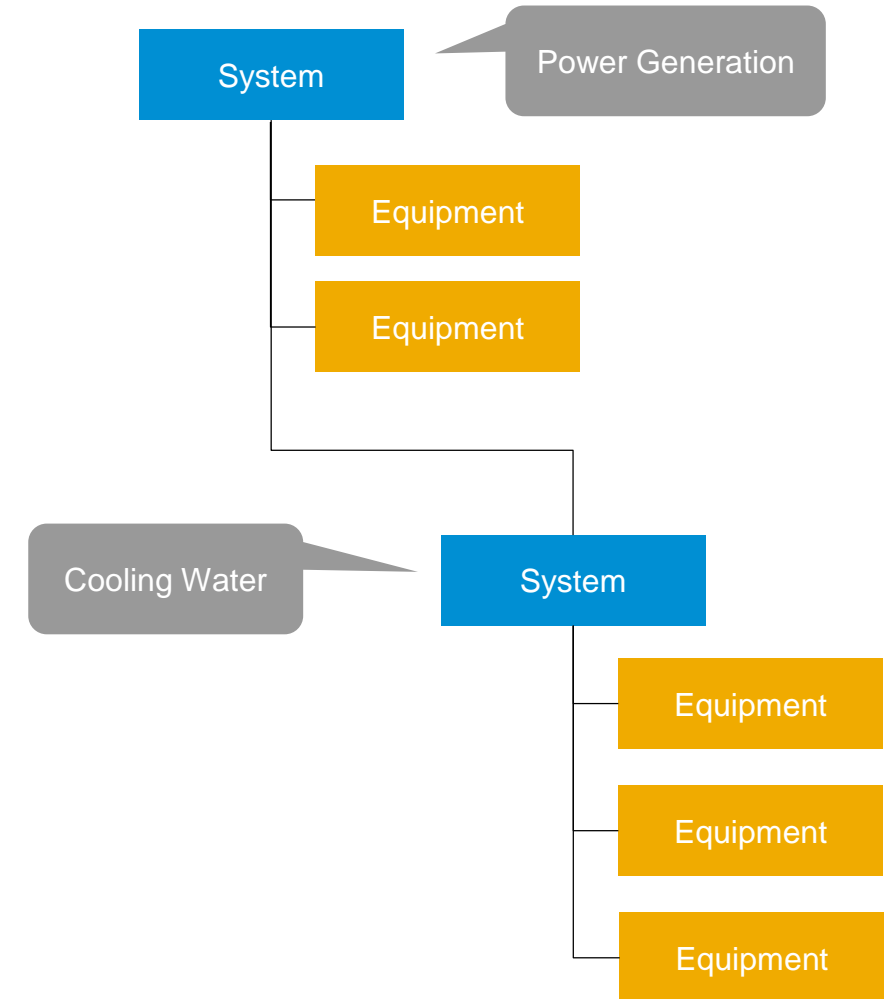
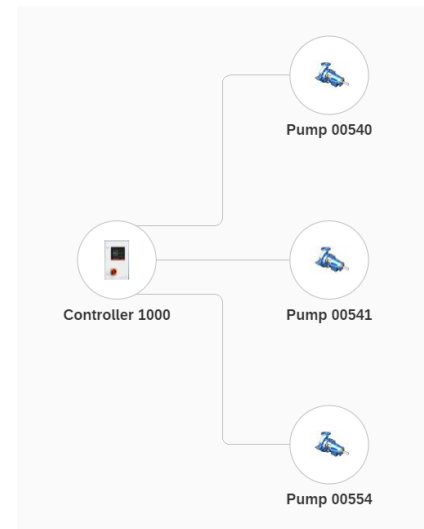
INFORMATION ▾ STRUCTURE & PARTS ▾ DOCUMENTATION ▾ MONITORING ▾ MAINTENANCE & SERVICE ▾ ASSESSMENT ▾ TIMELINE

INFORMATION	STRUCTURE & PARTS	DOCUMENTATION	MONITORING	MAINTENANCE & SERVICE	ASSESSMENT
Highlights	Highlights	Highlights	Indicators	Highlights	Highlights
Data Sheet	Structure	Documents	Component Indicators	Notifications	Matrix
Equipment Information	Spare Parts	Instructions		Work Orders	Risk and Criticality
Business Partners	Visual Parts	Failure Modes			Questionnaire
Installation Location		Alert Types			FMEA
Systems		Announcements			Checklists
Groups		Improvement Requests			RCM

Systems:

Define the boundaries and function of the systems that contain the selected equipment

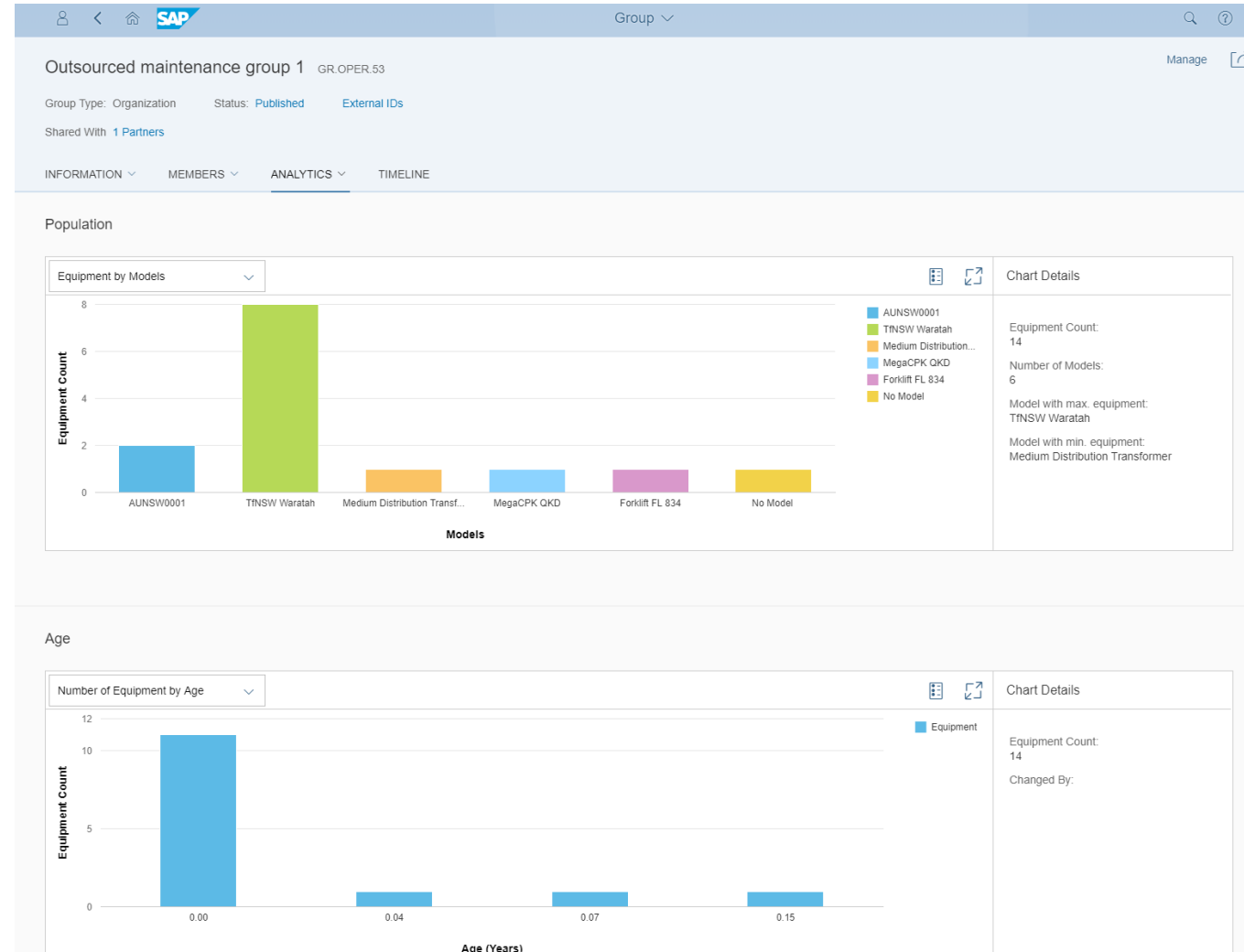
- A system is an overview with a logical structure throughout complex assets or asset structures
- Examples are fluid systems, braking systems or piping systems.
- Systems can be nested.
- In parallel the topology of a system can be visualized using the functionality of our Hilscher Net IoT partnership.



Groups

Models, Equipment and Locations

- There are different types of groups e.g. assign equipment into different groups based on risk and criticality assessment.
- Objects that are grouped can be analyzed by population or age. You can filter by all kinds of objects (Equipment, Model, Subclass, Manufacturer etc.)
- An FMEA Assessment can be performed on a group



Location

Asset Hierarchies

The screenshot displays the SAP S/4HANA Asset Management interface. On the left, a navigation pane shows a hierarchy of locations: Eagle_Ford_Field_(P1) (Eagle Ford Field), North_Field (P1-C4) (North Field), Well_Cluster_3_(P1-C4-U3) (Well Cluster 3), Centrifugal_Pump_(P1-C4-U3-A1) (Centrifugal Pump), Location_4_(P1-C4-U3-A1-L4) (Location 4), Location_1_(P1-C4-U3-A1-L1) (Location 1), Location_2_(P1-C4-U3-A1-L2) (Location 2), Rotating_Equipment / Pump Pump 00554 (Pump 00554), Rotating_Equipment / Pump Drivetrain Assembly 00554 (Drivetrain Assem), Hydraulics Assembly 00554 (Hydraulics Assem), Foundation (Foundation for Pumps), Baseplate (Baseplate for Pumps), Casing (Casing for Pumps), Location_3_(P1-C4-U3-A1-L3) (Location 3), Well_Cluster_1_(P1-C4-U1) (Well Cluster 1), Well_Cluster_2_(P1-C4-U2) (Well Cluster 2), West_Field (P1-C6) (West Field), and South_Field (P1-C5) (South Field).

The main content area shows details for Pump 00554. The header includes the equipment name, manufacturer (Pumps Ltd), location (Location_2_(P1-C4-U3-A1-L2)), and status (Fully Operational/Standby). The risk/criticality is High. Below the header, there are several key performance indicators (KPIs) and data sheets.

Highlights:

- Risk and Criticality:** Updated By Eastlea, Matthew (Jun 3, 2018). Risk/Criticality: 7.0 A "High". Normalized Risk: 25.0%. Action: FMEA.
- Phase:** Fully Operational/Standby. Jun 1, 2018. Previous Phase: Fully Operational. Planned Next Phase: Dispose May 30, 2018.
- Next Work Order:** Lubrication. WO.PDMS.7690. Remaining days: 0.
- Firmware Announcements:** Last Year. 1 Mandatory. Total: 1.

Data Sheet:

All Attributes	9	Changed Values Compared to Default	0	Attributes Without Values	0
----------------	---	------------------------------------	---	---------------------------	---

Rotating Equipment attributes on Equipment Level:

Model Year	2010
Installation Year	2010
Spared	No

Rotating Equipment attributes on Model level:

Model	200 Series
Manufacturer	Pumps Ltd
Maximum Flow	100 m3/h

- Flexible configuration of naming conventions for master data standardization
- Parent/child relationships for master data inheritance

Documents







Stores and shares multiple documents across objects

Document List

Standard * Search Show Filter Bar Filters (1) Go

Documents (1,069) Standard

Add Edit Assign View Image Delete Group Download

Document	File Name	File Type	Confidentiality	Language	Phase	Category	Source
<input type="checkbox"/>  jlg5 D.OPER.1211	jlg5.jpg	Image		English Add Another Language		Identification	 SAP Operator
Hotspot Exists: Assignments: Yes Created On: Aug 25, 2018 Data Sensitivity: No Sensitive Information							
<input type="checkbox"/>  jlg4 D.OPER.1210	jlg4.jpg	Image		English Add Another Language		Others	 SAP Operator
Hotspot Exists: Assignments: Yes Created On: Aug 25, 2018 Data Sensitivity: No Sensitive Information							
<input type="checkbox"/>  jlg3 D.OPER.1209	jlg3.jpg	Image		English Add Another Language		Drawings / Schemes	 SAP Operator
Hotspot Exists: Assignments: Yes							

Failure Modes

- A failure mode is a probable failure that could occur to piece of equipment
- Failure Modes can be assigned to Models, Equipment, Locations, Spare Parts and Groups.
- They are based on a subclass and have different categories and types.
- RAMS Figures (Reliability, availability, maintainability and safety) and KPIs (MTTF, MTTR, MTBF).

The screenshot shows the SAP interface for a Failure Mode. At the top, the SAP logo and navigation icons are visible. The page title is 'Failure Mode' with a dropdown arrow. Below the title, the failure mode is identified as 'EQ-CB-1000-1000 / FM.OPER.69 / Circuit Breaker Fails to Close FM.OPER.69'. There are tabs for 'External IDs', 'INFORMATION', 'EFFECTS', 'CAUSES', 'MAINTENANCE STRATEGY', and 'INSTRUCTIONS'. The 'INFORMATION' tab is active, showing a 'Highlights' section with FMEA details: 'Updated By Fitt, Dean (Oct 22, 2018)', 'RPN: 75', 'Preventive Activities: 1', and 'Corrective Activities: 0'. Below this is the 'Failure Mode Information' section, which includes: 'Subclass: OIL_CIRCUIT_BREAKER', 'Types: 1 - Designed Function is not obtained', 'Categories: Fails to close on demand', 'Long Description: Circuit Breaker Fails to Close', 'Detection Methods: Periodic maintenance', and 'Relevant To Equipment 'EQ-CB-1000-1000': YES'. The bottom section, 'RAMS Figures', contains four charts: 'Failure Pattern E' (a line graph showing Failure Rate vs Lifetime with a 4-star rating), 'Mean Time To Failure' (1 Year, 4-star rating), 'Mean Time To Repair' (5 Hours, 4-star rating), and 'Mean Time Between Failures' (6 Months, 4-star rating).

Instructions

Instructions describe how to execute maintenance

- There are different types of Instructions e.g. Breakdown, Installation, Operations, Planned Maintenance
- Instructions can be assigned to Models, Equipment and Groups
- Failure Modes can only be assigned to Breakdown Instructions.
- You can define the number of steps, duration, criticality, safety rules, tools and required spare parts.
- Additionally you can define preconditions, the steps themselves and post checks.
- You can add different documents. If you added an animated 3D file (.vds) the end user can view the sequences.

The screenshot displays the SAP interface for a 'Planned Maintenance Instruction'. The title is 'Oil Change' and it is marked as 'In Revision'. Key details include: Subclass: Demo subclass, Source: SAP Operator, External IDs, Published On, Instruction Revision: 2, and Instruction ID: I.OPER.16. A summary bar shows: Number of Steps: 3, Expected Duration: 4 Hours, People Required: 1, and Criticality: Moderate. Below this is a navigation menu with tabs for Information, Safety Rules, Tools and Spare Parts, Roles, Models, Equipment, and Groups. The 'Information' tab is active, showing: Activity: Service, Short Description: Oil Change, Failure Mode Category: Unknown, Frequency: 12 Months, Primary Document: 3D Visual: Centrifugal pump parts 6.vds, and Relevant to Warranty: Yes. A 'Long Description' field is also present. At the bottom, there are tabs for 'Preconditions', 'Steps', and 'Post Checks', with 'Steps' selected. A 3D model of a centrifugal pump is visible in a viewer, and a 'Play Step' button is present.

Function

Functions are used to define how the assigned objects are intended to operate. You can assign functions to equipment, models, locations and systems.

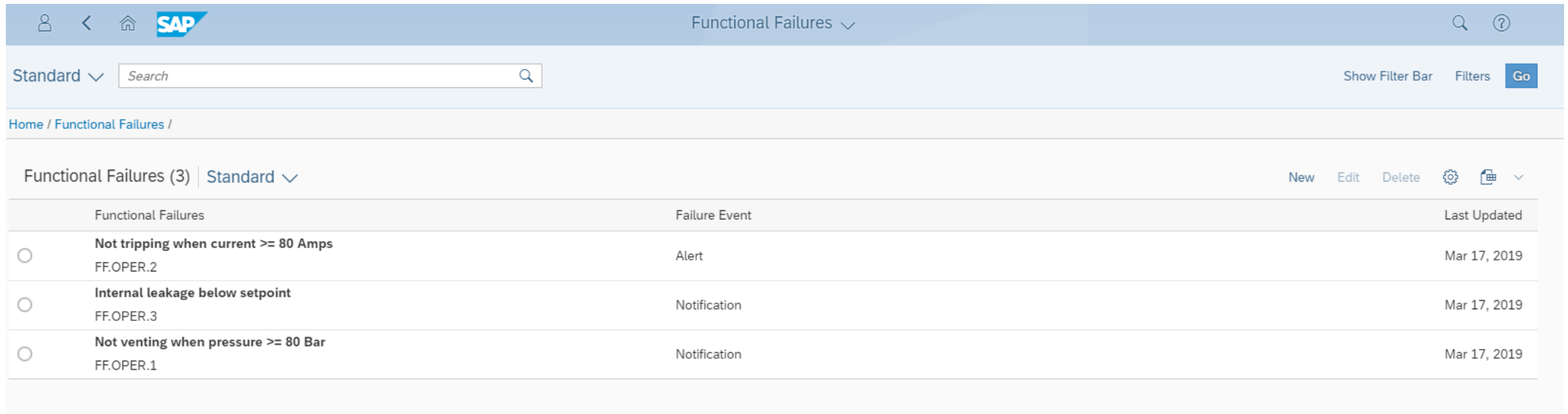
You can currently use this feature in the Reliability Centred Maintenance (RCM) assessment.

The screenshot shows the SAP S/4HANA user interface for configuring a function. The header bar includes navigation icons, the SAP logo, and the text 'Function' with a dropdown arrow. A search icon is in the top right corner. Below the header, the function name 'De-energize equipment' is displayed with the ID 'FN.OPER.1'. There are icons for 'Characteristics' and 'Language EN'. A 'Source' field is also visible. Below this, there are three tabs: 'BASIC INFORMATION' (which is selected and highlighted), 'DOCUMENTS', and 'ASSIGNMENTS' with a dropdown arrow. On the right side of the main content area, there is an 'Edit' button. The main content area displays the following information:

- Description:**
De-energize equipment
- Long Description:**
Switchgear is used both to de-energize equipment to allow work to be done and to clear faults downstream.
- Characteristics:**
Safety , Operation
- Characteristics Description:**
De-energize equipment

Functional Failure

A functional failures is assigned to a function during RCM assessment



The screenshot shows the SAP Functional Failures interface. At the top, there is a navigation bar with the SAP logo and a breadcrumb trail 'Functional Failures'. Below this is a search bar with the text 'Standard' and a search icon. To the right of the search bar are buttons for 'Show Filter Bar', 'Filters', and 'Go'. Below the search bar is a breadcrumb trail 'Home / Functional Failures /'. The main content area displays a table of Functional Failures. The table has a header row with columns: 'Functional Failures', 'Failure Event', and 'Last Updated'. There are three rows of data, each with a radio button in the first column. The first row is 'Not tripping when current >= 80 Amps' (FF.OPER.2) with an 'Alert' event. The second row is 'Internal leakage below setpoint' (FF.OPER.3) with a 'Notification' event. The third row is 'Not venting when pressure >= 80 Bar' (FF.OPER.1) with a 'Notification' event. All 'Last Updated' dates are 'Mar 17, 2019'. To the right of the table are buttons for 'New', 'Edit', 'Delete', and a settings icon.

Functional Failures	Failure Event	Last Updated
<input type="radio"/> Not tripping when current >= 80 Amps FF.OPER.2	Alert	Mar 17, 2019
<input type="radio"/> Internal leakage below setpoint FF.OPER.3	Notification	Mar 17, 2019
<input type="radio"/> Not venting when pressure >= 80 Bar FF.OPER.1	Notification	Mar 17, 2019

Asset Central Foundation

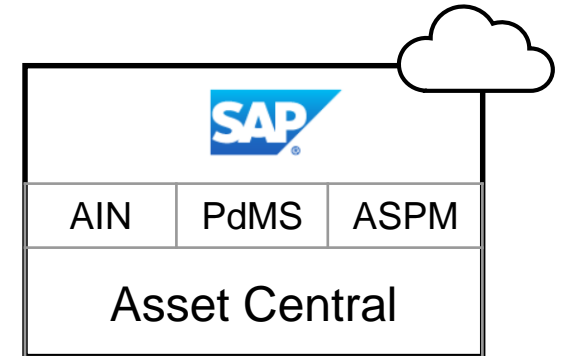
ERP Integration

[Checkout the new integration](#) guide!



- Integration scenario ensures asset information is kept current between Asset Central (ACF) and Enterprise Asset Management (EAM).
- Integration between AC & EAM, covers both data & user experience improvements.
- Integration provides Bi-directional synchronization of asset information for technical objects –
 - Equipment
 - Functional Location
 - Documents
 - Notifications
 - Work orders

Cloud solutions



On-Premise solutions



Supported Releases – **S/4 HANA On Premise 1709 & above, ERP Enhancement package 6 & above.**

SAP Asset Strategy and Performance Management



SAP Asset Strategy and Performance Management

Risk and Criticality Assessment

Assess which are the **critical assets** to determine which assets are likely to benefit most from application of RCM, FMEA or PM Review

Description:

- Assessment of asset(s) (equipment, location, group or system) criticality based on risk score.
- Calculation of risk score based on different dimensions and scales and for different impact categories.
- Supporting the selection of the most appropriate analytical process (i.e. RCM/FMEA, PM review, CM) based on the result of the criticality assessment
- Informed assessment based on historical maintenance data and relevant KPIs (EAM/PdMS integration).

Risk and Criticality Assessment

Questions & Answers View

<
>

Equipment
v

🔍
?

SWITCHING_DEVICE / MECHANICAL_SWITCHING_DEVICE / EQ-CB-1000 /

Circuit Breaker - Type 1000

EQ-CB-1000-1000

Manage
☆
📦
⚙️
📄

INFORMATION v
STRUCTURE & PARTS v
DOCUMENTATION v
MONITORING v
MAINTENANCE & SERVICE v
ASSESSMENT v
TIMELINE

Matrix

🏠
Operations (2/2)

🏭
Production (2/2)

🌿
Environment (2/2)

🛡️
Safety (2/2)

📊
📄

Dimensions (2)

	Question	Question Text	Answer
✓	What is Category of Failure Consequence?	What is Category of Failure Consequence?	Moderate
✓	What is the consequence to Operations?	What is the consequence of Failure to Operations?	XII

Answers (4)

	Answers	Description
<input type="radio"/>	Catastrophic	Failure resulting in death - system loss
<input type="radio"/>	Severe	Severe injury. Damage < 100000 USD
<input checked="" type="radio"/>	Moderate	Minor injury or illness. Damage < 250000
<input type="radio"/>	Minor	Very minor Injury. Damage < 50000 USD

Note:

Risk & Criticality Assessment

Matrix View

Equipment

SWITCHING_DEVICE / MECHANICAL_SWITCHING_DEVICE / EQ-CB-1000 /
 Circuit Breaker - Type 1000 EQ-CB-1000-1000

Manage ☆ 📦 ⚙️ 📄

INFORMATION ▾ STRUCTURE & PARTS ▾ DOCUMENTATION ▾ MONITORING ▾ MAINTENANCE & SERVICE ▾ **ASSESSMENT ▾** TIMELINE

Matrix

🔍 Operations (2/2) 🏭 Production (2/2) 🌿 Environment (2/2) 🛡️ Safety (2/2) 📊 📄

🔍 Operations Swap Axis 📄

What is Category of ... 3 ⓘ
 What is the consequ... 3 ⓘ

What is the consequence to Opera...
 What is Category of Failure Consequence?

	Catastrophic	Severe	Moderate	Minor
IV	1.00	2.00	3.00	4.00
VIII	2.00	4.00	6.00	8.00
XII	3.00	6.00	9.00	12.00
XVI	4.00	8.00	12.00	16.00

Equipment

Assessment Overview

SAP Equipment

SWITCHING_DEVICE / MECHANICAL_SWITCHING_DEVICE / EQ-CB-1000 /

Circuit Breaker - Type 1000 EQ-CB-1000-1000

Manufacturer: SAP Manufacturer External IDs Phase: Fully Operational Status: Published Risk/Criticality: ● High Maintenance Strategy Languages: EN Connection Status: Not Available

INFORMATION STRUCTURE & PARTS DOCUMENTATION MONITORING MAINTENANCE & SERVICE **ASSESSMENT** TIMELINE

Highlights

Risk and Criticality
Updated By Fitt, Dean (Nov 5, 2018)

Risk/Criticality: ● 11.5 A "High"
Normalized Risk: 70.0%
Action: OEM guidelines

Risk Type Score Difference

Current Risk	8.25
Mitigated Risk	11.5
Score Difference	3.25

FMEA
Updated By Fitt, Dean (Nov 14, 2018)

RPN: ● 108
Preventive Activities: 1
Corrective Activities: 1

Checklist Records

- Substation Inspection ● 3.00
- Substation Inspection ● 3.00

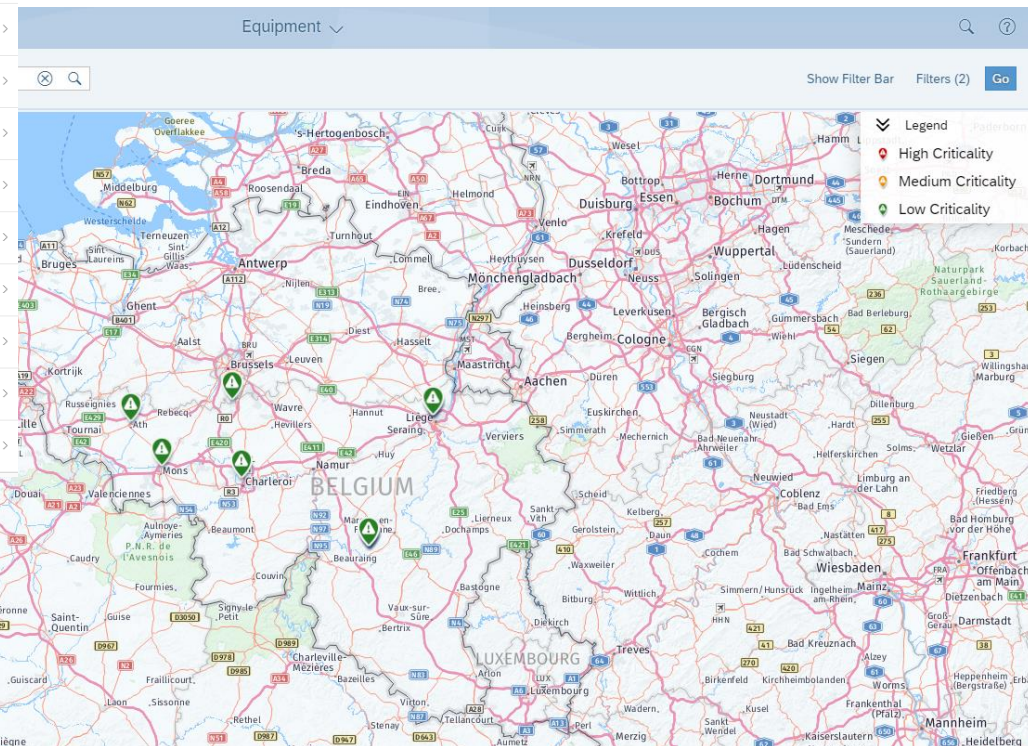
Pending Assessment

Risk and Criticality	0
Questionnaire	0
FMEA	0
Checklist	1
RCM	0

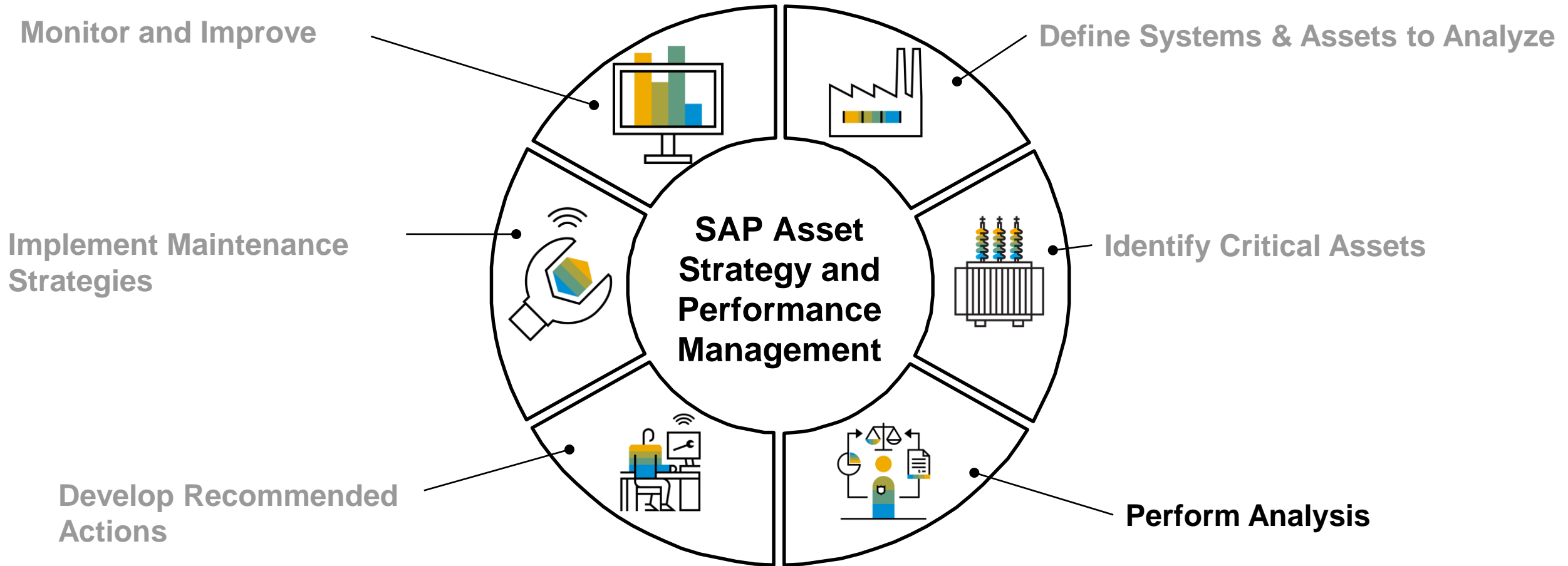
Equipment List

Showing Risk, Criticality and Recommended Action

Equipment	Subclass	Model ID	Manufacturer	Operator	Phase	Criticality	Risk Score	Action
ORES-1000 Magnefix type MF	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Fully Operational	A "High "	1.62	
ORES-11000	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Planned	B "Medium "	650.90	
ORES-5000-somme ORES-5000-somme	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Planned	A "High "	1600.70	
ORES-3000-JEMELLE ORES-3000-JEMELLE	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Planned	A "High "	2701.20	
ORES-6000-LIEGE ORES-6000-LIEGE	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Planned	B "Medium "	350.20	
ORES-7000-WATERLOO ORES-7000-WATERLOO	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Planned	A "High "	2201.20	
ORES-10000-JEMEL ORES-10000-JEMEL	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Planned	A "High "	2201.30	FMEA
ORES-9000-JUMET ORES-9000-JUMET	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Fully Operational	A "High "	1200.80	
ORES-8000-ath ORES-8000-ath	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Fully Operational	C "Low "	100.00	PM review
ORES-4000-JEMELLE ORES-4000-JEMELLE	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Planned	A "High "	1400.70	
ORES-2000 Magnefix type MF	MECHANICAL_SWITC HING_DEVICE	Magnefix-MF	SAP Manufacturer	SAP Operator	Planned	C "Low "	920.30	



SAP Asset Strategy and Performance Management

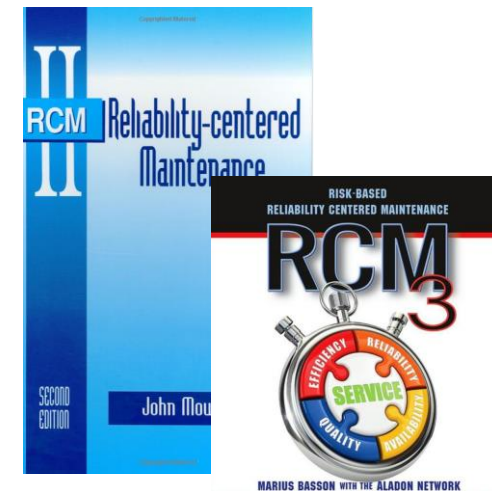
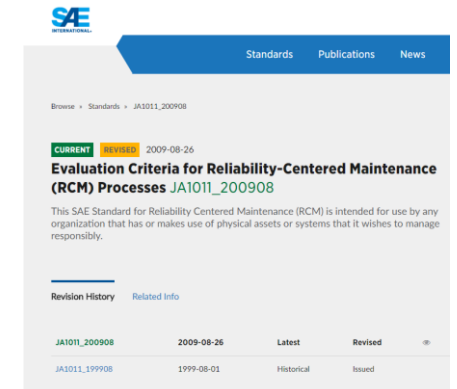


Reliability Centered Maintenance (RCM)

The purpose of the standard SAE JA1011, published in 1999, is to set out the criteria that any process must comply with in order to be called “RCM.” The twelve pages’ document, revised in august 2009, describes the minimum criteria for a process to be considered an RCM-compliant method. The standard provides the criteria to establish if a given process follows the creeds of RCM as originally proposed. It can also serve as a guide for organizations seeking RCM training, facilitation or consulting.

Document SAE JA1011, AUG 2009, establishes that **for a Process be acknowledged as RCM it must follow the seven steps in the order shown below:**

1. What are the functions and associated desired standards of performance of the asset in its present operating context (**functions**)?
2. In what ways can it fail to fulfill its functions (**functional failures**)?
3. What causes each functional failure (**failure modes**)?
4. What happens when each failure occurs (**failure effects**)?
5. In what way does each failure matter (**failure consequences**)?
6. What should be done to predict or prevent each failure (**proactive tasks and task intervals**)?
7. What should be done if a suitable proactive task cannot be found (**default actions**)?



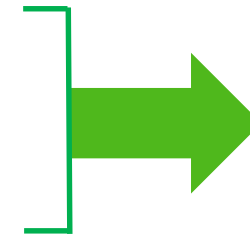
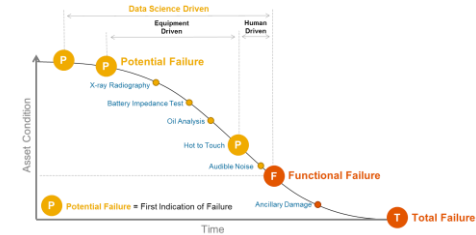
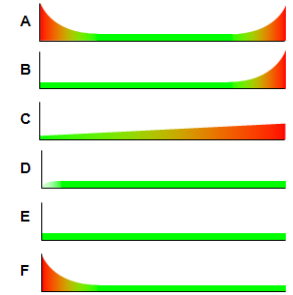
* Reliability Centered Maintenance (RCM) is a process standardized through [SAE JA 1011](#) - SAP ASPM supports asset centric companies to apply this standard and allow partners & customers to enrich and extend complying with more specific RCM processes like [RCM 3™ by the Aladon Network](#)

Reliability Centered Maintenance (RCM*)

7 + 1 Questions

0. Which Assets or Systems do I want to Analyze?
Scope – Switchgear System
1. What are the desired functions and performance in it's operating context?
Functions – Switchgear is used both to de-energize equipment to allow work to be done and to clear faults downstream.
2. In what ways does it fail to fulfil its functions?
Functional Failures – Not tripping when current \geq 80 Amps
3. What causes each functional failure?
Failure Modes – Circuit Breaker Fails to Close
4. What happens when each failure occurs?
Failure Effects – Loss of Power
5. In what way does each failure matter?
Failure Consequences – Network operation impacted
6. What can be done to predict or prevent each failure?
Proactive Tasks & Task Intervals – Yearly inspection to check for water ingress
7. What can be done if the failure cannot be predicted or prevented?
Default Actions – Replace switchgear

Failure Mode Library & Patterns



Result: Recommendations

- Preventive Tasks
 - Corrective Tasks
- = 'Maintenance Strategy'

Reliability Centered Maintenance (RCM): RCM Assessment

Consequence Evaluation is
Decision Diagram

SAP Assessments

RCM for SWITCH-1000 RCM.OPER.26

Status: Published Assessment Template: AT.OPER.153

INFORMATION ASSESSMENT DOCUMENTATION

SWITCH-1000 / De-energize equipment / Not tripping when current >= 80 Amps / Circuit Breaker Fails to Close /

Effects (1) Effect

Loss of Power
EF.OPER.25

ID: EF.OPER.25
Description: Loss of Power

Consequence Evaluation

Can the network still be operated? Yes

Is a replacement possible in the short term? Yes

Is this switchgear part of the 3% to be replaced this year? Yes

Impacts / Sections: Operation
Recommended Mitigation Step: Perform combination of On-Condition/Restoration/Replacement Task
Observations: Add preventive task

Preventive / Corrective Instructions

Preventive Instructions Corrective Instructions Search

Description	Activity	Estimated Cost (Euro)	Estimated Frequency	Risk Reduction (%)	Performed By
Visual inspection I.MANF.13	Inspection	500	12 Time Months	75	Electrician

Observations:

Recommendations
Recommended Task

Decision Diagram (Advanced Check List)

SAP Checklist Template

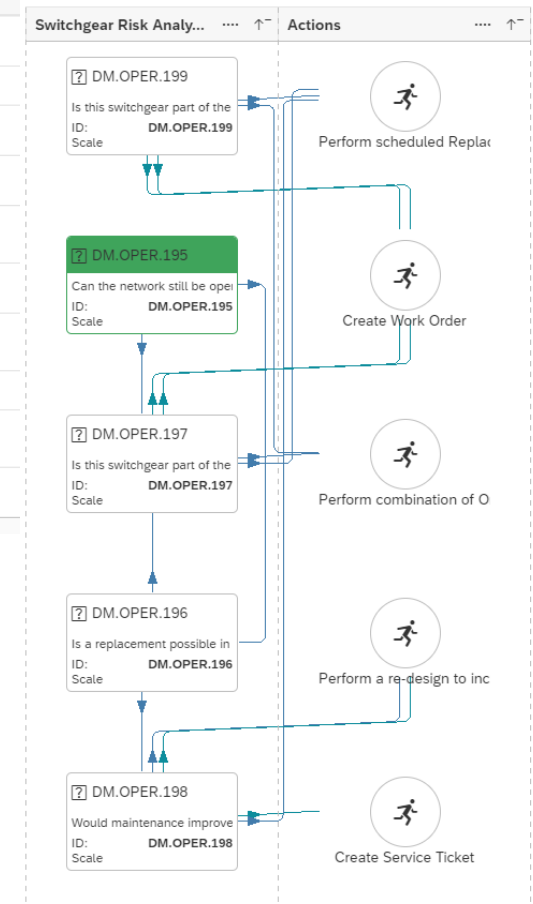
Switchgear Risk Analysis AT.OPER.132 Simulate Manage

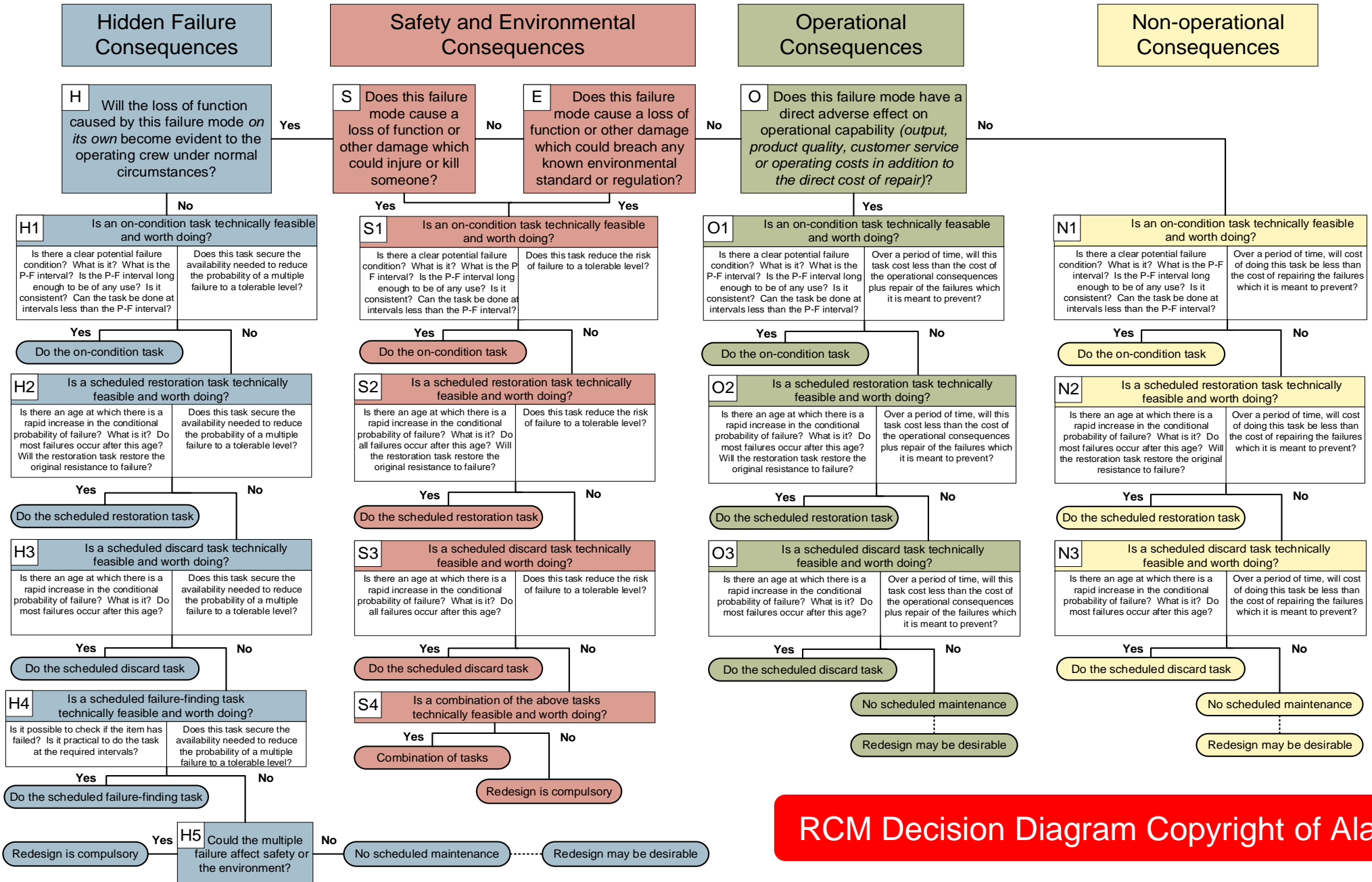
Checklist Type: Advanced [Long Description](#) Status: Published Assignments: Sections: 1 Trigger: DM.OPER.195

INFORMATION ASSIGNMENTS **QUESTIONS** TIMELINE

Switchgear Risk Analysis (5) Search

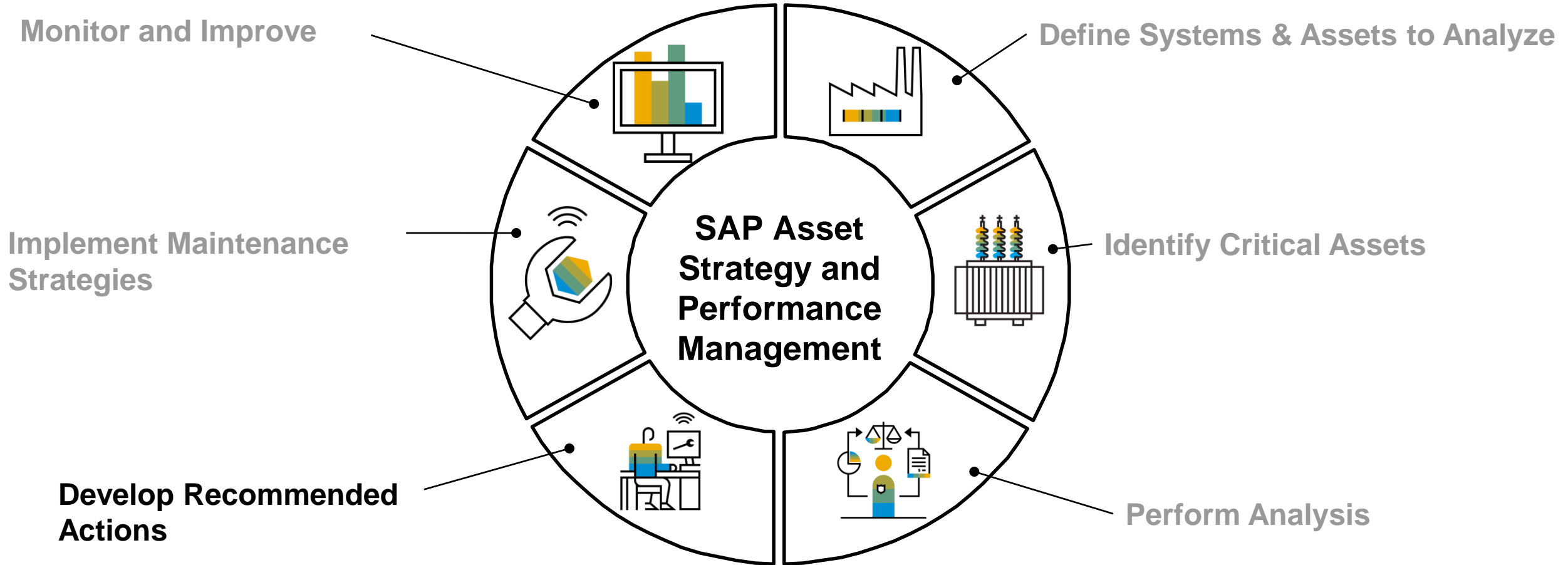
Question	Question Text	Answers	Next Step	Secondary Step
DM.OPER.195	Can the network still be operated?	No	Is this switchgear part of the 3% to be replaced this year?	
		Yes	Is a replacement possible in the short term?	
DM.OPER.196	Is a replacement possible in the short term?	No	Would maintenance improve the durability of the switchgear?	
		Yes	Is this switchgear part of the 3% to be replaced this year?	
DM.OPER.197	Is this switchgear part of the 3% to be replaced this year?	No	Perform scheduled Replacement Task	Create Work Order
		Yes	Perform combination of On-Condition/Restoration/Replacement Task	Create Work Order
DM.OPER.198	Would maintenance improve the durability of the switchgear?	No	Perform a re-design to increase Availability	Create Service Ticket
		Yes	Perform scheduled Replacement Task	Perform a re-design to increase Availability
DM.OPER.199	Is this switchgear part of the 3% to be replaced this year?	No	Perform scheduled Replacement Task	Create Work Order
		Yes	Perform combination of On-Condition/Restoration/Replacement Task	Create Work Order





RCM Decision Diagram Copyright of Aladon LLC

SAP Asset Strategy and Performance Management



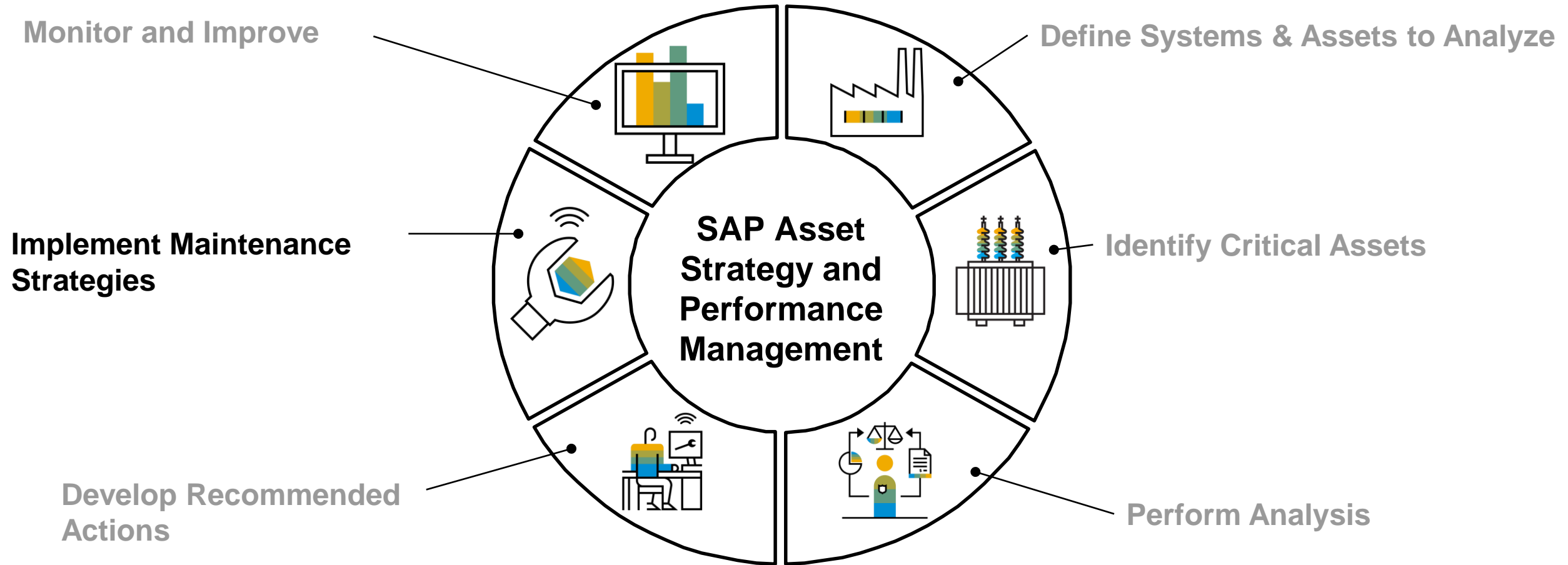
Instructions

Instructions describe how to execute maintenance

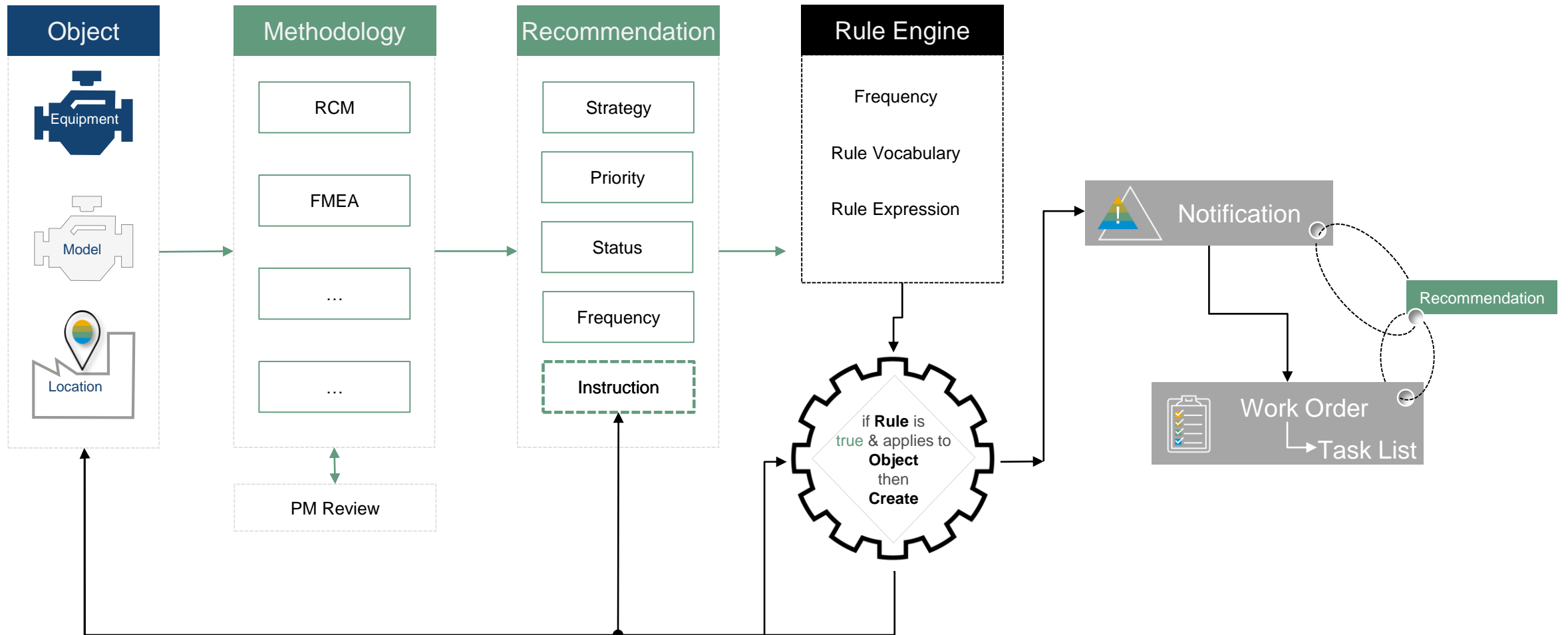
- There are different types of Instructions e.g. Breakdown, Installation, Operations, Planned Maintenance
- Instructions can be assigned to Models, Equipment and Groups
- Failure Modes can only be assigned to Breakdown Instructions.
- You can define the number of steps, duration, criticality, safety rules, tools and required spare parts.
- Additionally you can define preconditions, the steps themselves and post checks.
- You can add different documents. If you added an animated 3D file (.vds) the end user can view the sequences.

The screenshot displays the SAP interface for a 'Planned Maintenance Instruction'. The title is 'Oil Change' and it is marked as 'In Revision'. Key details include: Subclass: Demo subclass, Source: SAP Operator, External IDs, Published On, Instruction Revision: 2, and Instruction ID: I.OPER.16. A summary bar shows: Number of Steps: 3, Expected Duration: 4 Hours, People Required: 1, and Criticality: Moderate. Below this is a navigation menu with tabs for Information, Safety Rules, Tools and Spare Parts, Roles, Models, Equipment, and Groups. The 'Information' tab is active, showing: Activity: Service, Short Description: Oil Change, Failure Mode Category: Unknown, Frequency: 12 Months, Primary Document: 3D Visual: Centrifugal pump parts 6.vds, and Relevant to Warranty: Yes. A 'Long Description' field is also present. At the bottom, there are tabs for 'Preconditions', 'Steps', and 'Post Checks', with 'Steps' selected. A 3D model of a centrifugal pump is visible in a viewer, with a 'Play Step' button and 'Step Descriptions' link below it.

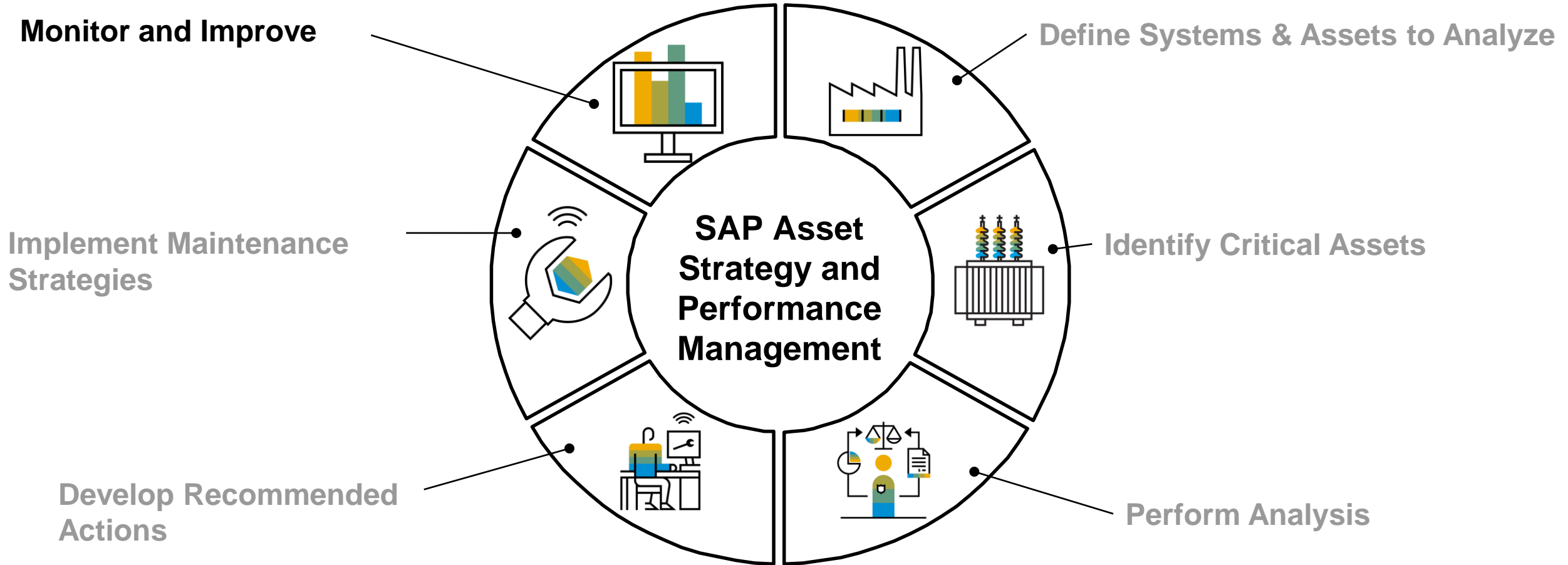
SAP Asset Strategy and Performance Management



Implement RCM/FMEA Recommendations



SAP Asset Strategy and Performance Management





SAP Predictive Maintenance and Service

Advanced analytics to support maintenance execution and strategy decisions

Capability Highlights



Failure Mode Analytics

Utilizes machine learning to generate KPIs around documented failure modes



Fingerprint Management

A visual approach to capturing asset reference states. Used for visual comparison to current operating performance. (i.e., trend analysis)



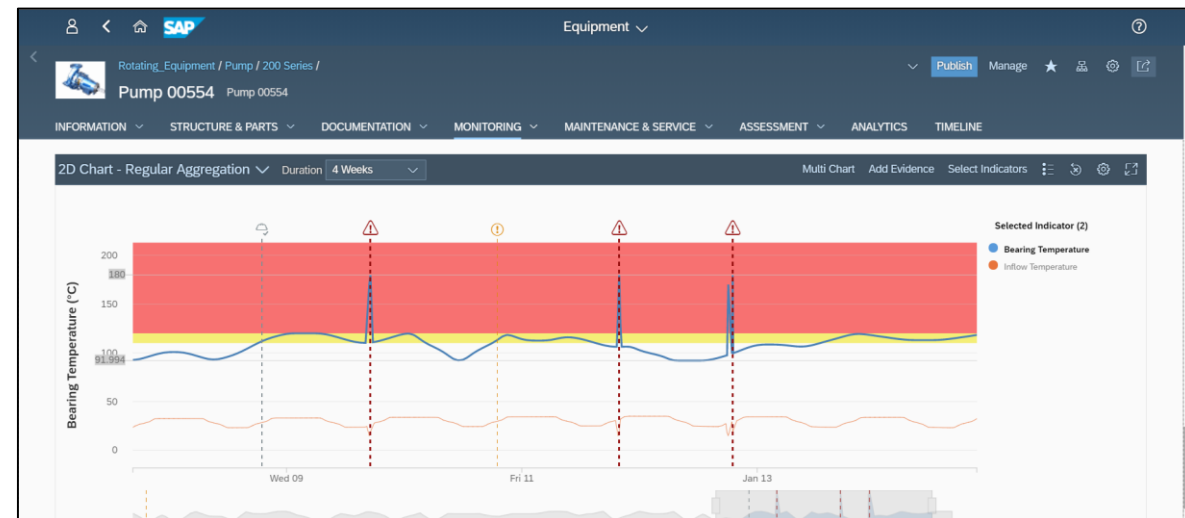
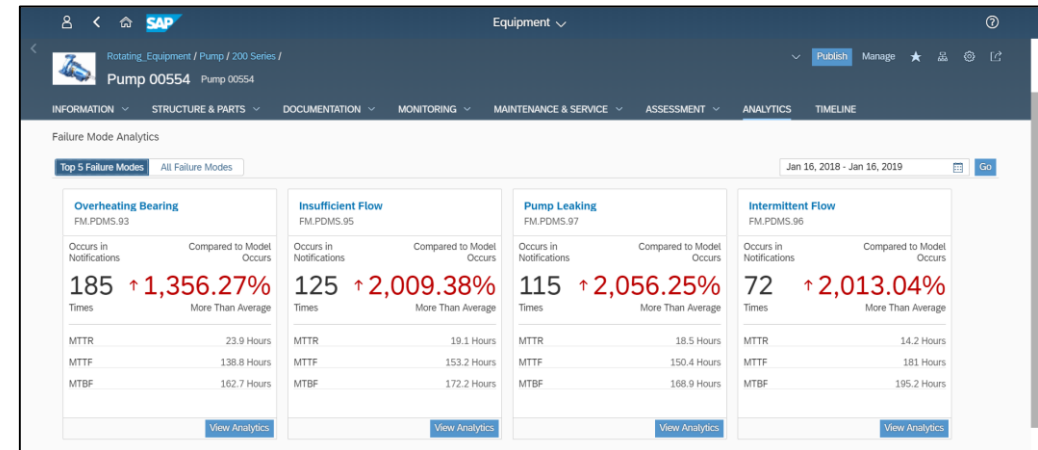
IT/OT Data Fusion Views

Equipment lists and geospatial views combining model data and sensor based health indicators to prioritize maintenance actions and support strategy decisions



Advanced Rule-based Alert Creation

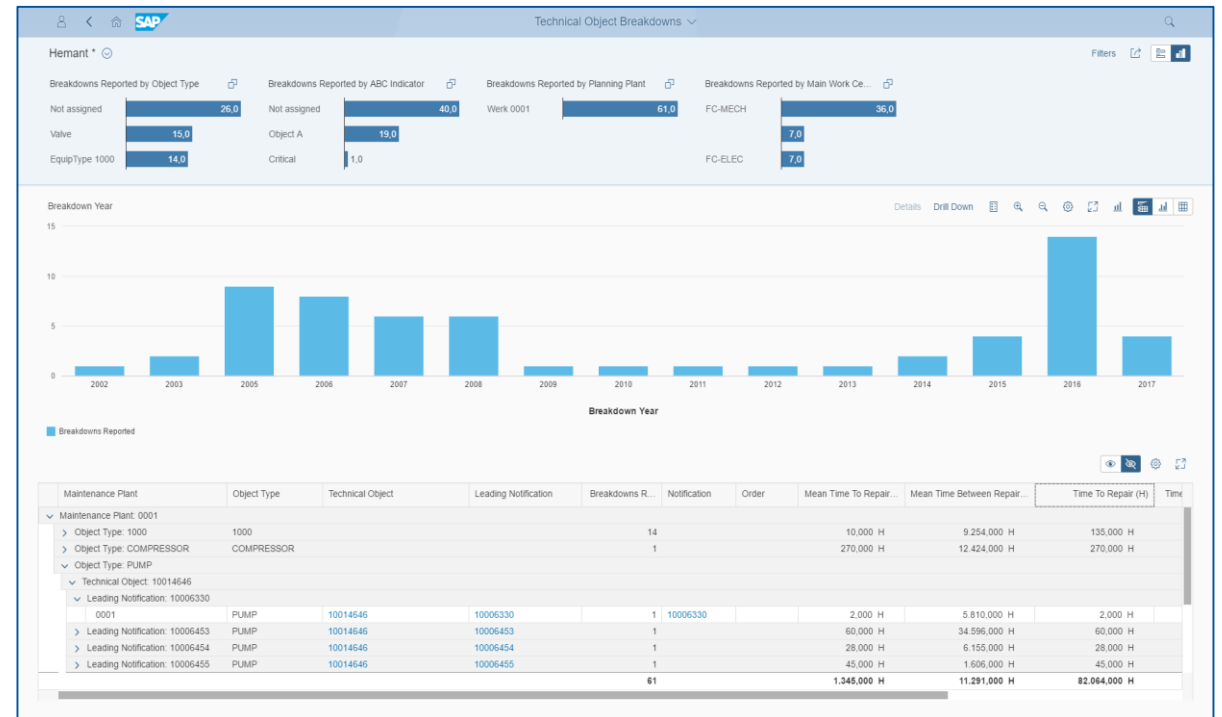
Generate value added alerts for maintenance professionals through an intuitive and flexible rules engine



SAP S/4HANA Maintenance Management

Technical Object Breakdowns

- Analyze Breakdown and its impact on Reliability
- Evaluate effective time to repair and time between repair
- Evaluate Mean and Total time between repair as well time to repair
- Real time evaluation of statistical KPIs without storing aggregates
- identify where the equipment was installed if the breakdown is identified after the equipment was dismantled.
- Identify equipment that fails often or long time to repair
- Identify location where equipment fails quite often
- Compare reliability of the equipment from different manufacturers
- Identify repair frequencies for a type or make of an equipment



SAP S/4HANA Maintenance Management

Damage Analysis

Main KPIs

- Detailed failure mode analysis
- Number of damages recorded, related causes and activities
- Covers all the features covered by MCI5 / IW69

High-level innovation description

For malfunction report and activity reports, it is critical to records parts that were observed as damaged. Number of damages and corresponding causes could help in analyzing reliability of equipment.

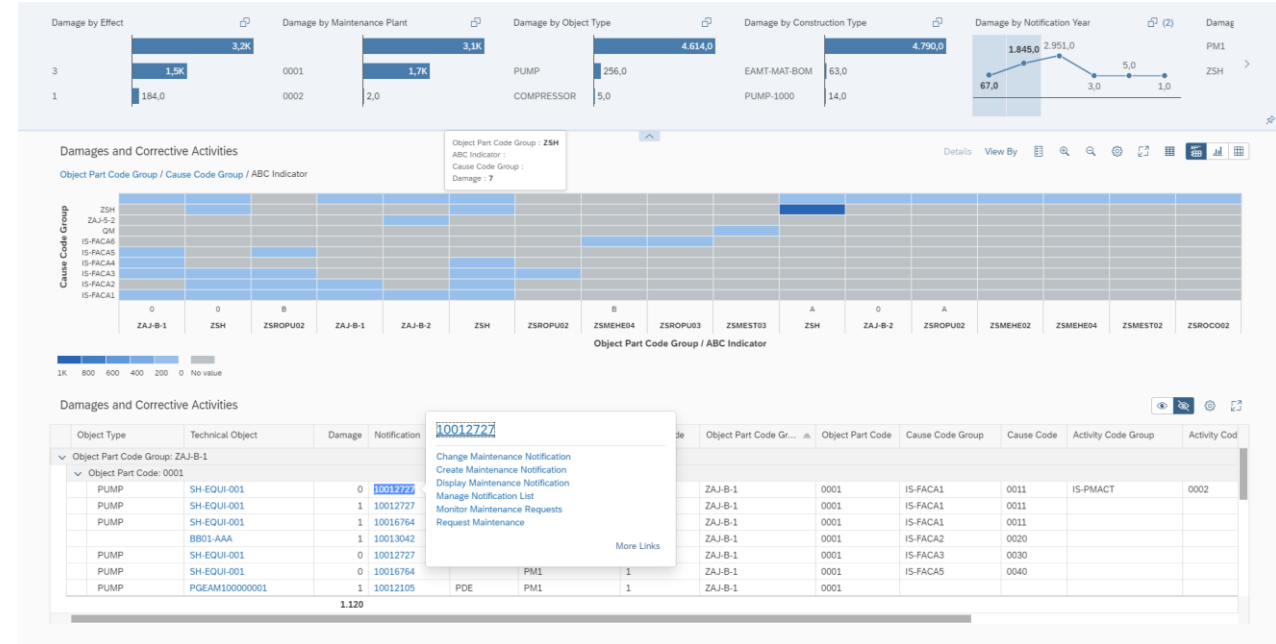
Value Proposition

Increased reliability due to

- Identify failure modes of an equipment
- Identify parts that gets damaged and activities that are needed to repair or replace them
- Identifying main causes observed by technicians and plan preventive or inspections activities to avoid future unplanned breakdown.
- Identify parts that are over maintained and remove them from preventive activities.

Capabilities

- Analyze frequent offenders that create reliability issues for an equipment
- Identify relation between Failure mode, damages, causes and effect it has on operation of asset



Improvements over PMIS

- Calculation and aggregation is in real time with transactional data and not stored in S-structure.
- KPIs can be aggregated at equipment type, manufacturer, model or any other critical attributes.
- Much easy navigation that lets user drill down to notification or order and get better visibility for historical failures.

SAP S/4HANA Cloud for Asset Management

Actual Cost Analysis

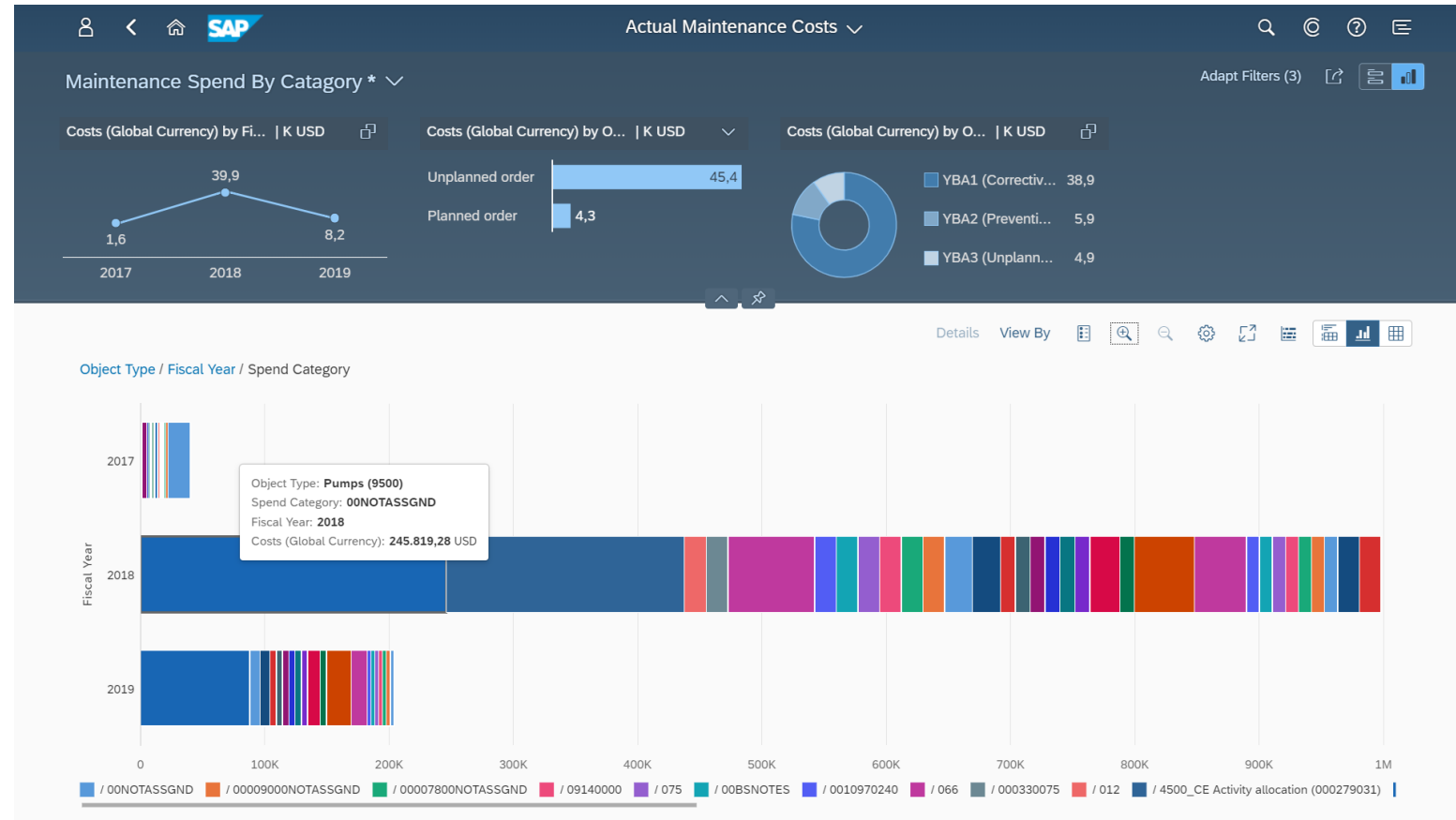
The SAP Fiori app *Actual Cost Analysis* supports the *Maintenance Planner* in monitoring and evaluating actual costs resulting from current maintenance orders.

Value Proposition

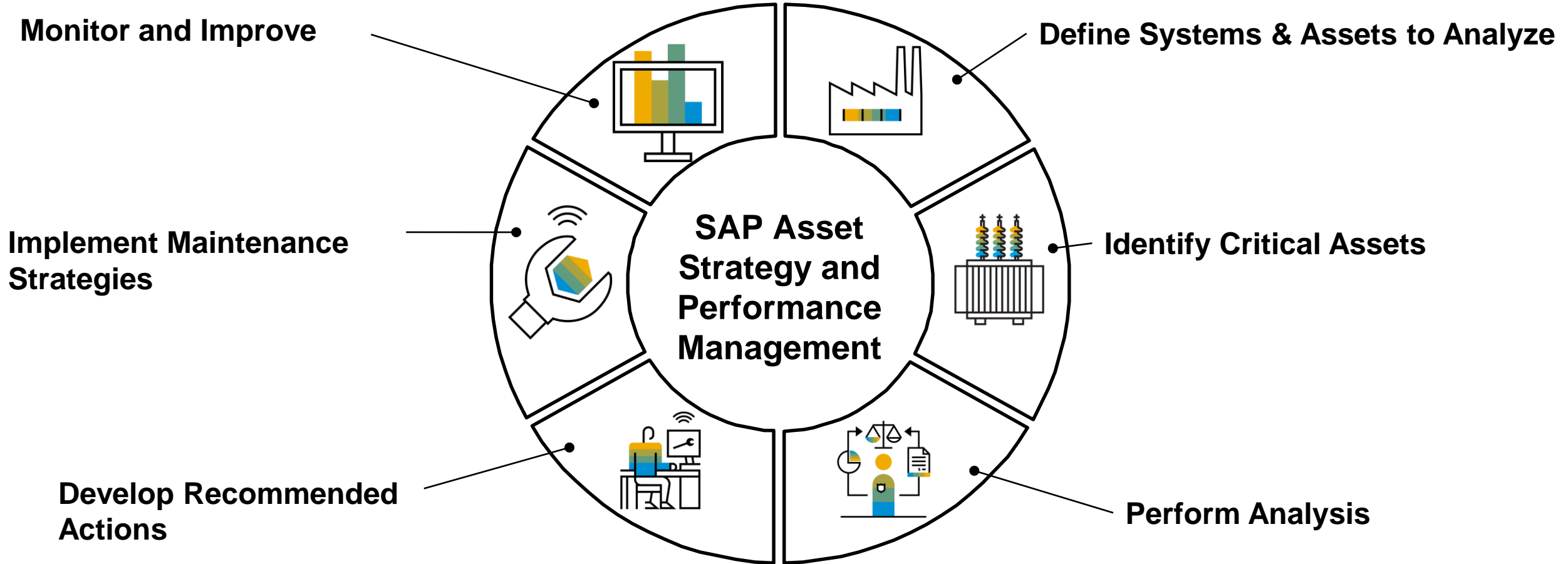
- Easily identify the maintenance activities leading to the highest costs or parts of the asset that were particularly costly on inspections
- Evaluate actual maintenance costs stored in the Universal Journal Entry
- Seamless navigation within one page that combines transactional and analytical data using chart and table visualization

Capabilities

- Analyze the actual costs for materials and labor in maintenance
- Compare the total maintenance cost for unplanned, corrective and preventive maintenance activities
- Filters allow you to analyze critical costs in a fiscal year from different perspectives, such as the order type, the construction type, the location, the planner group or the manufacturer



Summary



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Presentation Materials

Access the slides from 2019 ASUG Annual Conference here:

<http://info.asug.com/2019-ac-slides>

Q&A

For questions after this session, contact me at dean.fitt@sap.com

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