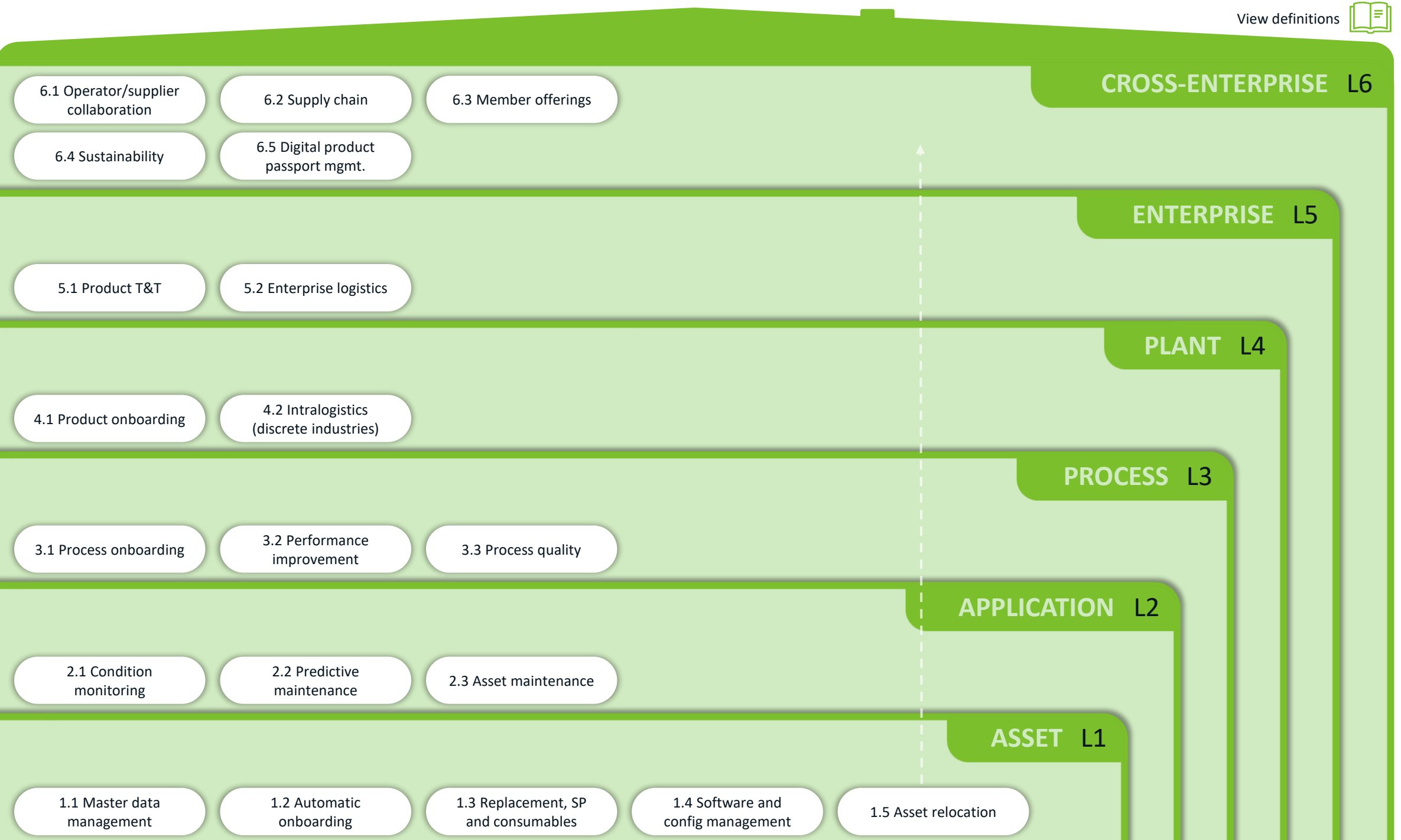
View definitions



L1

ASSET

Definition

An asset is the lowest entity relevant for maintenance of the operator. It can also be a maintenance relevant component that can be ordered (e.g., an actuator, a sensor, a pump – in most cases a screw is not relevant).

1.1 Master data management

Challenge: Master data is often a grown structure. It often lacks standardization and provide application specific data models which prevent fast and efficient implementation of Industry 4.0 use cases. Fast and efficient data sharing along the supply chain missing.

Description: The objective of master data management is to ensure the uniformity, accuracy, stewardship, semantic consistency and accountability of the enterprise's official shared master data assets for I4.0 use cases.

Roles/personas: asset managers of the operator and service manager of the manufacturers

Target group: manufacturer, operator and external service provider

Benefits & value: reduce systematic errors, reduce efforts of manual data management, increase access speed and details of master data, improve quality of master data in other processes (e.g., maintenance)

Supporting content:

Legend

Mandatory

Optional

CLOSE

Asset manager

Manufacturer

Add/update/retrieve/remove plant specific information for assets (connected and non-connected)

Add/update authorization & data exchange concept for assets

Adds/updates published to cloud central, direct entry or via AAS

Asset Twin (administrated by AAS)

Systems (e.g., master data, maintenance mgmt., MES)

L1

ASSET

Definition

An asset is the lowest entity relevant for maintenance of the operator. It can also be a maintenance relevant component that can be ordered (e.g., an actuator, a sensor, a pump – in most cases a screw is not relevant).

1.2 Automatic onboarding

Challenge: Onboarding of new assets causes efforts and often comes with errors as information needs to be gathered and maintained manually.

Description: The objective of the asset onboarding process is to provide a standardized procedure to onboard new assets to the OI4 edge and operator cloud. The goal is that physically connected assets are detected and asset identification will be updated automatically and related data according to the process manually or automatically as applicable.

Roles/personas: plant managers, technicians, maintenance managers and manufacturer

Target group: plant operators, manufacturers

Benefits & value: reduce systematic errors, reduce manual information search, increase access speed and ease of asset onboarding

Supporting content:

Legend

Mandatory

Optional

Information flow

CLOSE

Machine/plant

Physically connect new asset

Connected assets are detected

OI4 Identifier(s) created or updated in edge / operator cloud / cloud central

Asset manager

Manually identify assets & create OI4 Identifier(s) in edge/operator cloud or cloud central

Add/update/retrieve plant specific information for assets (connected and non-connected)

Define authorization & data exchange concepts for assets

Manufacturer

Initial upload of OI4 Identifier(s) to cloud central

On demand update of detailed asset information to cloud central

Updates published to cloud central

Asset Twin (administrated by AAS)

Systems (e.g., master data, IoT (operator cloud, edge), maintenance mgmt., MES)

L1

ASSET

Definition

An asset is the lowest entity relevant for maintenance of the operator. It can also be a maintenance relevant component that can be ordered (e.g., an actuator, a sensor, a pump – in most cases a screw is not relevant).

1.3 Replacement, spare parts and consumables

Challenge: Inefficient replacement of spare parts can lead to extensive downtimes in production. Preserving a large-scale stock of spare parts is cost intensive and requires warehousing.

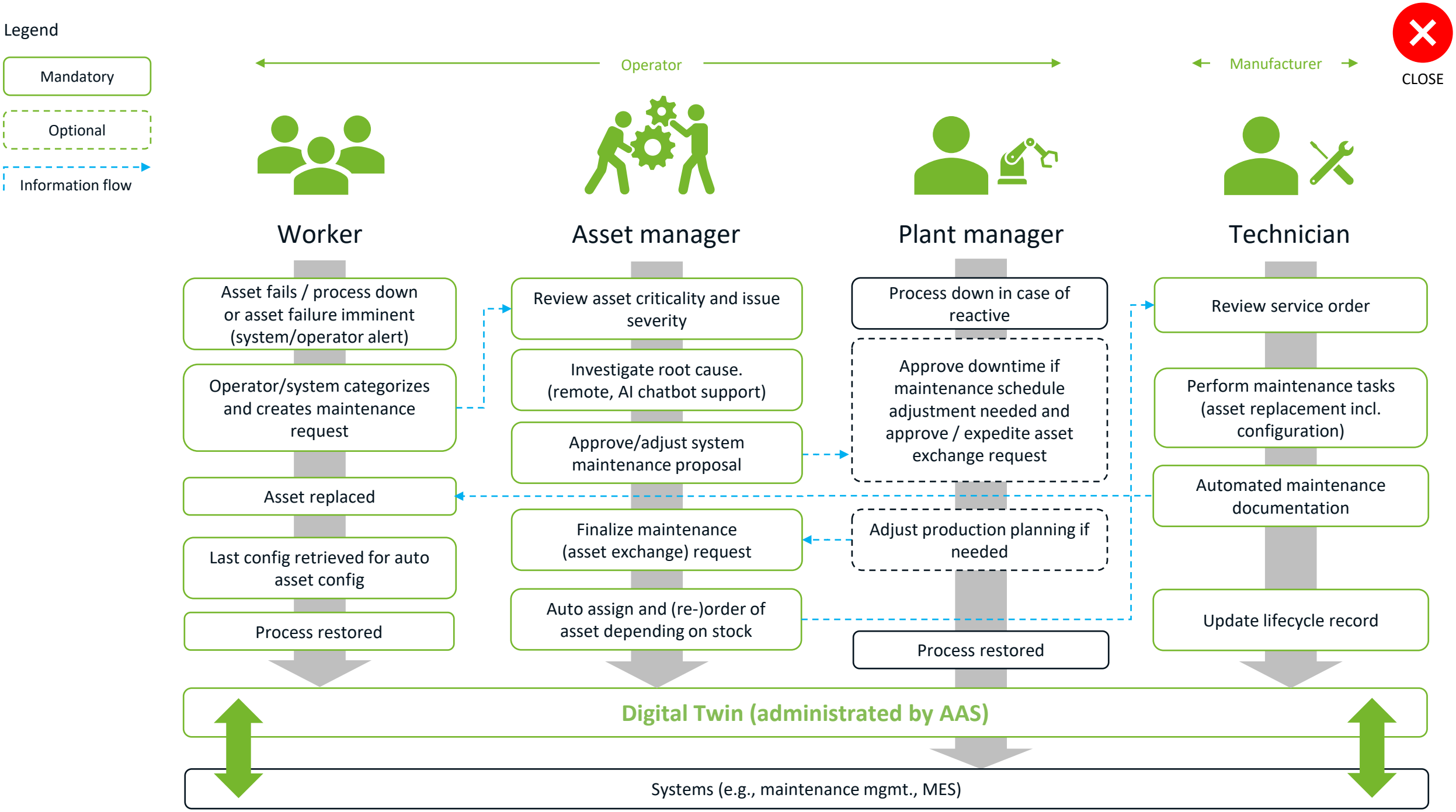
Description: Spare parts management (SPM) is used by companies to ensure that the right spare part is at the right place at the right time. Replacement of spare parts can be planned reactive or proactive. The scope of SPM therefore includes all functions from the supplier through to the point of use: identification and coding, criticality classification, procurement, quality inspection, stocking policies, links to work planning, supplier management and internal performance.

Roles/personas: workers, asset/ maintenance managers, plant managers, technicians (operator or manufacturer)

Target group: plant operators, manufacturers

Benefits & value: reduce downtime, reduce systematic errors, reduce problem identification and resolution time/effort (MTTR), simplify stock management

Supporting content:


Legend
Mandatory
Optional
Information flow
Operator
Manufacturer
CLOSE
Worker
Asset manager
Plant manager
Technician
Asset fails / process down or asset failure imminent (system/operator alert)
Operator/system categorizes and creates maintenance request
Asset replaced
Last config retrieved for auto asset config
Process restored
Review asset criticality and issue severity
Investigate root cause. (remote, AI chatbot support)
Approve/adjust system maintenance proposal
Finalize maintenance (asset exchange) request
Auto assign and (re-)order of asset depending on stock
Process down in case of reactive
Approve downtime if maintenance schedule adjustment needed and approve / expedite asset exchange request
Adjust production planning if needed
Process restored
Review service order
Perform maintenance tasks (asset replacement incl. configuration)
Automated maintenance documentation
Update lifecycle record
Digital Twin (administrated by AAS)
Systems (e.g., maintenance mgmt., MES)

L1

ASSET

Definition

An asset is the lowest entity relevant for maintenance of the operator. It can also be a maintenance relevant component that can be ordered (e.g., an actuator, a sensor, a pump – in most cases a screw is not relevant).

1.4 Software and config management

Challenge: It often requires extensive efforts to manage and update changes to software and firmware. The replacement of an asset and reconfiguration are often time consuming and costly. The topic is complex as changes usually affect multiple interfaces.

Description: The goal is to ensure that software configurations are properly identified, tracked, updated and controlled throughout their lifecycle. Key aspects are version control, merging of code, audit trail of changes, deployment and release management as well as configuration consistency of distributed systems.

Roles/personas: asset/maintenance manager, service manager (manufacturer)

Target group: manufacturers and operators

Benefits & value: improve asset and process performance due to software robustness, improve visibility and control over an asset's configuration/firmware & software, reduce systematic errors, reduce effort for asset maintenance

Supporting content:

Legend

Mandatory

Optional

Information flow

CLOSE

Machine/plant

Asset manager

Manufacturer

New asset successfully onboarded

Initial/periodic *update request

Asset *updated as per approved maintenance schedule

If changed, save latest configuration

*Defaults defined for each asset (batch/templates)

Review changes & resolve potential conflicts

Asset authorization & data exchange rules determine if manual approval needed

Change asset configuration

Publish recommended default configuration for each asset type

Publish update software feature

Publish new firmware

Digital Twin (administrated by AAS)

Systems (e.g. Maintenance Mgmt, Parameter Database, MES)

L1

ASSET

Definition

An asset is the lowest entity relevant for maintenance of the operator. It can also be a maintenance relevant component that can be ordered (e.g., an actuator, a sensor, a pump – in most cases a screw is not relevant).

1.5 Asset relocation

Challenge: Asset relocation comes with issues such as disruption of operations (downtimes), costs (e.g., transportation, packaging, labor, or potential equipment modifications), coordination (mainly logistics), risk of damage or loss, regulatory compliance (e.g., specific permits or license management) and communication. Depending on the organizational level, asset relocation requires different process and legal functions, which are often covered in different data silos.

Description: Asset relocation refers to the process of moving physical assets, such as equipment, machinery, or inventory, from one location to another. According to the OI4 Process House the use case “asset relocation” occurs on every single level as assets can be transferred within a company's premises, between different sites or across enterprises.

Roles/personas: plant managers, technicians, maintenance managers

Target group: operators and manufacturers

Benefits & value: Asset relocation can be a complex task, but it can help businesses streamline their operations, improve efficiency, and adapt to needs changing. Mastering the efforts of asset relocation can positively affect business flexibility and improve productivity.

L2

APPLICATION

Definition

An application is an aggregation of assets which you monitor and control. This is typically a module or a machine.

2.1 Condition monitoring

Challenge: Unplanned production downtimes and high maintenance costs.

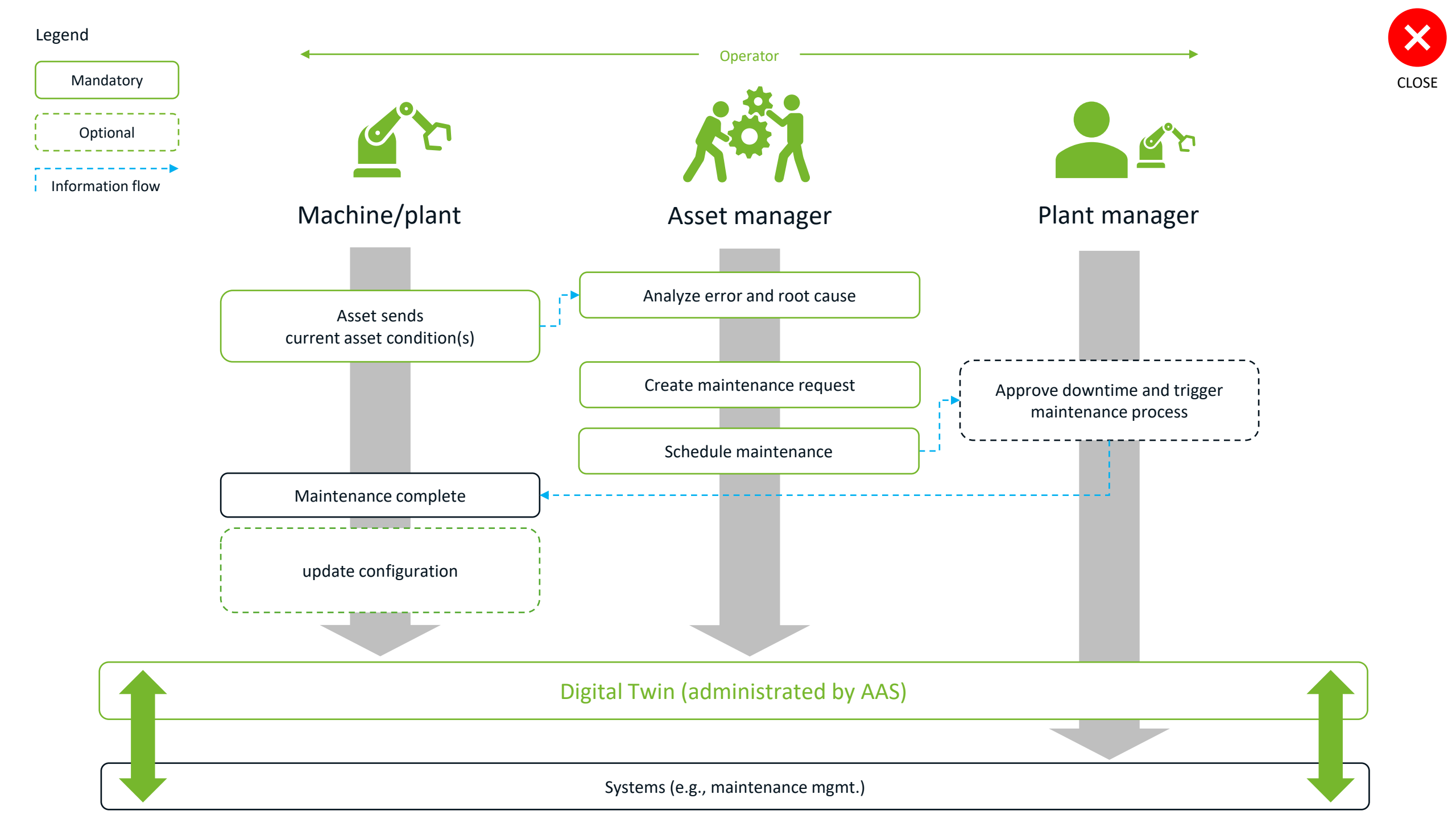
Description: Condition monitoring is one of the most known I4.0 use cases. The main objective of condition monitoring is to diagnose and prognose faults in your machines, equipment, or systems. Fault diagnosis is the process of identifying the type, location, and severity of a fault based on the data analysis results. It is closely related and sometimes overlapping with common (predictive) maintenance use cases.

Roles/personas: asset/maintenance manager, plant manager, technician (manufacturer)

Target group: operators and manufacturers

Benefits & value: reduce downtime, extend asset lifetime, reduce systematic errors, reduce problem identification and resolution (MTTR) time/effort, simplify stock management and reduce stock

Supporting content:


Legend
Mandatory
Optional
Information flow
Operator
CLOSE
Machine/plant
Asset manager
Plant manager
Asset sends
current asset condition(s)
Analyze error and root cause
Create maintenance request
Schedule maintenance
Approve downtime and trigger
maintenance process
Maintenance complete
update configuration
Digital Twin (administrated by AAS)
Systems (e.g., maintenance mgmt.)

L2

APPLICATION

Definition

An application is an aggregation of assets which you monitor and control. This is typically a module or a machine.

2.2 Predictive maintenance

Challenge: Unplanned downtimes result in high costs for maintenance.

Description: Predictive maintenance is probably the most famous I4.0 use case. It as a proactive maintenance strategy that uses data analysis, machine learning algorithms, and other advanced technologies to predict equipment failures before they occur. To unlock the potential, you need to collect and analyze equipment data to identify patterns and anomalies that could indicate potential problems.

Roles/personas: plant managers, asset- and maintenance managers

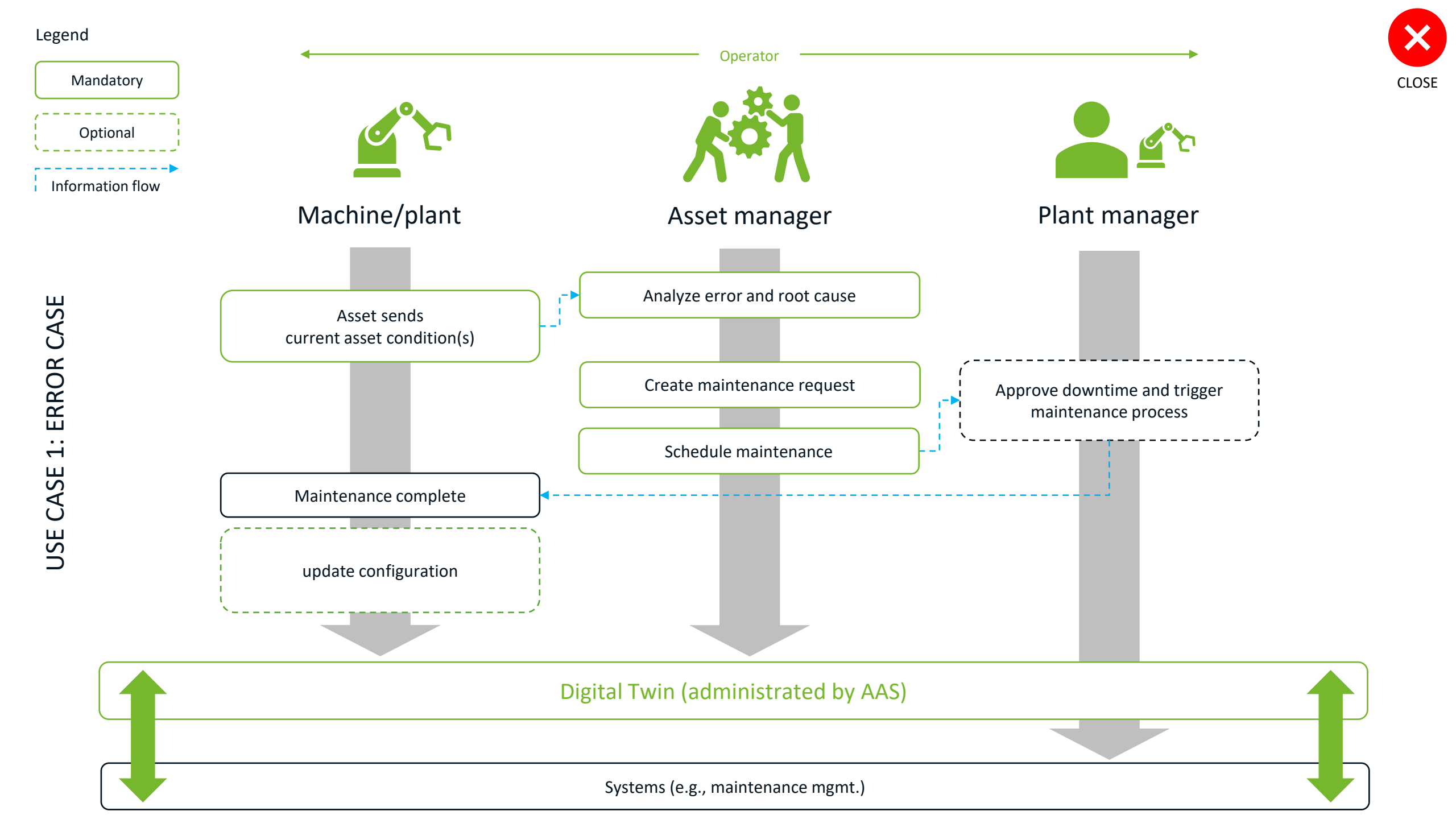
Target group: operators

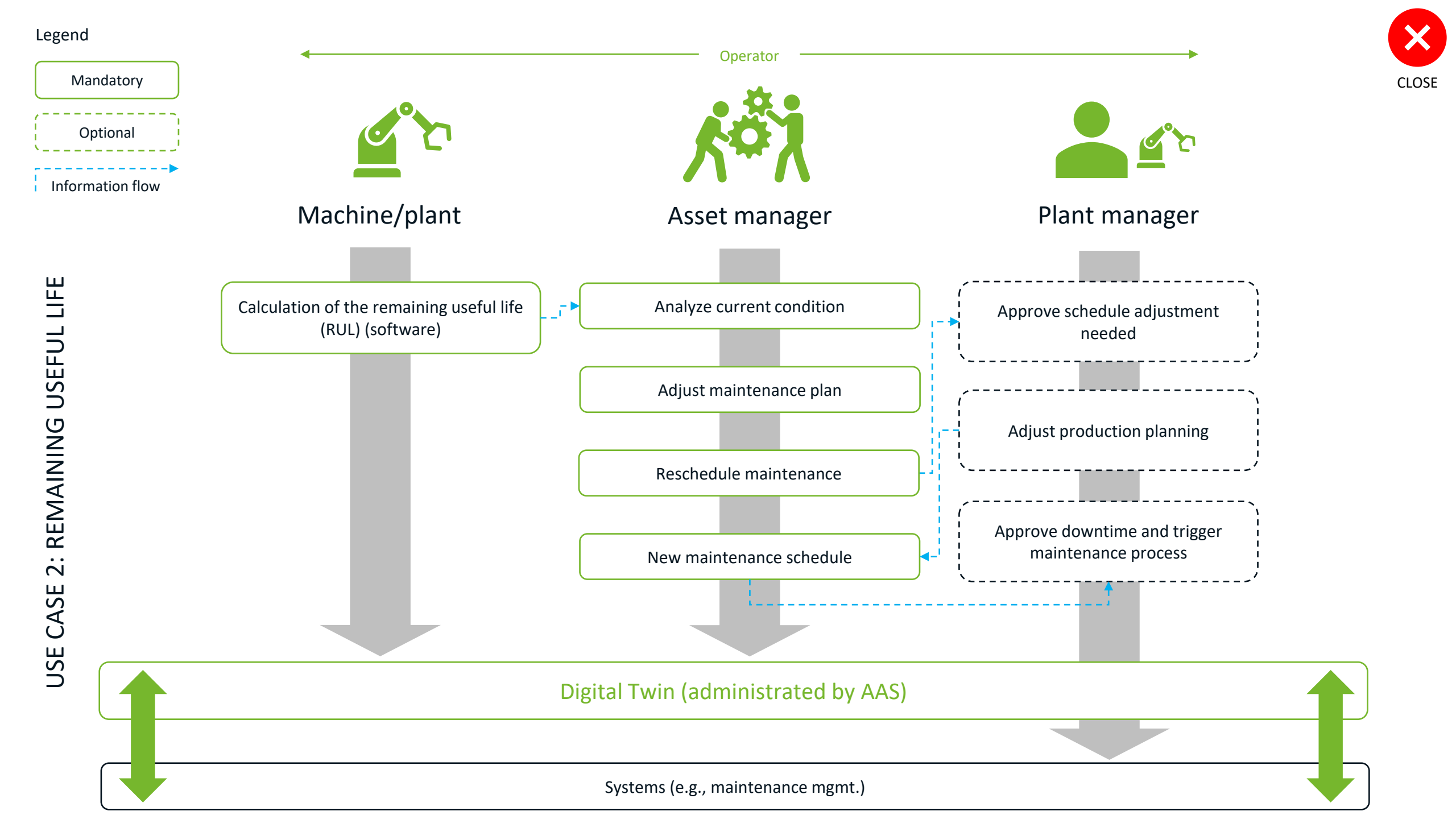
Benefits & value: Reduce potential for downtime, extend asset lifetime, reduce systematic errors, reduce problem identification and resolution (MTTR) time/effort, simplify stock management

Supporting content:


use case 1


use case 2


Legend
Mandatory
Optional
Information flow
Operator
CLOSE
Machine/plant
Asset manager
Plant manager
USE CASE 1: ERROR CASE
Asset sends
current asset condition(s)
Analyze error and root cause
Create maintenance request
Schedule maintenance
Approve downtime and trigger
maintenance process
Maintenance complete
update configuration
Digital Twin (administrated by AAS)
Systems (e.g., maintenance mgmt.)


Legend
Mandatory
Optional
Information flow
Operator
CLOSE
Machine/plant
Asset manager
Plant manager
USE CASE 2: REMAINING USEFUL LIFE
Calculation of the remaining useful life (RUL) (software)
Analyze current condition
Adjust maintenance plan
Reschedule maintenance
New maintenance schedule
Approve schedule adjustment needed
Adjust production planning
Approve downtime and trigger maintenance process
Digital Twin (administrated by AAS)
Systems (e.g., maintenance mgmt.)

L2

APPLICATION

Definition

An application is an aggregation of assets which you monitor and control. This is typically a module or a machine.

2.3 Asset maintenance

Challenge: High efforts and costs to keep physical assets in good working condition (such as equipment, machinery, and buildings).

Description: Asset maintenance can include tasks such as routine inspections, cleaning, lubrication, and minor repairs. Internal maintenance can provide greater control over maintenance schedules and quality. External maintenance, on the other hand, refers to maintenance activities that are carried out by manufacturer and/or external service providers, such as specialized maintenance contractors or vendors. External maintenance can provide access to specialized expertise, equipment, and technology.

Roles/personas: plant managers, technicians, asset- and maintenance managers

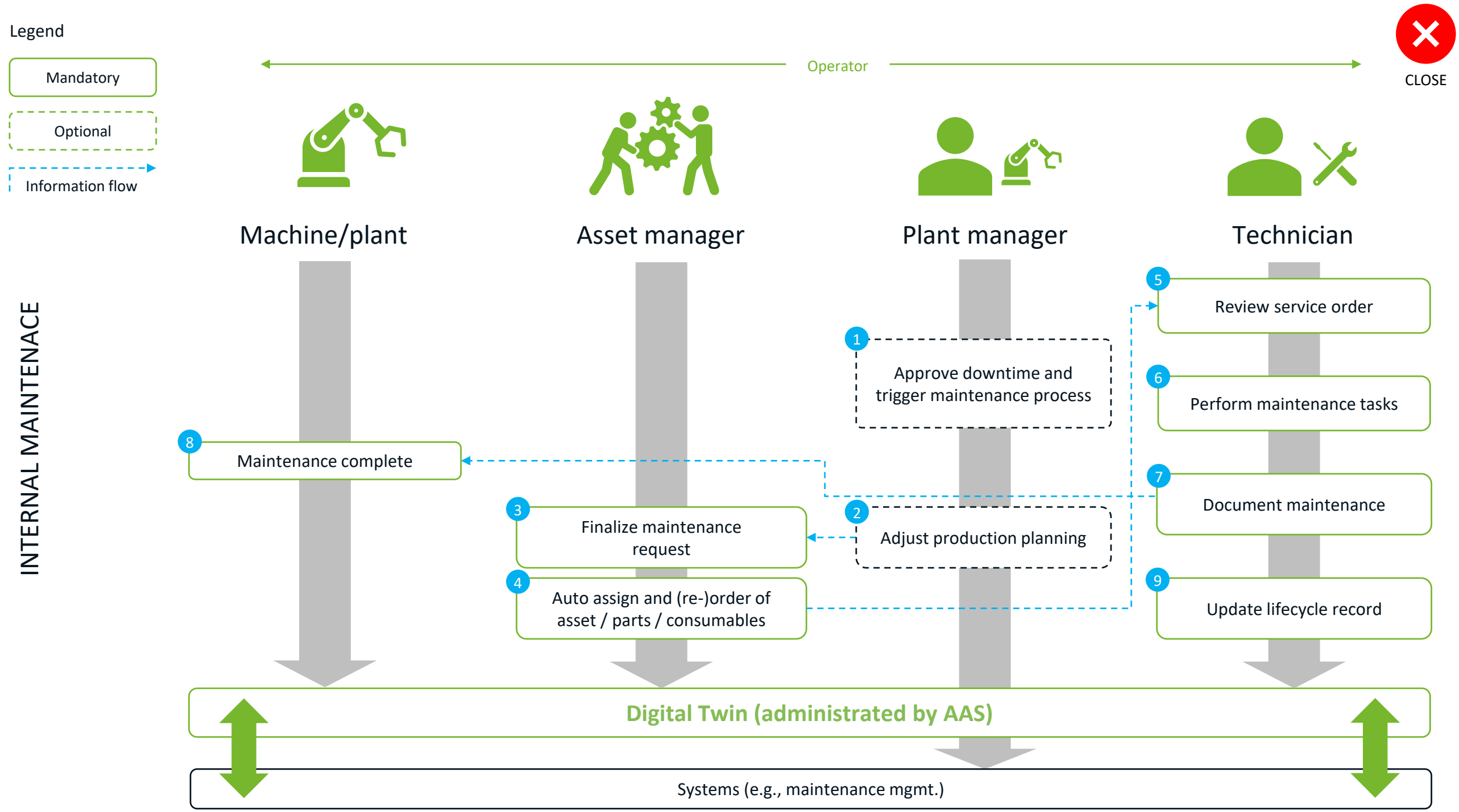
Target group: plant operator, manufacturer

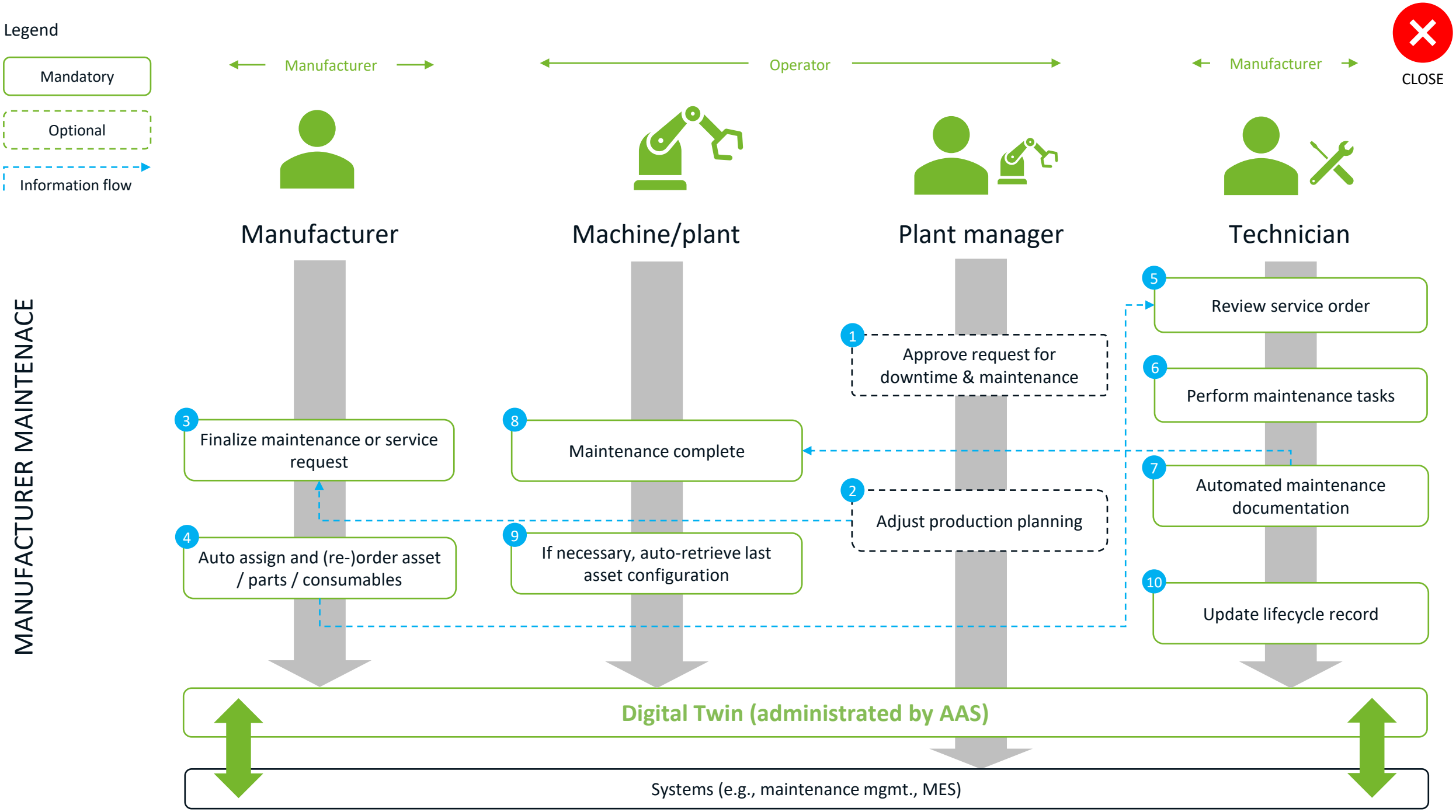
Benefits & value: reduce potential for downtime, extend asset lifetime, reduce systematic errors, reduce problem identification and resolution (MTTR) time/effort, simplify stock management

Supporting content:

internal maintenance

manufacturer maintenance


Legend
Mandatory
Optional
Information flow
Operator
CLOSE
Machine/plant
Asset manager
Plant manager
Technician
INTERNAL MAINTENACE
1
Approve downtime and trigger maintenance process
2
Adjust production planning
3
Finalize maintenance request
4
Auto assign and (re-)order of asset / parts / consumables
5
Review service order
6
Perform maintenance tasks
7
Document maintenance
8
Maintenance complete
9
Update lifecycle record
Digital Twin (administrated by AAS)
Systems (e.g., maintenance mgmt.)


Legend
Mandatory
Optional
Information flow
Manufacturer
Operator
Manufacturer
CLOSE
Manufacturer
Machine/plant
Plant manager
Technician
MANUFACTURER MAINTENACE
1
Approve request for downtime & maintenance
2
Adjust production planning
3
Finalize maintenance or service request
4
Auto assign and (re-)order asset / parts / consumables
5
Review service order
6
Perform maintenance tasks
7
Automated maintenance documentation
8
Maintenance complete
9
If necessary, auto-retrieve last asset configuration
10
Update lifecycle record
Digital Twin (administrated by AAS)
Systems (e.g., maintenance mgmt., MES)

L3

ASSET

Definition

An asset is the lowest entity relevant for maintenance of the operator. It can also be a maintenance relevant component that can be ordered (e.g., an actuator, a sensor, a pump – in most cases a screw is not relevant).

3.1 Process onboarding

Challenge: *work in progress*

Description: *work in progress*

Roles/personas: *work in progress*

Target group: *work in progress*

Benefits & value: *work in progress*

Supporting content: *work in progress*

L3

ASSET

Definition

An asset is the lowest entity relevant for maintenance of the operator. It can also be a maintenance relevant component that can be ordered (e.g., an actuator, a sensor, a pump – in most cases a screw is not relevant).

3.2 Performance improvement

Challenge: *work in progress*

Description: *work in progress*

Roles/personas: *work in progress*

Target group: *work in progress*

Benefits & value: *work in progress*

Supporting content: *work in progress*

L3

ASSET

Definition

An asset is the lowest entity relevant for maintenance of the operator. It can also be a maintenance relevant component that can be ordered (e.g., an actuator, a sensor, a pump – in most cases a screw is not relevant).

3.3 Process quality

Challenge: Managing complexity, resource allocation, and adapting to evolving customer expectations and technology. Consistency across locations, risk mitigation, and effective technology integration are crucial aspects for success.

Description: Process quality refers to the degree to which a process consistently produces outputs that meet or exceed customer requirements and expectations. Process requirements must be defined based on customer needs and expectations. This includes identifying process inputs, outputs, critical parameters, and acceptance criteria.

Roles/personas: process experts, plant manager, operator

Target group: technician, operator, worker

Benefits & value: reduce potential for downtime, extend asset lifetime, reduce systematic errors, reduce problem identification and resolution (MTTR) time/effort, simplify stock management

L4

PLANT

Definition

A plant comprises the process industry and the factory in the discrete industry. A plant (factory) is a facility used for production or processing of goods. There can be multiple plants per production site.

4.1 Product onboarding

Challenge: Requires digital product documentation and internally a central product data base. Today the product data is distributed in several silos and therefore the challenge of creating a digital product twin and services based on that data.

Description: Product onboarding refers to the processes to create the seamless digital product twin across the whole value chain from research & development to aftermarket & service. The product type is started in the research & development process and maintained across the whole lifecycle. The following processes vary between process and discrete industries. In the discrete industries the product instance is created now of serialization in production (like a birth certificate) and maintained across the lifecycle. In process industries typically batches are used, and the batch number is created in the beginning of the production process.

Roles/personas: developers, product managers, production- and service employees

Target group: discrete and process industries

Benefits & value: increase data quality, improve process quality (e.g., lower return and complaint rate), pre-requisite for other use cases

L4

PLANT

Definition

A plant comprises the process industry and the factory in the discrete industry. A plant (factory) is a facility used for production or processing of goods. There can be multiple plants per production site.

4.2 Intralogistics (discrete industries)

Challenge: Internal material movement and flow can cause delays. Expansive warehousing to manage inventory, order picking, packing, and shipping can be a side effect of intralogistics issues.

Description: Intralogistics refers to the internal logistics within a company or organization, including the planning, implementation, and control of the flow of materials, products, and information from the point of origin to the point of consumption. It involves the efficient movement, storage, and handling of materials and products within a facility or warehouse, as well as the coordination of transportation and logistics activities.

Roles/personas: factory (production- and purchase manager, machine operator), warehouse/parts center (PC manager, worker), vendor (supplier)

Target group: discrete industries

Benefits & value: Optimized flows of materials and products within a facility require the use of software and technology to manage, track and coordinate logistics activities. Efficient and effective management of intralogistics activities will pay off due to higher material throughput and smaller footprint.

Supporting content:


list of actions


supply route

Underlaying layers

- 4.2.1 Large parts management
- 4.2.2 Small parts management
- 4.2.3 Non-conformity management

CLOSE

WAREHOUSE/ PARTS CENTER

PC manager

Actions:
Confirm parts in inventory
Manage inventory levels
Coordinate with suppliers

Worker

Actions:
Unpack and receive material
Prepare parts for each manufacturer line
Inspect and register outgoing parts
Pick large parts
Place empty pallets
Place empty containers

FACTORY

Production manager

Actions:
Change of specifications
Change of schedule
Production schedule
Material return
Material request

Purchase manager

Actions:
Purchase orders
Supplier coordination
Procurement schedule

Machine operator

Actions:
Pick large material from stock
Pick small material from sideline
Inspect quality of materials
Non-conformity reports

Worker

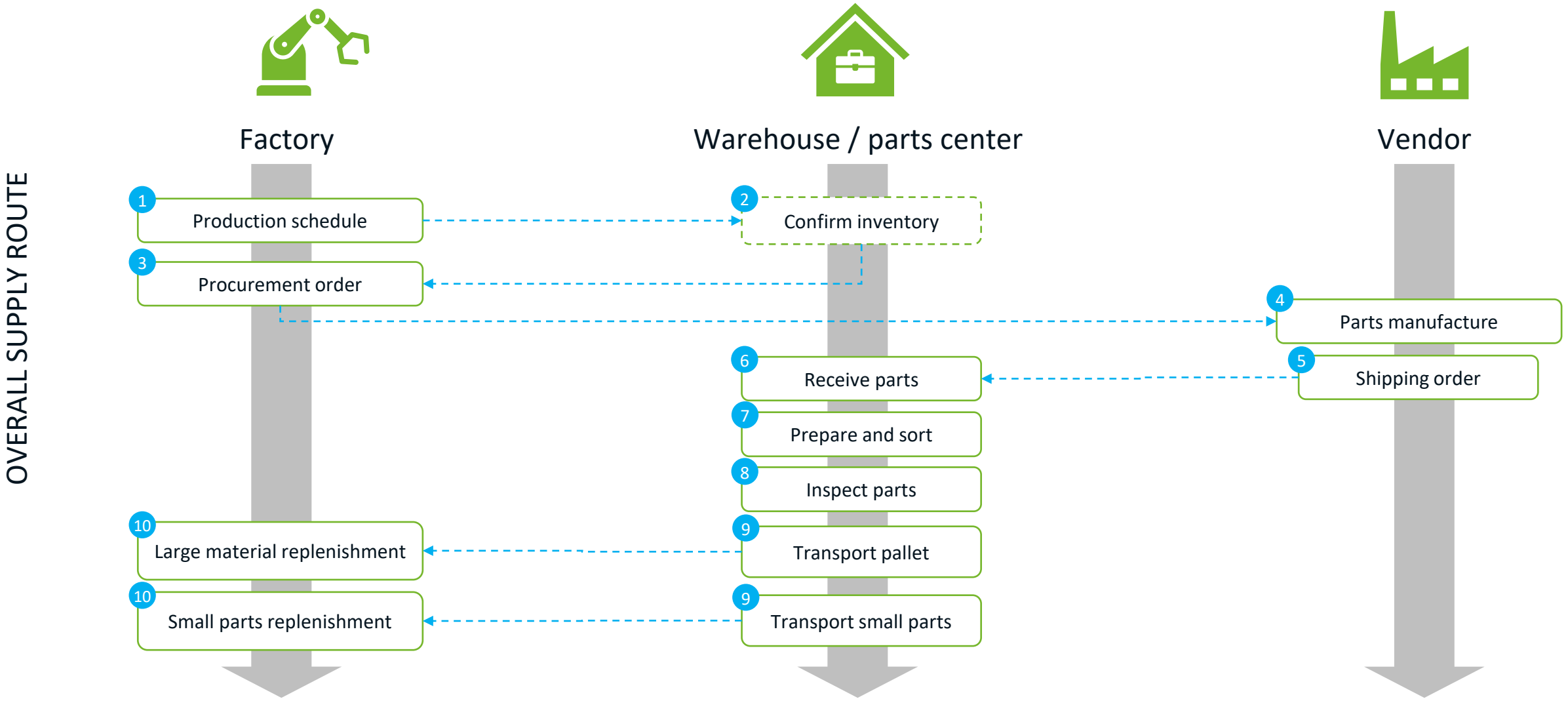
Actions:
Place large parts
Confirm inventory status
Pick empty pallets containers
Pick return parts

Legend

Mandatory

Information flow

CLOSE



L4.2

Intralogistics (discrete industries)

Definition

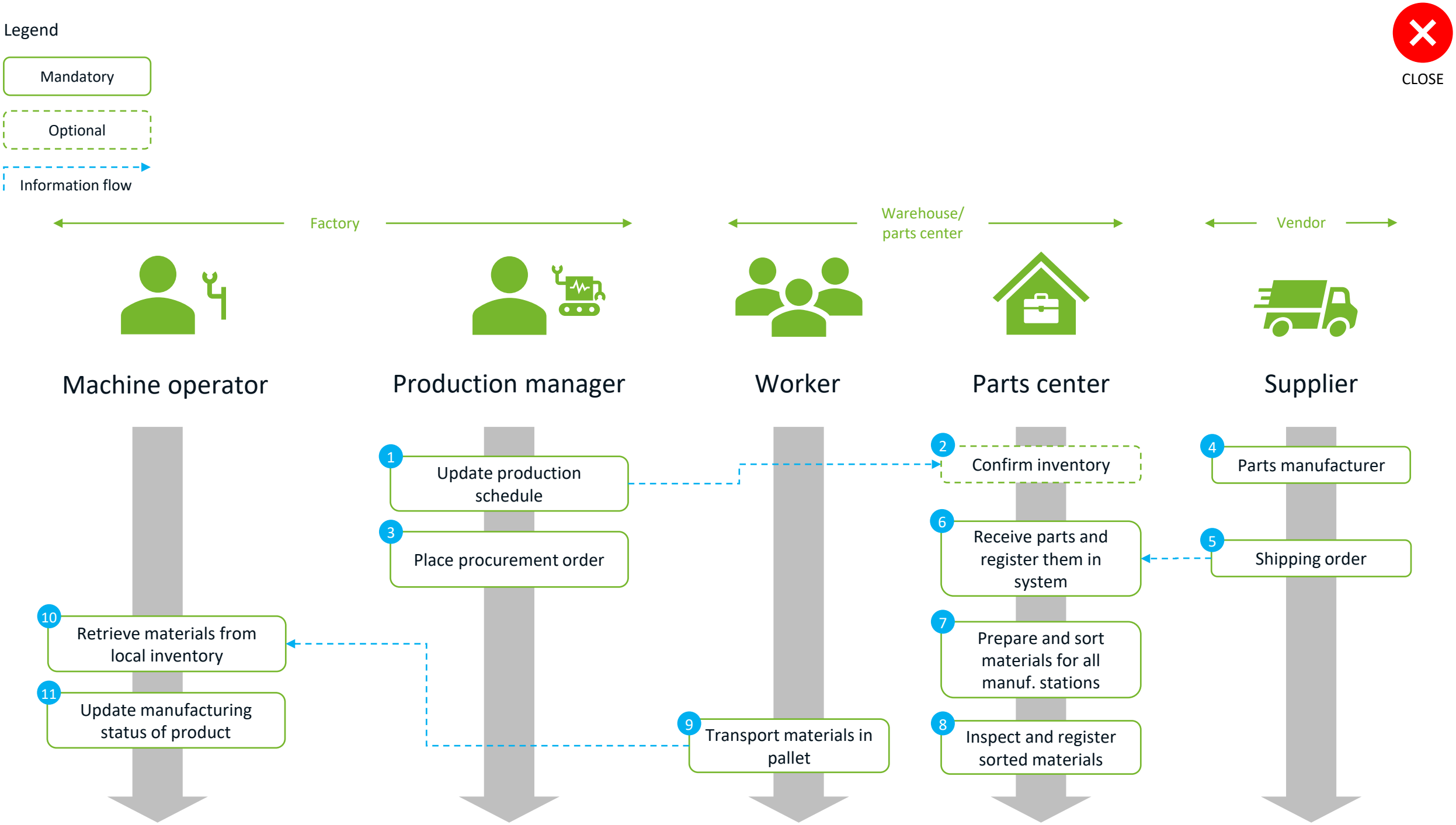
Intralogistics refers to the internal logistics within a company or organization, including the planning, implementation, and control of the flow of materials, products, and information from the point of origin to the point of consumption.

Go back one layer

4.2.1 Large parts mgmt.

Description: Larger parts are products usually ordered for a production or engineering order. They usually are more complex, also from perspective of value, quality inspection

Supportive content:


Legend
Mandatory
Optional
Information flow
CLOSE
Factory
Warehouse/
parts center
Vendor
Machine operator
Production manager
Worker
Parts center
Supplier
1
Update production schedule
2
Confirm inventory
3
Place procurement order
4
Parts manufacturer
5
Shipping order
6
Receive parts and register them in system
7
Prepare and sort materials for all manuf. stations
8
Inspect and register sorted materials
9
Transport materials in pallet
10
Retrieve materials from local inventory
11
Update manufacturing status of product

L4.2

Intralogistics (discrete industries)

Definition

Intralogistics refers to the internal logistics within a company or organization, including the planning, implementation, and control of the flow of materials, products, and information from the point of origin to the point of consumption.

Go back one layer

4.2.2 Small parts mgmt.

Description: Smaller parts are products usually ordered in bulks on stock and can be ordered by production with Kanban or pick process. They usually are less complex, used for different orders, such as bolts and nuts.

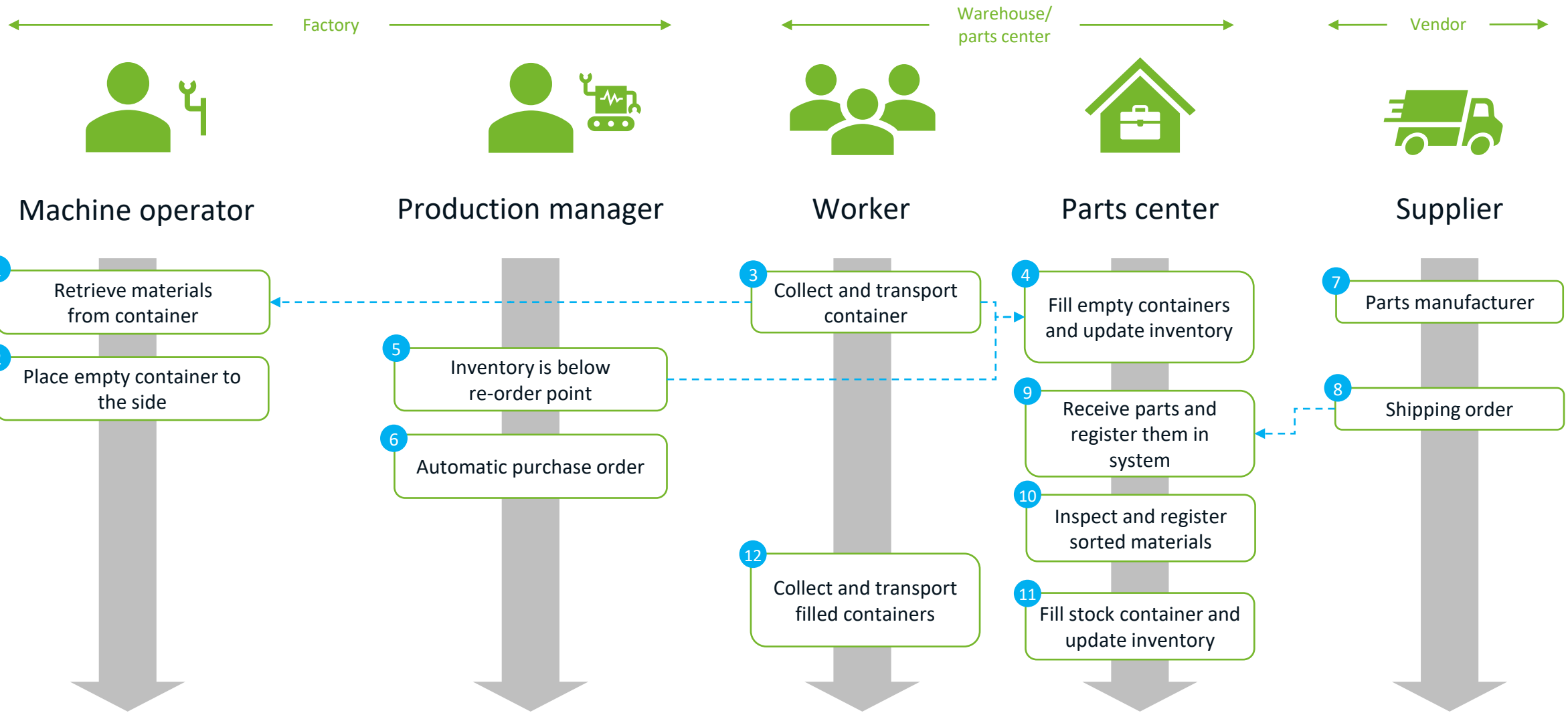
Supportive content:

Legend

Mandatory

Information flow

CLOSE



Definition

Intralogistics refers to the internal logistics within a company or organization, including the planning, implementation, and control of the flow of materials, products, and information from the point of origin to the point of consumption.

Go back one layer

4.2.3 Non-conformity parts mgmt.

Description: Non-conformity parts are defect parts which needs to be scrapped or returned and of course replaced for the production process.

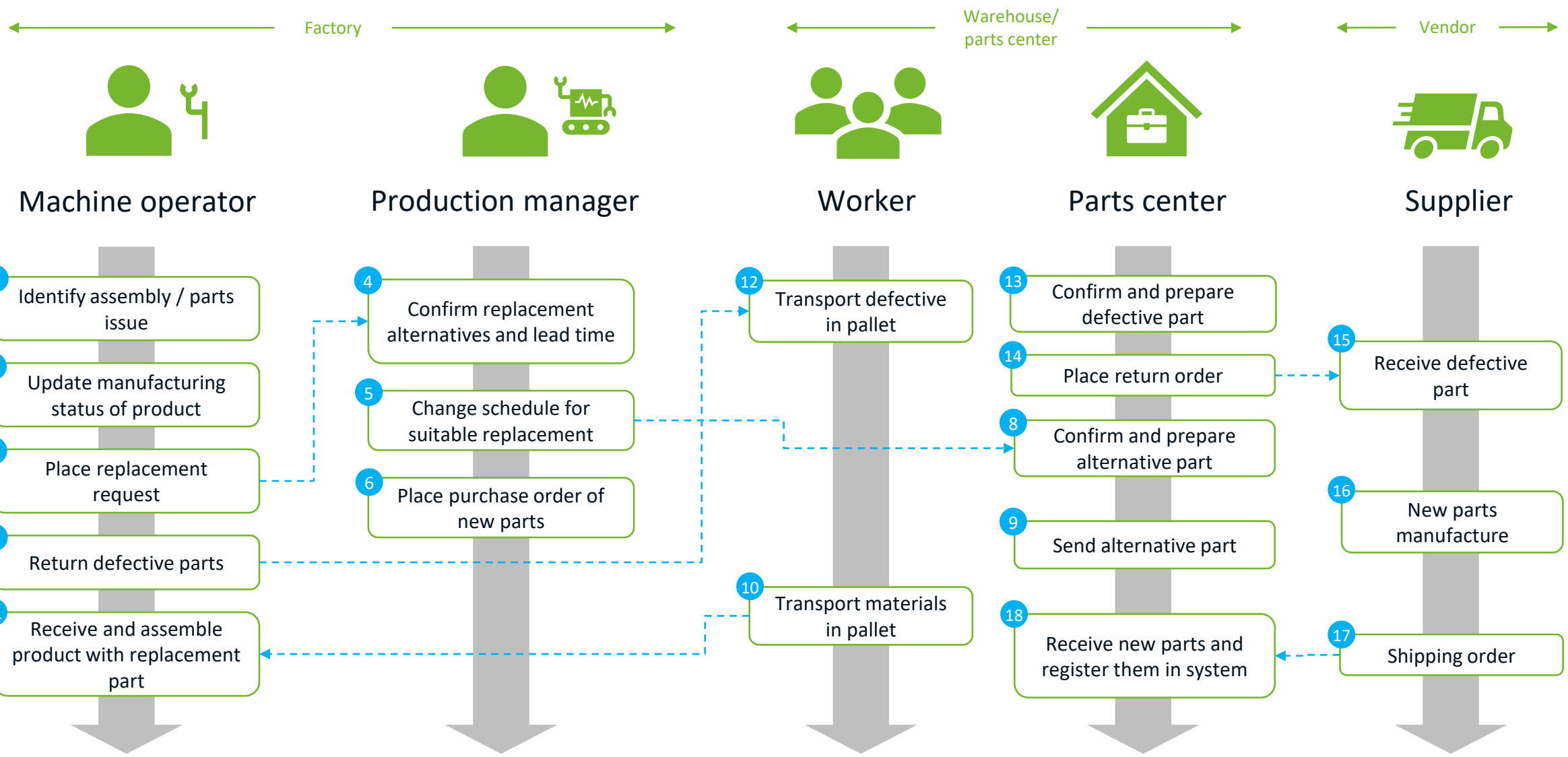
Supportive content:

Legend

Mandatory

Information flow

CLOSE



L5

ENTERPRISE

Definition

An enterprise can comprise multiple plants as well as multiple legal entities (e.g., subsidiaries). This is the company level where all the information and processes of the lower levels are consolidated.

5.1 Product track and trace

Challenge: Material track and trace shall provide visibility and transparency into the movement of materials, allowing organizations to ensure product quality, safety, and compliance, as well as to identify and address supply chain issues or disruptions.

Description: Material track and trace refers to the process of tracking and tracing materials throughout the supply chain, from the point of origin to the point of consumption. Material track and trace typically involves the use of technology such as barcodes, RFID tags, or GPS tracking devices to monitor and track the movement of materials. This technology is often integrated with supply chain management systems or enterprise resource planning (ERP) systems to provide real-time visibility into inventory levels, location, and status.

Roles/personas: plant managers, suppliers

Target group: supply chain

Benefits & value: Material track and trace provides real-time visibility into the movement of materials, allowing organizations to identify and address supply chain issues, supply chain inefficiencies, disruptions or quality standard requirements quickly. Further it helps organizations to comply with regulatory requirements, such as those related to food safety or product labeling.

L5

ENTERPRISE

Definition

An enterprise can comprise multiple plants as well as multiple legal entities (e.g., subsidiaries). This is the company level where all the information and processes of the lower levels are consolidated.

5.2 Enterprise logistics

Challenge: Enterprise logistics aims to optimize supply chain performance, reduce costs, and improve customer service.

Description: Enterprise Logistics refers to the process of planning, implementing, and controlling the movement of goods and information throughout an organization's supply chain. This involves managing the movement (or storage) of goods from one location to another, including selecting carriers, negotiating rates, and monitoring shipments.

Roles/personas: logistics manager, suppliers, warehouse manager, transportation manager, procurement specialist

Target group: supply chain

Benefits & value: Optimized inventory management regarding demand forecasts based on data analysis and statistical methods. Also refers closely to Product Track & Trace as real-time visibility of supply chain activities is vital for overall performance. Further benefits are data for conducting proper risk management and to optimize sustainability related topics such as reducing waste, improving energy efficiency, and using renewable resources.

L6

CROSS-ENTERPRISE

Definition

This is the level where use cases are assigned that go beyond company borders, e.g., the manufacturer/ operator collaboration.

6.1 Operator/supplier collaboration

Challenge: work in progress

Description: work in progress

Roles/personas: work in progress

Target group: work in progress

Benefits & value: work in progress

Supporting content:

Underlaying layers

wip

wip

wip

L6

CROSS-ENTERPRISE

Definition

This is the level where use cases are assigned that go beyond company borders, e.g., the manufacturer/ operator collaboration.

6.2 Supply chain

Challenge: work in progress

Description: work in progress

Roles/personas: work in progress

Target group: work in progress

Benefits & value: work in progress

Supporting content:

Underlaying layers

wip

wip

wip

L6

CROSS-ENTERPRISE

Definition

This is the level where use cases are assigned that go beyond company borders, e.g., the manufacturer/ operator collaboration.

6.3 Member offerings

Challenge: work in progress

Description: work in progress

Roles/personas: work in progress

Target group: work in progress

Benefits & value: work in progress

Supporting content:

Underlaying layers

wip

wip

wip

L6

CROSS-ENTERPRISE

Definition

This is the level where use cases are assigned that go beyond company borders, e.g., the manufacturer/ operator collaboration.

6.4 Sustainability

Challenge: work in progress

Description: work in progress

Roles/personas: work in progress

Target group: work in progress

Benefits & value: work in progress

Supporting content:

Underlaying layers

wip

wip

wip

L6

CROSS-ENTERPRISE

Definition

This is the level where use cases are assigned that go beyond company borders, e.g., the manufacturer/ operator collaboration.

6.5 Digital product passport mgmt.

Challenge: work in progress

Description: work in progress

Roles/personas: work in progress

Target group: work in progress

Benefits & value: work in progress

Supporting content:

Underlaying layers

wip

wip

wip

DEFINITIONS

ASSET TWIN

A dynamic, shared set of „distributed digital information“ about an asset and/or equipment, that various stakeholders (operators, manufacturers, service partners) can contribute to, and acquire information from. The OI4 Alliance focusses on the following aspects of the digital twin: EDGE, operator cloud, cloud central and manufacturer cloud.

DIGITAL TWIN

A digital twin is a virtual representation of a physical object or system. This can be either an asset, a product or a technical process that is running on the assets like painting e.g., it is a dynamic, shared set of „distributed digital information“ that various stakeholders (operators, manufacturers, service partners) can contribute to, and acquire information from. There is a relationship between the different digital twins.

MANUFACTURER & OPERATOR

A machine or equipment manufacturer is a company or organization that specializes in designing, producing, distributing and servicing machinery, equipment, or industrial devices used in various industries. In the context of the OI4 Alliance, the machine or equipment operator uses these machines or equipment to manufacture his own products or run his services on it. Generally, we use the term operator related to maintainable asset (machines, equipment, devices). The manufacturer is usually also in an operator role during his manufacturing process, e.g., using machines on which he produces his equipment. Manufacturers and operators both are suppliers and customers. Supplier and customer are more generic terms, used in context of product twin. To run maintenance of the asset across its lifecycle the manufacturer usually not operates alone, but in a network with his suppliers, importers and service companies.

OI4 PROCESS HOUSE

A process house is a graphical representation that structures a certain set of business processes. The purpose of the OI4 Process House is to document and structure OI4 Alliance relevant use cases. This allows to align internally and helps supporting customers in their process design. These use cases include relevant process steps from the perspective of an operator in collaboration with a manufacturer. The processes are described via the swim lane method with process steps assigned to certain roles (personas). The process house is based on collected industry best practices and will be updated periodically.

DEFINITIONS

PROCESS TWIN

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PRODUCT TWIN

In the industrial environment, digital product twins are developed and applied along the product lifecycle. Starting from the initial project idea through development and design to series production and product deployment for digital services. The product twin can be transferred alongside a supply chain.
The OI4 Alliance considers the digital product passport is a subset of the product twin.