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The OpenValue Solution

The main OpenValue Applications

The Manufacturing Planning Solution

- **MRP Planning Engine**
- **MRP Planning Engine Subcontracting**
- **MRP Planning Engine MTO**
- **MRP Planning Engine Capacity Load**
- **MRP Planning Engine Availability Check**

The Manufacturing Execution Solution

- **MRP Shop Floor Control**
- **MRP SFC Master Production Plan**
- **MRP SFC Scheduling Engine**
- **MRP SFC External Operation**
- **MRP SFC BoM Substitute Component**
- **MRP SFC BoM Comparison**
- **MRP Product Costing**

The Plant Maintenance Solution

- **MRO Maintenance**
- **MRP MRO Maintenance Integration**

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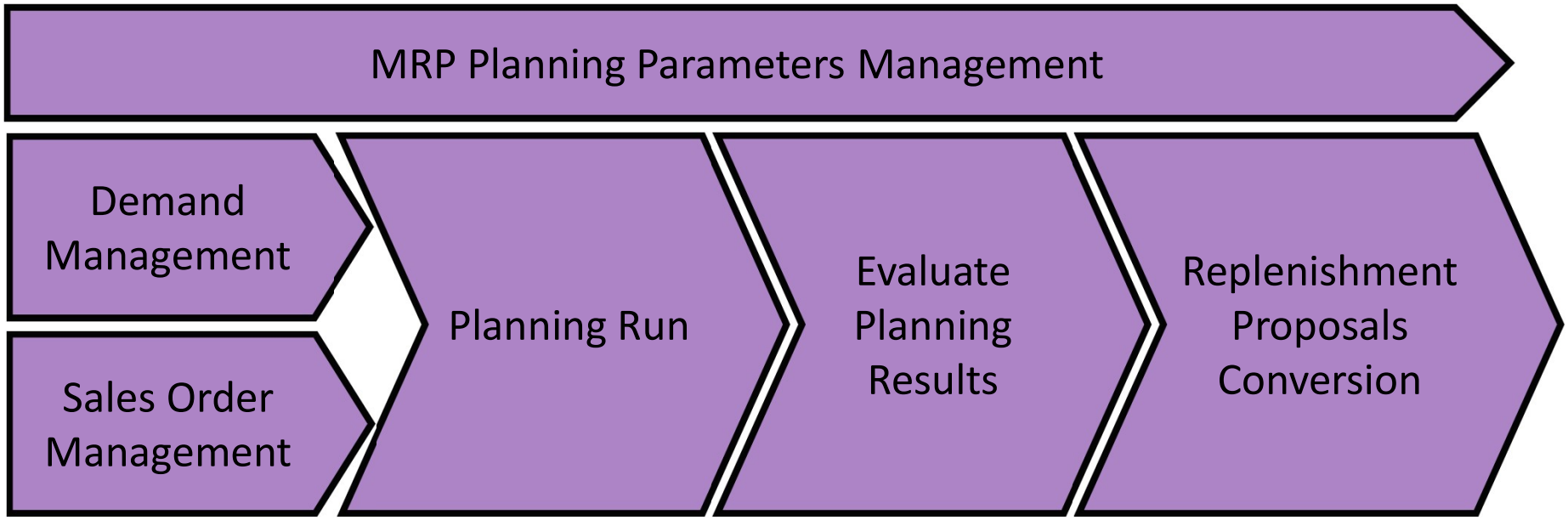
The Manufacturing Planning Solution

The Manufacturing Planning process



The OpenValue Solution supports the full Material Requirements Planning process.

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MRP Planning Engine

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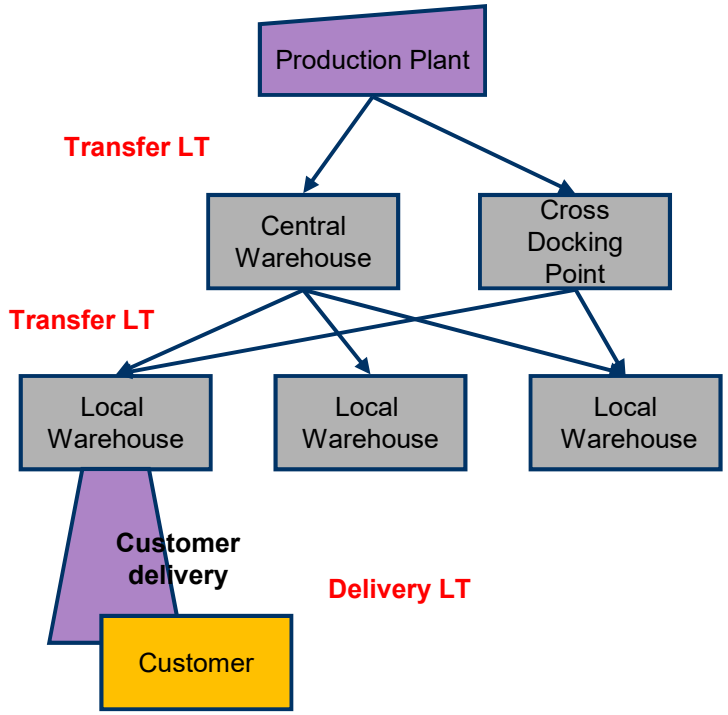
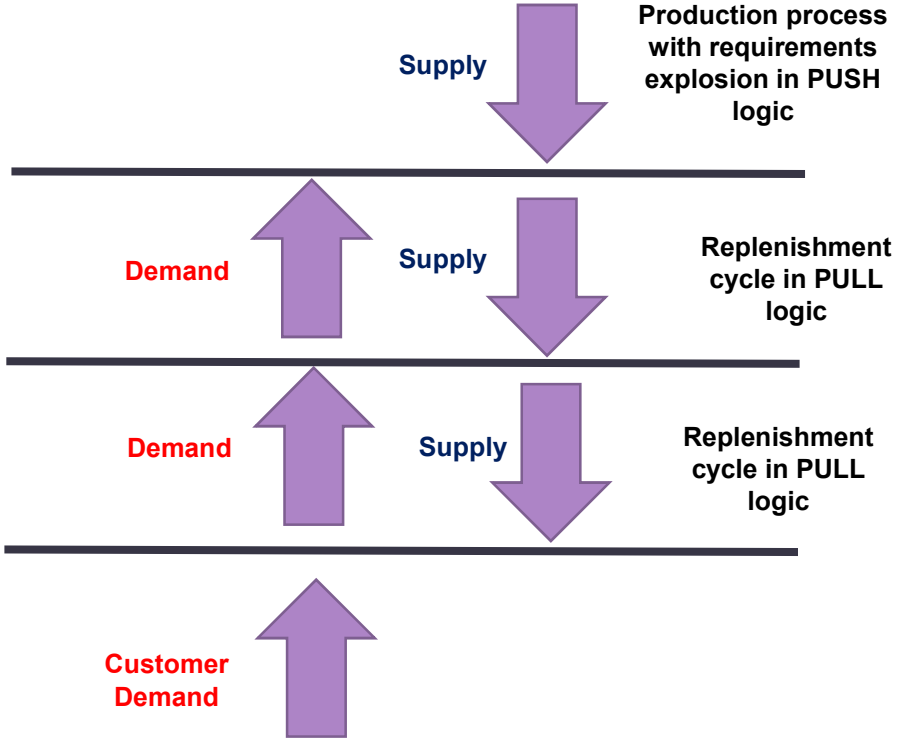
The OpenValue solution in Supply Chain management

Distribution Network





The OpenValue Solution manages planning and execution processes in challenging distribution systems

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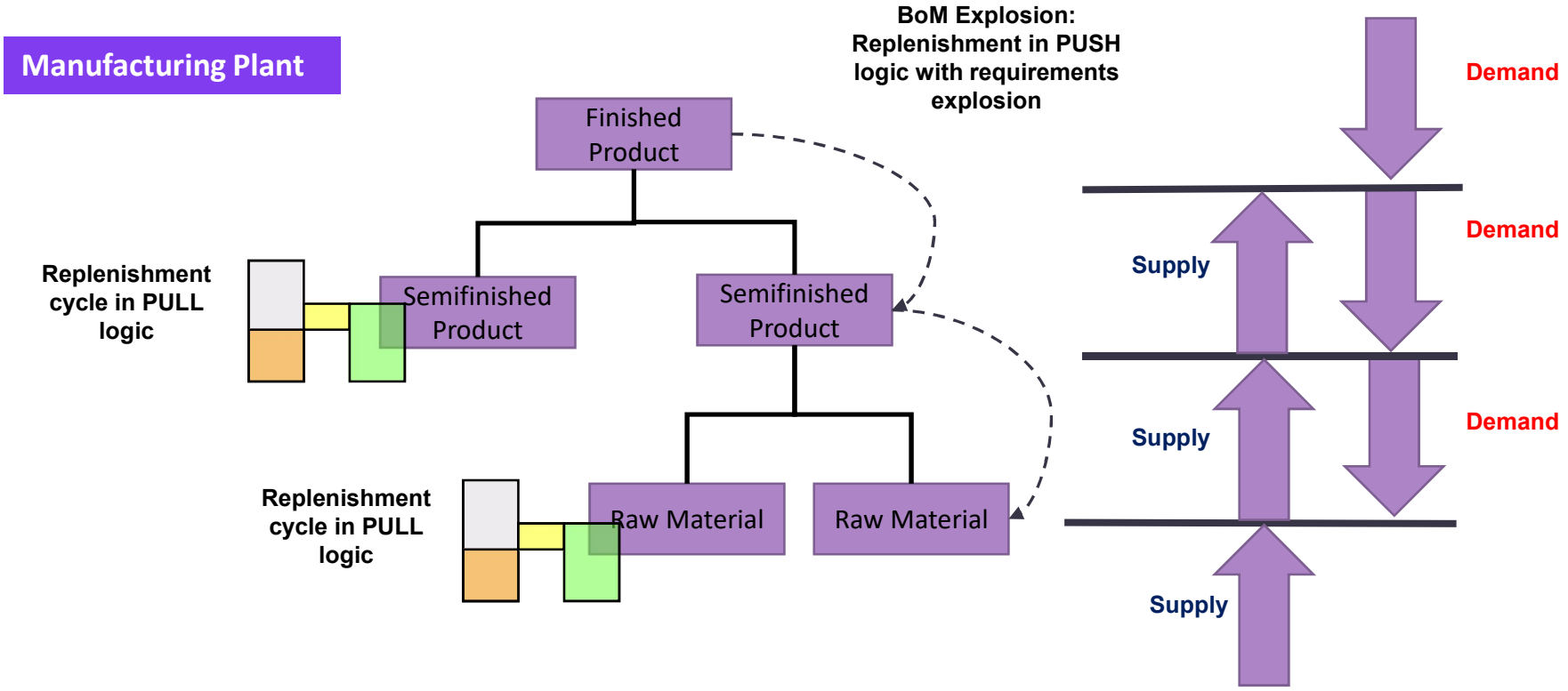
The OpenValue Solution material planning for manufacturing plants



The Material Requirements Planning process inside the production plant is supported by the Planning Engine

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The planning methodologies: PULL vs PUSH

The two basic materials planning methods are:

- **Push logic** with backwards scheduling and requirements explosion (where BoM is defined); that's the classical **MRP** tool provided in the most of ERP packages
- **Pull logic**, that's **the Reorder Point planning** with forward scheduling for automatic stock replenishment

The "MRP Planning Engine" implements the two planning methodologies in only one tool

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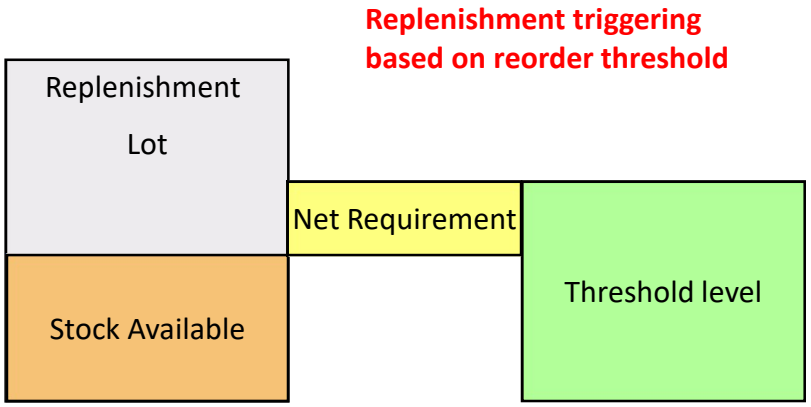
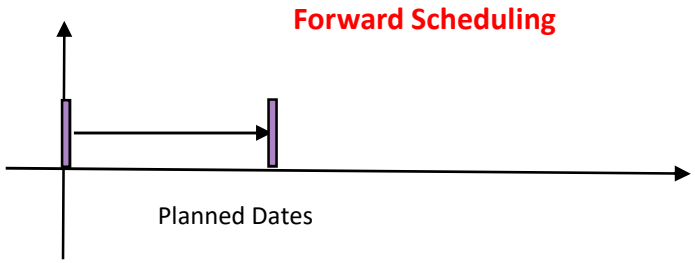
The Reorder Point planning

It’s based on a manually entered reorder point parameters. During the planning run, the system checks only whether stock has fallen below this reorder point or not. It that is the case, the system triggers procurement of the quantity defined by the lot size method.





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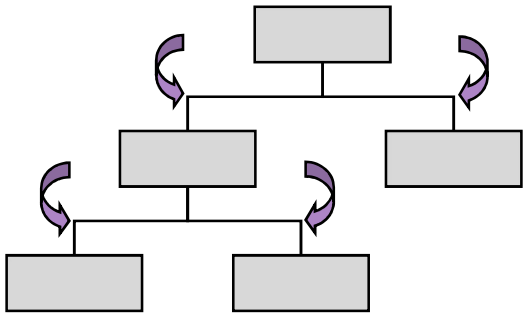
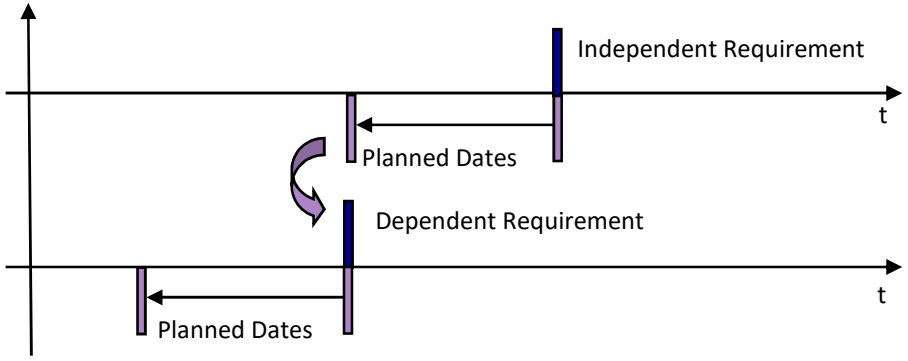
The Material Requirements Planning

MRP takes current and future demand as it's reference point. Depending on the Demand Management strategy, actual and planning sales requirements trigger the MRP calculation. In MRP, the requirements elements include sales orders, planned demand items, material reservations and the dependent requirements created by exploding the BOM.

BoM explosion for requirements determination



Backwards Scheduling



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The replenishment processes

In case the planning run determines shortage quantities, the system creates procurement proposal (planned orders) which can be changed, rescheduled or deleted when and where necessary.

The planned orders are to be converted in their final document:

- For **in-house production**, planned order is converted in a **manufacturing order**
- For **external procurement**, planned order is converted in a **purchase order**
- For **subcontracting**, planned order is converted in a **purchase order for subcontracting**
- For **internal procurement**, a **goods transfer** chain from the source warehouse is achieved by converting planned orders

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The Demand Management

The following **Demand Management Strategies** are supported:

- *Make To Stock Anonymous*
- *Make To Order*
- *Planning production by lots*
- *Planning with final assembly*
- *Planning without final assembly*

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The Planning Strategies: *MTS Anonymous*

- The independent demand is defined without considering any sales order: the Sales orders are not relevant for MRP calculation but they are displayed for information purposes in the MRP list with quantity as zero.

- Sales order are covered by warehouse stock.

- The forecast items consumption is carried out at goods issues (performed sales order delivery) in FIFO logic

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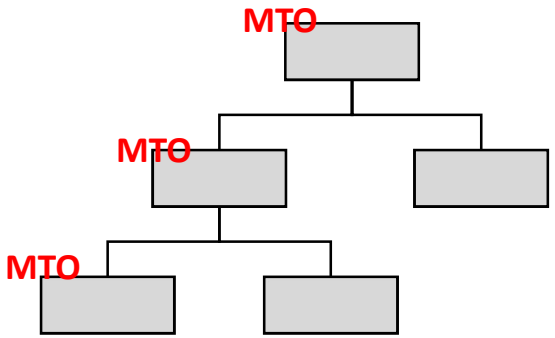
The Planning Strategies: *Make To Order*

- The forecast items cannot be defined for MTO strategy; therefore, only Sales orders are relevant for triggering MRP calculation
- For MTO products, the MRP type “MRP” and the “lot for lot” order quantity method for lot sizing procedure are to be used; therefore the net requirement calculation considers requirements in the same requirement date only
- It’s possible to assign the **Requirements Type** for specifying which subassemblies are to be produced or which components are to be purchased when receiving the customer order



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The Planning Strategies: *Planning production by lots*

- The requirements for finished products are transferred to MRP when sales order is confirmed.
- It is possible to plan additional warehouse requirements with forecast demand items also.
- Independent demand items, i.e. sales orders and forecast items, are grouped according to the lot sizing procedure (procurement lot size).
- Sales orders can be covered from existing stock from the warehouse
- the forecast demand is consumed when performing sales goods issues (sales order delivery) in FIFO logic.

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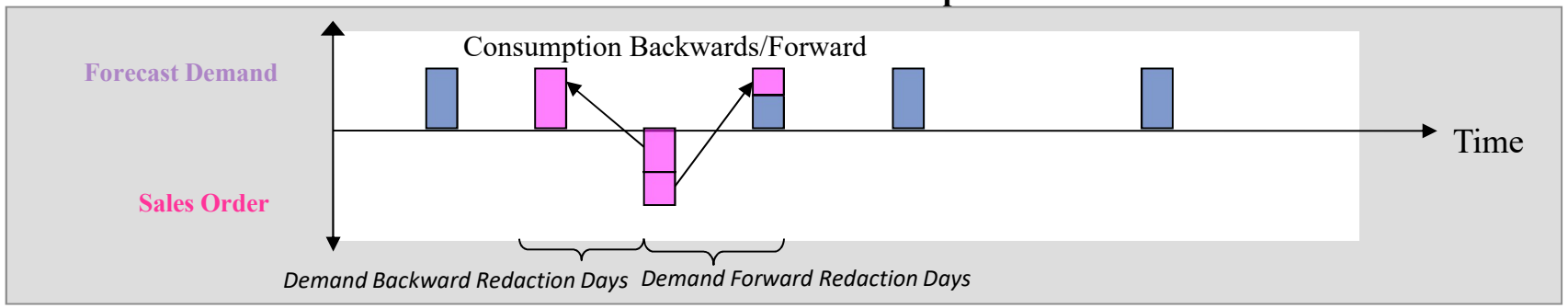
The Planning Strategies: *Planning with final assembly* (1/2)

- The replenishment process, i.e. manufacturing and purchase processes, is triggered by the forecast demand Items before receiving Sales Order.
- the demand reduction occurs when confirming sales orders by searching forecast items from the sales order planned delivery date in the past by the demand backward reduction days and afterwards in the future by the demand forward reduction days.

Forecast Demand Reduction in the past and in the future



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The Planning Strategies: *Planning with final assembly* (2/2)

- Overplanning is taken into account: if the sales order quantities exceed forecast items quantities, the system creates a planned order for the unplanned quantities for a fast reaction to customer demand.

- Demand Items left unconsumed increase the warehouse stock; therefore the "**adjust requirements**" procedure by forcing as zero the MRP quantity is provided

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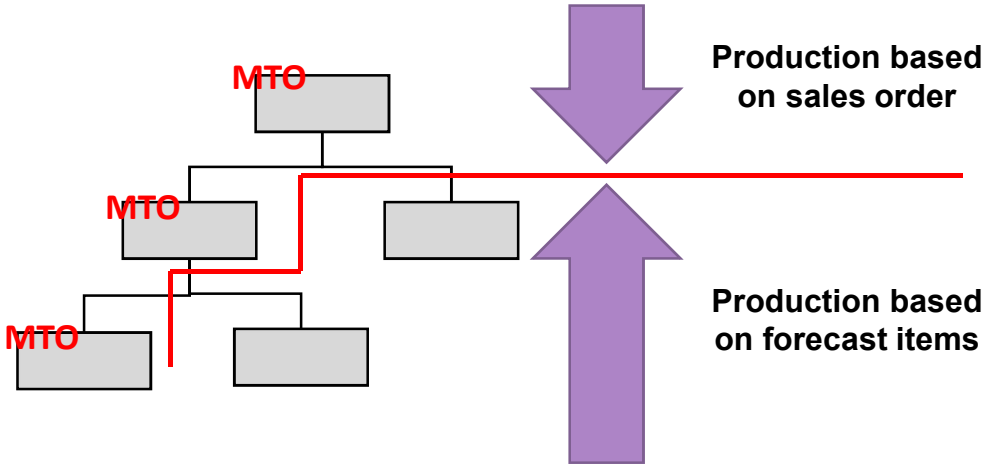
The Planning Strategies: *Planning without final assembly* (1/2)

- As the MTO planning strategy, the “planning without final assembly” enables to manufacture final products specifically for the customer whereas subassemblies are to be produced or procured before the sales orders is received.
- Therefore, planned orders related to forecast Items are created for planning purposes only and cannot be converted; that means the last stage of production process can be performed after receiving the sales order only.



- As described in the “make to order” planning strategy, It’s possible to assign the **Requirements Type** for specifying which subassemblies are to be produced or which components are to be purchased when receiving the customer order

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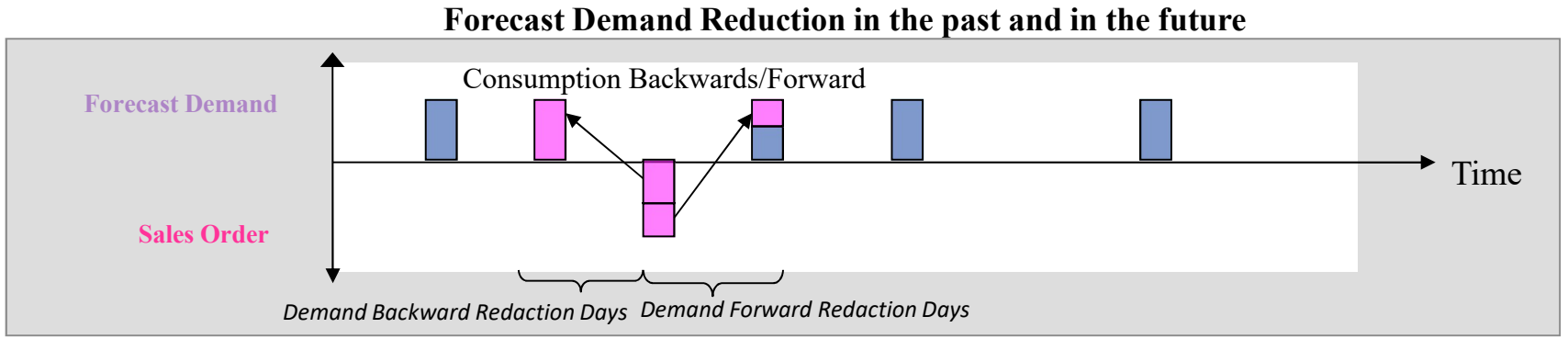
The Planning Strategies: *Planning without final assembly* (2/2)

- As described in the “planning with final assembly”, the demand reduction occurs at sales order confirmation.



- The overplanning (the actual demand has not covered by the forecast items) is transmitted to the lower BoM levels and it is relevant for planning.

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Planning Strategies Overview

Planning Strategy	PIRs – Planned Independent Requirements	Sales Orders
MTS Anonymous	NOT Relevant for planning	Not relevant for planning PIRs consumption at delivery (goods issue)
Make To Order	Not relevant for planning	Relevant for planning
Planning production by lots	Relevant for planning	Relevant for planning PIRs consumption at delivery (goods issue)
Planning with final assembly	Relevant for planning	Relevant for planning: overplanning for quantities not covered by PIRs. PIRs reduction at sales order confirmation
Planning without final assembly	Relevant for planning Not relevant for execution (finished products planned order cannot be converted)	Relevant for planning: semifinished products overplanning for quantities not covered by PIRs. PIRs reduction at sales order confirmation

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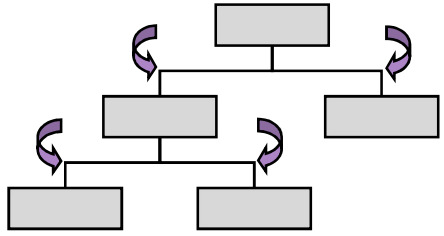
The Planning Engine run

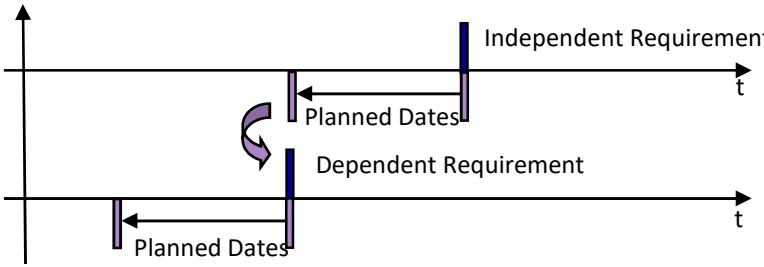
- The planning run is performed at warehouse level (planning area)
- Planned Orders are the result of a planning run session: they are created by the planning run as replenishment proposals to fulfill requirements.
- In case of errors, an exception message is posted on the MRP planning parameters master data and assigned to the responsible planner.
- In the same planning run, both MRP (PUSH logic) and Reorder Point (PULL logic) procedures are performed

PUSH

BoM explosion for requirements determination

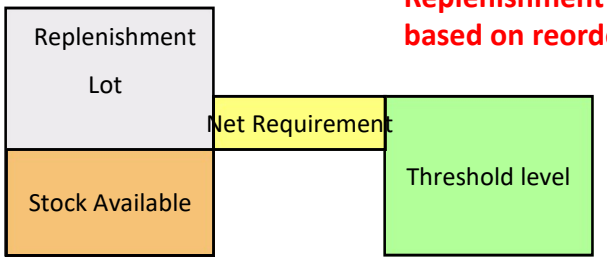


Backwards Scheduling

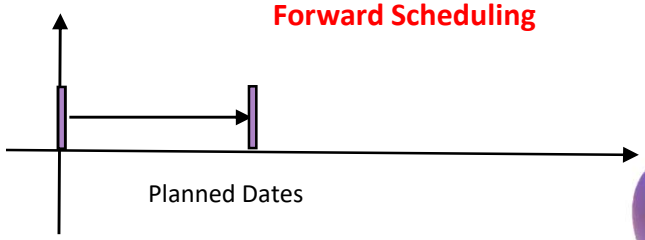


PULL

Replenishment triggering based on reorder threshold



Forward Scheduling



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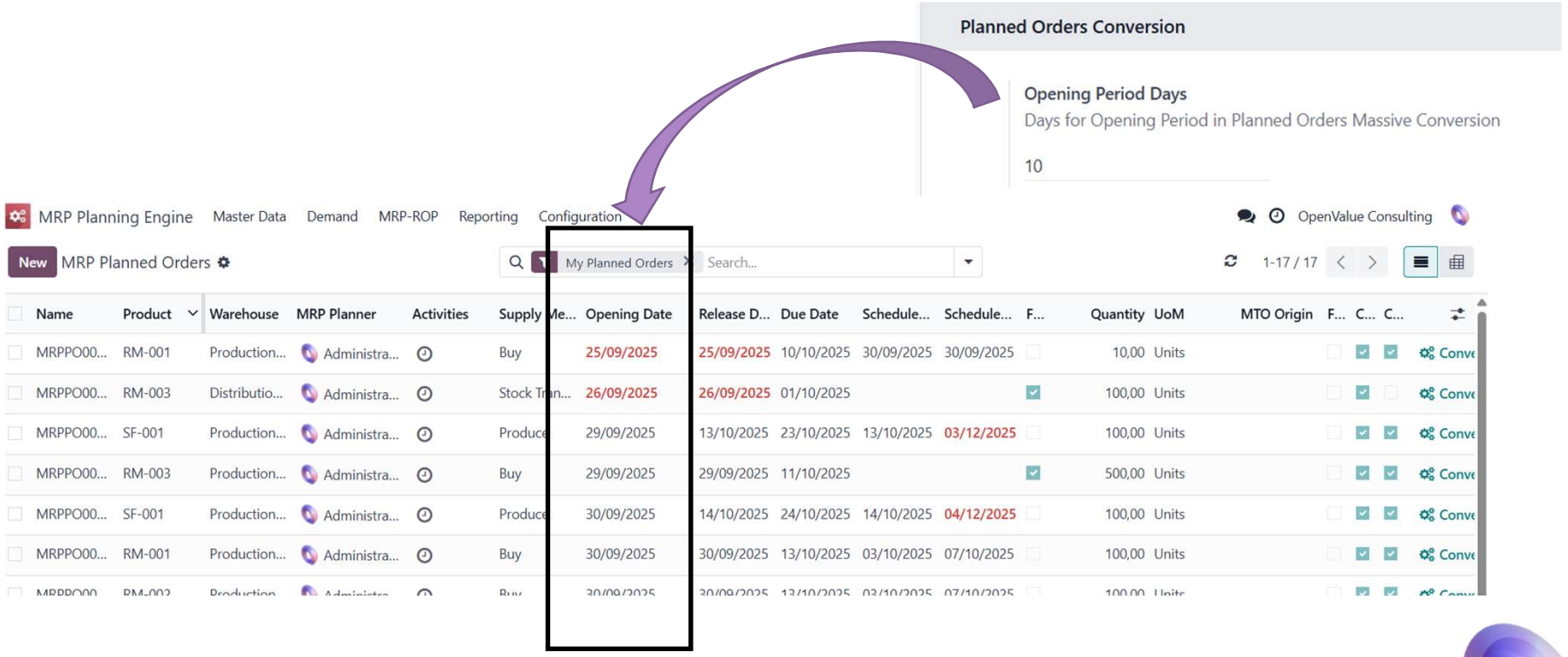
Planned orders list and conversion process

- The Planned orders list by Release Date represents the workload of the responsible planner.
- An **Opening Period** in working days is defined for the management of planned order conversion. The **Opening Date** determines when a planned order must be converted into a final document, following an ‘as late as possible’ approach. A filter allows the selection of the planned orders to be converted.



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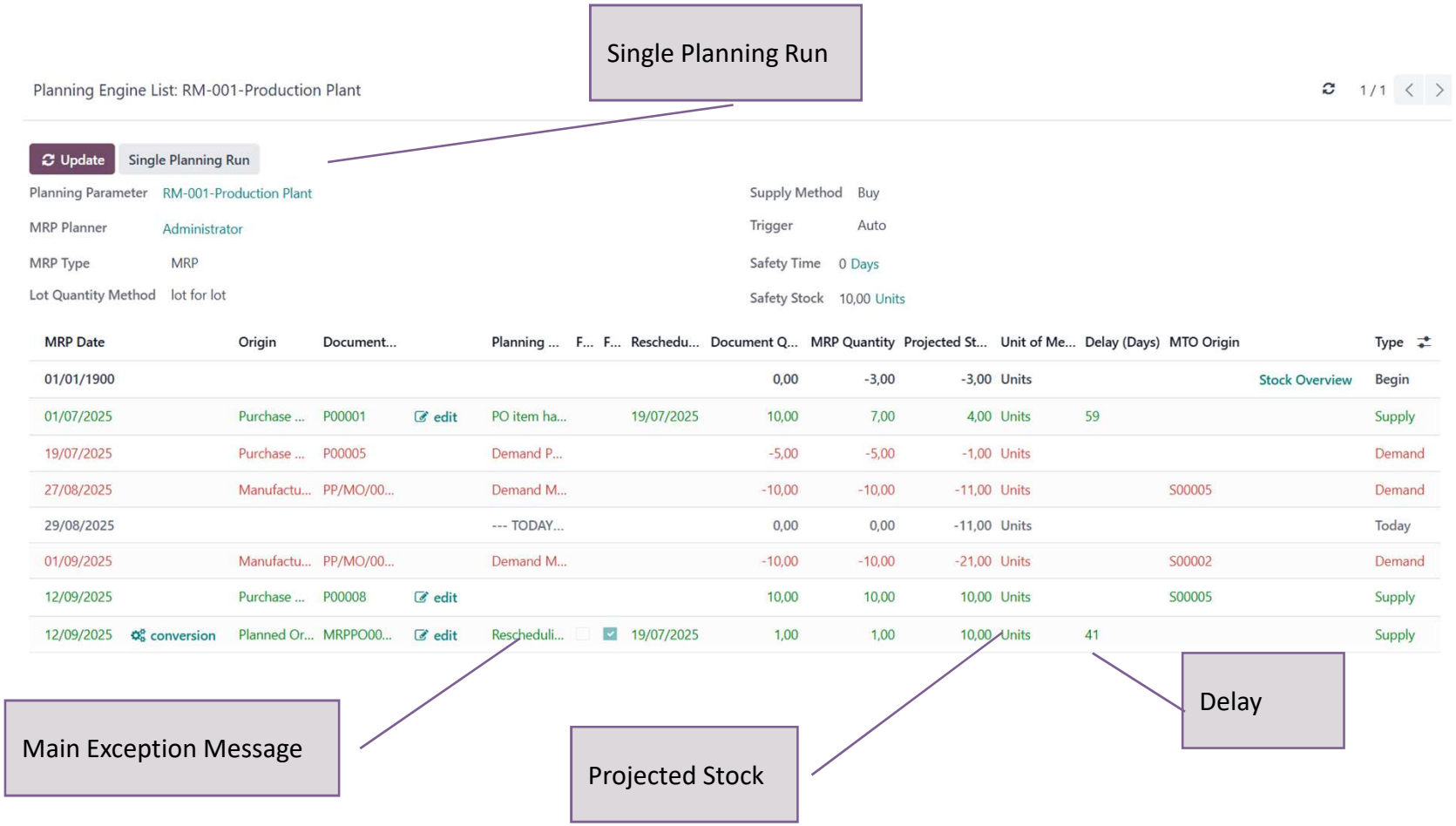
Evaluate planning run results

The main tool for evaluating the planning results is the "**MRP Planning Engine List**": all procurement requirements elements are listed over the time.



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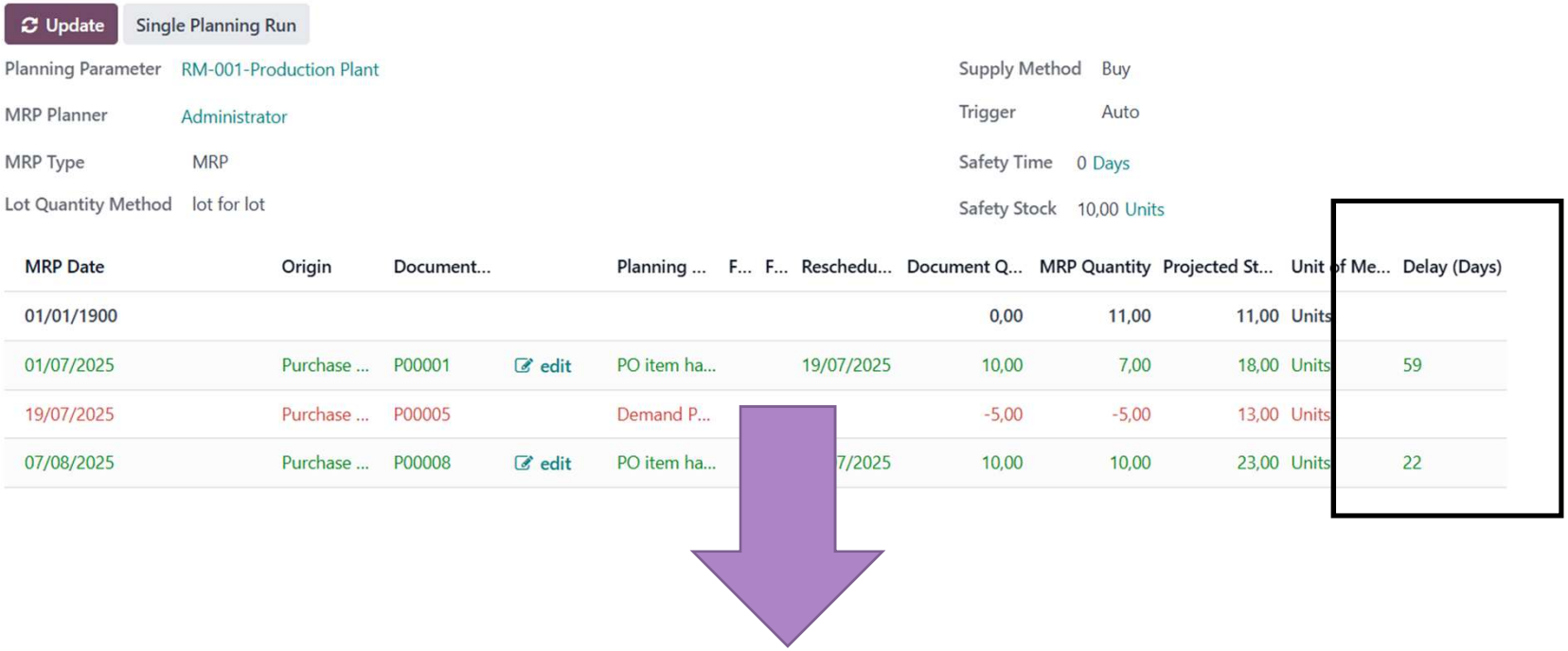
Delay Analysis in Execution process

The Delay Analysis is crucial for planning results consolidation.

Two possible methods are possible for delay determination:

- Optimistic: it is due for delivery today
- Pessimistic: it start for delivering today



Based on delays due to the execution process, the expediting and sales order delivery date confirmation processes are to be triggered.

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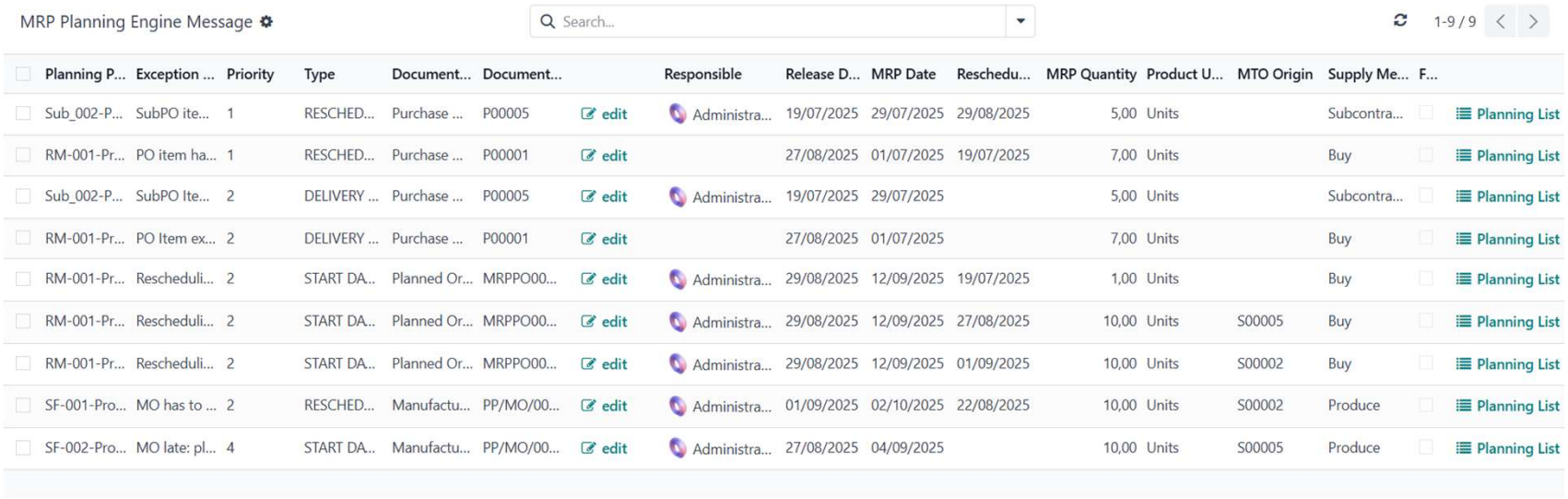
Planning Engine exception messages

- All planning exception messages are collected in the “**MRP Planning Engine Messages List**”.
- The list is sorted by release date and the responsible user is available to address the issue


MRP Planning Engine Message

Search...

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Planning P...	Exception ...	Priority	Type	Document...	Document...		Responsible	Release D...	MRP Date	Reschedu...	MRP Quantity	Product U...	MTO Origin	Supply Me...	F...	
Sub_002-P...	SubPO ite...	1	RESCHED...	Purchase ...	P00005	edit	Administra...	19/07/2025	29/07/2025	29/08/2025	5,00	Units		Subcontra...		Planning List
RM-001-Pr...	PO item ha...	1	RESCHED...	Purchase ...	P00001	edit		27/08/2025	01/07/2025	19/07/2025	7,00	Units		Buy		Planning List
Sub_002-P...	SubPO Ite...	2	DELIVERY ...	Purchase ...	P00005	edit	Administra...	19/07/2025	29/07/2025		5,00	Units		Subcontra...		Planning List
RM-001-Pr...	PO Item ex...	2	DELIVERY ...	Purchase ...	P00001	edit		27/08/2025	01/07/2025		7,00	Units		Buy		Planning List
RM-001-Pr...	Rescheduli...	2	START DA...	Planned Or...	MRPPO00...	edit	Administra...	29/08/2025	12/09/2025	19/07/2025	1,00	Units		Buy		Planning List
RM-001-Pr...	Rescheduli...	2	START DA...	Planned Or...	MRPPO00...	edit	Administra...	29/08/2025	12/09/2025	27/08/2025	10,00	Units	S00005	Buy		Planning List
RM-001-Pr...	Rescheduli...	2	START DA...	Planned Or...	MRPPO00...	edit	Administra...	29/08/2025	12/09/2025	01/09/2025	10,00	Units	S00002	Buy		Planning List
SF-001-Pro...	MO has to ...	2	RESCHED...	Manufactu...	PP/MO/00...	edit	Administra...	01/09/2025	02/10/2025	22/08/2025	10,00	Units	S00002	Produce		Planning List
SF-002-Pro...	MO late: pl...	4	START DA...	Manufactu...	PP/MO/00...	edit	Administra...	27/08/2025	04/09/2025		10,00	Units	S00005	Produce		Planning List

- The following exceptions are managed:
  - Planned Orders with release date in the past (expired planned order or possible stockout in the projected stock)
  - RfQs with document date in the past (delay in converting RfQ in PO)
  - PO items not yet delivered with delivery date in the past (vendor expediting)
  - Draft or converted MOs with planned start pivot date in the past (shop floor expediting)
  - Open MOs with the scheduled finished date after the planned finished pivot date (scheduling issue)
  - Firmed Planned Orders, POs and MOs to be rescheduled (see Rescheduling Prosess)

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MRP Planning Engine Subcontracting

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The Subcontracting components replenishment

- The subcontracting replenishment process is supported by the "**Planning Engine Subcontracting List**"
- The transfer of components to subcontractors is based on components requirements calculated by the planning engine: in case of projected stock quantity shortage in subcontracting location, a replenishment element, the "**Subcontracting Stock Replenishment Order**", is created
- By releasing a Stock Subcontracting Replenishment Order, a delivery stock transfer is created from warehouse stock to subcontracting location

The "MRP Planning Engine Subcontracting" module enhances the OpenValue MRP Planning Engine solution by implementing a subcontracting replenishment process based on the projected stock quantity shortage

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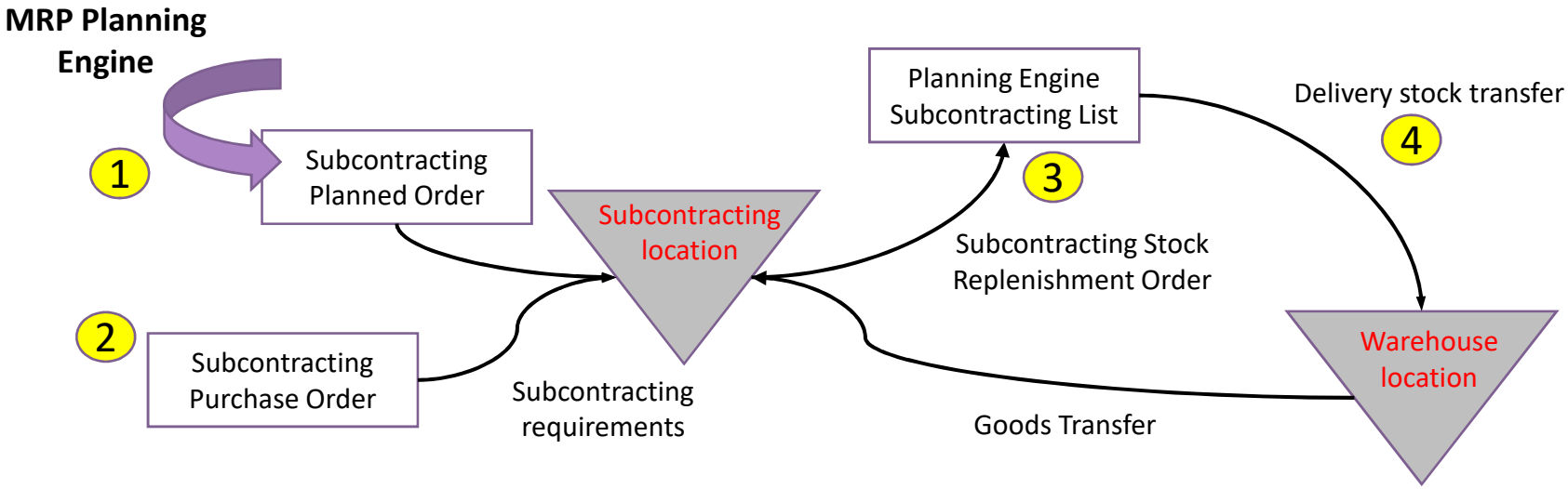
The Subcontracting Replenishment process



1. In case of quantity shortage the MRP Planning Engine run creates a subcontracting planned order; the subcontracting BoM explosion creates subcontracting requirements on subcontracting location
2. The subcontracting PO confirmation triggers the components subcontracting replenishment process
3. the Planning Engine Subcontracting list points out the projected stock shortage and creates a **Subcontracting Stock Replenishment Order** to fulfill requirements on subcontracting locazion
4. When confirming the Subcontracting Stock Replenishment Order, a delivery stock transfer is created to fulfill subcontracting requirements

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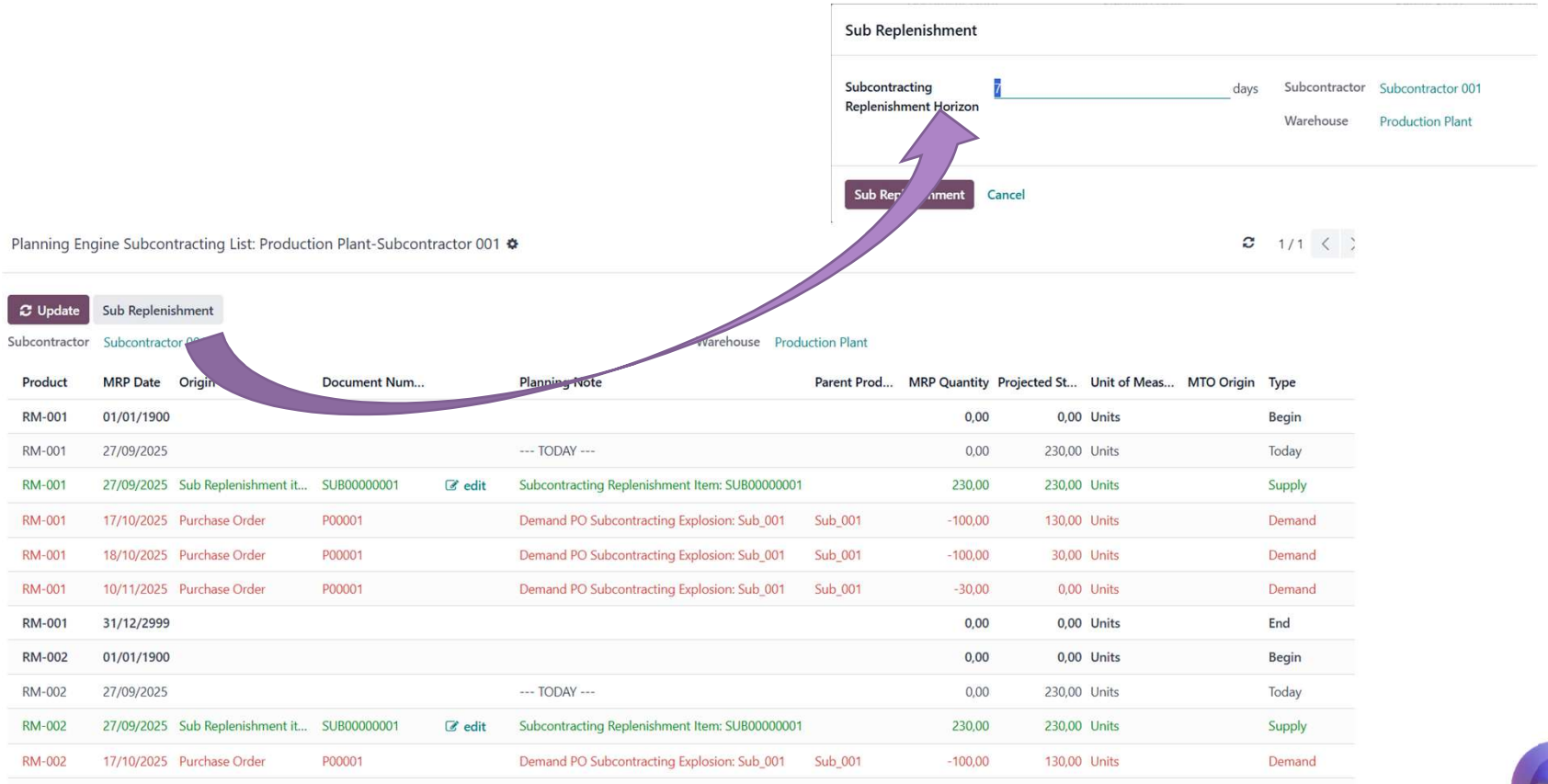
The Planning Engine Subcontracting List

- By specifying the replenishment horizon, subcontracting replenishment orders are generated to cover subcontracting requirements.
- The component quantity can be changed
- The Planning Engine Subcontracting List monitors in real time



Product	MRP Date	Origin	Document Num...		Planning Note	Parent Prod...	MRP Quantity	Projected St...	Unit of Meas...	MTO Origin	Type
RM-001	01/01/1900						0,00	0,00	Units		Begin
RM-001	27/09/2025				--- TODAY ---		0,00	230,00	Units		Today
RM-001	27/09/2025	Sub Replenishment it...	SUB00000001	edit	Subcontracting Replenishment Item: SUB00000001		230,00	230,00	Units		Supply
RM-001	17/10/2025	Purchase Order	P00001		Demand PO Subcontracting Explosion: Sub_001	Sub_001	-100,00	130,00	Units		Demand
RM-001	18/10/2025	Purchase Order	P00001		Demand PO Subcontracting Explosion: Sub_001	Sub_001	-100,00	30,00	Units		Demand
RM-001	10/11/2025	Purchase Order	P00001		Demand PO Subcontracting Explosion: Sub_001	Sub_001	-30,00	0,00	Units		Demand
RM-001	31/12/2999						0,00	0,00	Units		End
RM-002	01/01/1900						0,00	0,00	Units		Begin
RM-002	27/09/2025				--- TODAY ---		0,00	230,00	Units		Today
RM-002	27/09/2025	Sub Replenishment it...	SUB00000001	edit	Subcontracting Replenishment Item: SUB00000001		230,00	230,00	Units		Supply
RM-002	17/10/2025	Purchase Order	P00001		Demand PO Subcontracting Explosion: Sub_001	Sub_001	-100,00	130,00	Units		Demand

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MRP Planning Engine MTO (Make to Order)

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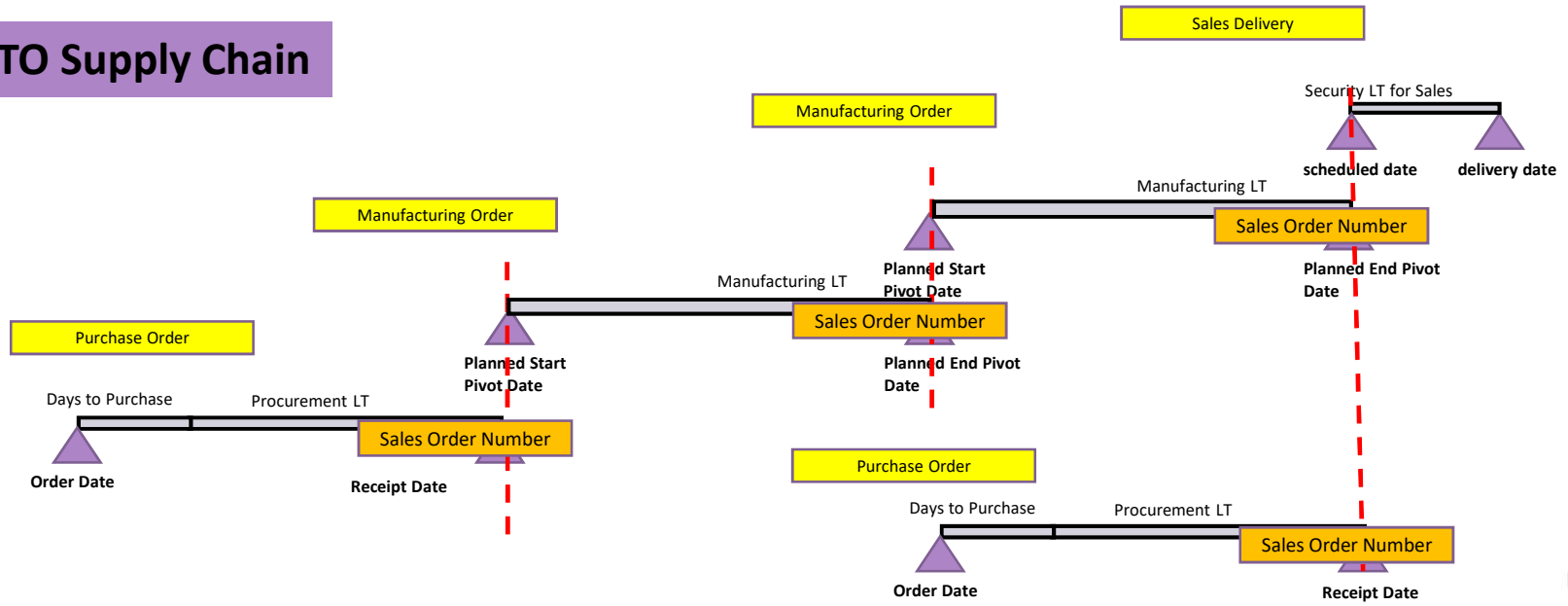
MTO Planning Engine Report

- The **MTO Planning Engine Report** purpose is to monitor the **MTO supply chain** status to track the promised customer delivery date with alerts for quantity shortages and time delays
- It provides for a MTO sales order an overview of the overall MTO supply chain status by listing of all the MTO replenishment elements, i.e. MTO manufacturing orders and MTO purchase order items for subcontracting also, with their status, dates and quantities
- a recap of all necessary figures support in only one report the monitoring of the overall MTO supply chain status

MTO Supply Chain



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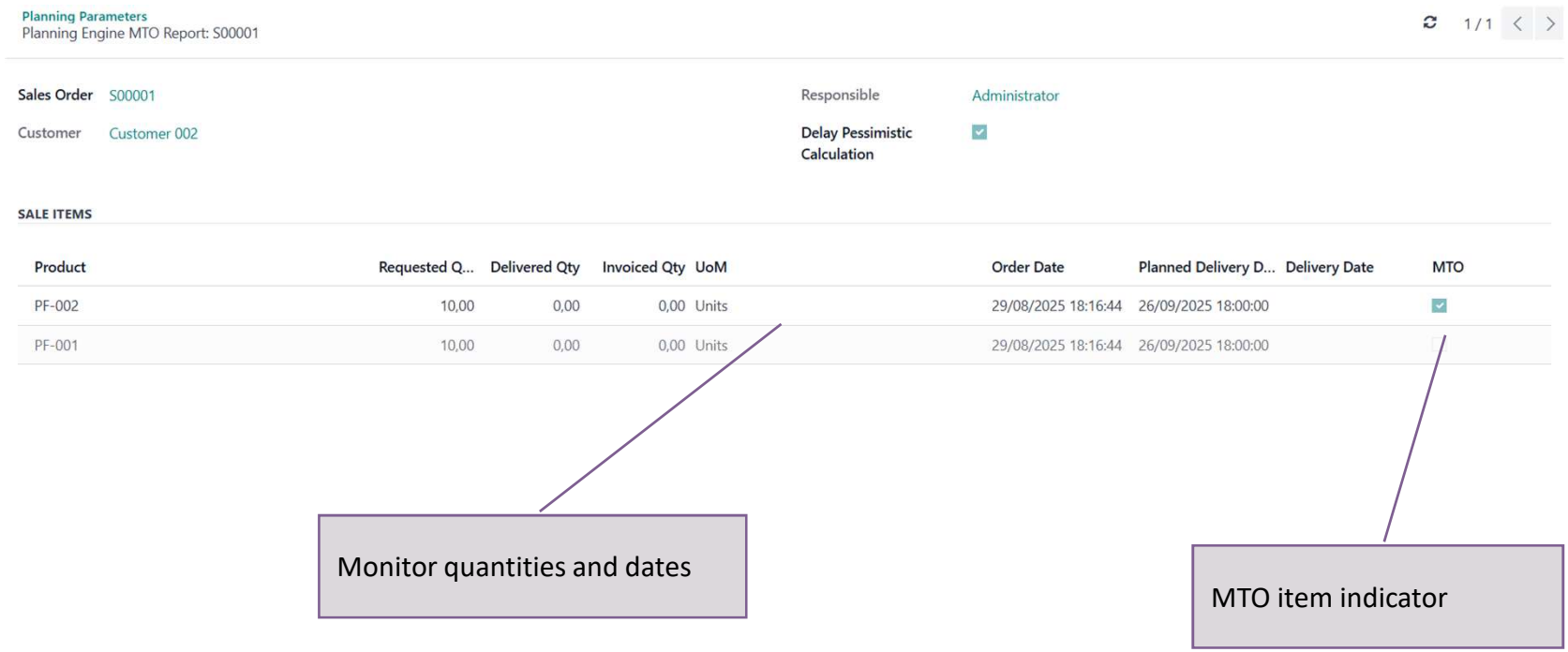
MTO Planning Engine Report: sales section



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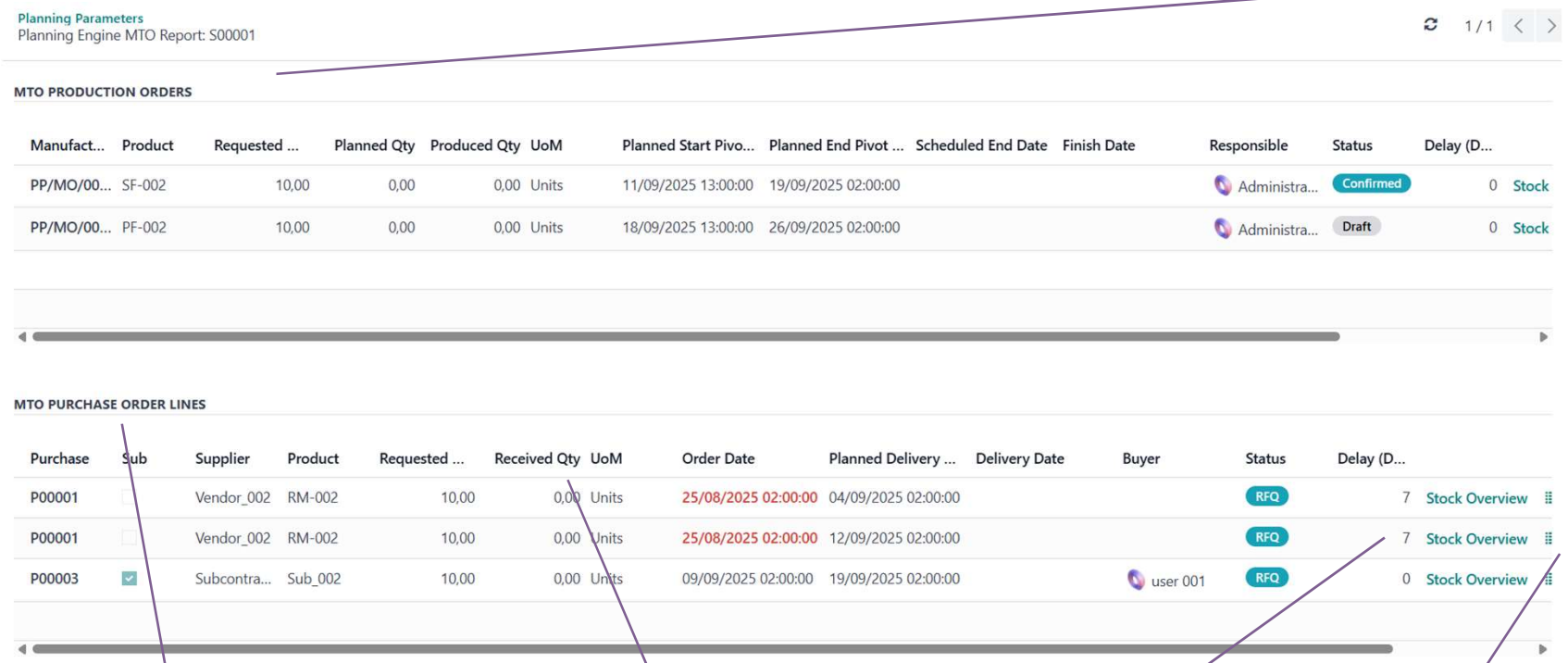
MTO Planning Engine Report: replenishment items section

MTO Manufacturing Orders Section



Planning Parameters
Planning Engine MTO Report: S00001

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MTO PRODUCTION ORDERS

Manufact...	Product	Requested ...	Planned Qty	Produced Qty	UoM	Planned Start Pivo...	Planned End Pivot ...	Scheduled End Date	Finish Date	Responsible	Status	Delay (D...	
PP/MO/00...	SF-002	10,00	0,00	0,00	Units	11/09/2025 13:00:00	19/09/2025 02:00:00			Administra...	Confirmed	0	Stock
PP/MO/00...	PF-002	10,00	0,00	0,00	Units	18/09/2025 13:00:00	26/09/2025 02:00:00			Administra...	Draft	0	Stock

MTO PURCHASE ORDER LINES

Purchase	Sub	Supplier	Product	Requested ...	Received Qty	UoM	Order Date	Planned Delivery ...	Delivery Date	Buyer	Status	Delay (D...	
P00001		Vendor_002	RM-002	10,00	0,00	Units	25/08/2025 02:00:00	04/09/2025 02:00:00			RFQ	7	Stock Overview
P00001		Vendor_002	RM-002	10,00	0,00	Units	25/08/2025 02:00:00	12/09/2025 02:00:00			RFQ	7	Stock Overview
P00003	☑	Subcontra...	Sub_002	10,00	0,00	Units	09/09/2025 02:00:00	19/09/2025 02:00:00		user 001	RFQ	0	Stock Overview

MTO Purchase Orders Section

Monitor quantities and dates

Delays

Stock Quantity Overview
MRP Planning List

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MRP Planning Engine Capacity Load

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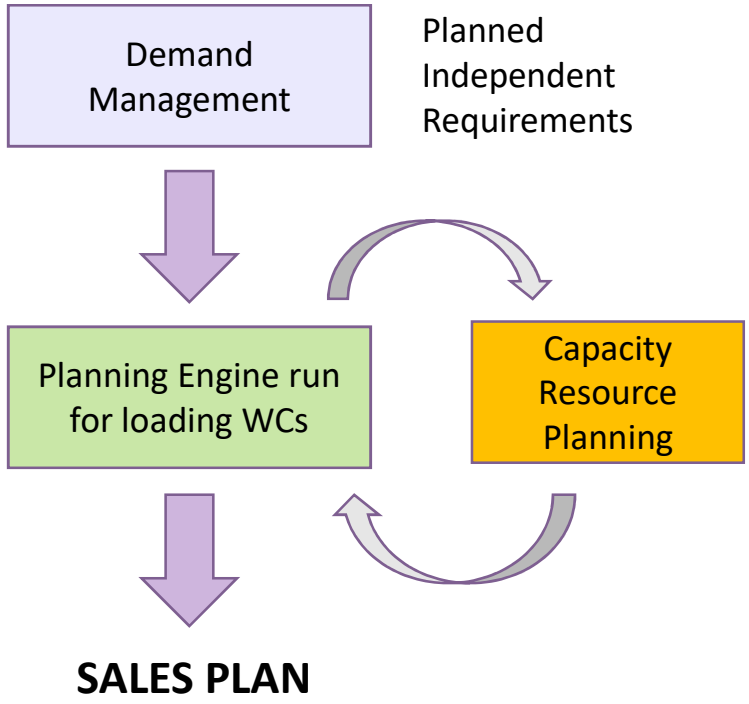
MRP Planning Engine Capacity Load

It is crucial to consolidate demand into a feasible plan: with the support of the “MRP Planning Engine Capacity Planning” app, it is possible to determine a **capacity-constrained demand plan,** i.e. **Sales Plan,** through a recursive cycles in planning with work-center capacity loading and capacity resource planning cycles.

The necessary **production capacity** is assessed over the medium-long-term horizon.

Strategic components sourcing is evaluated for determining **procurement strategies** and define purchase agreements.



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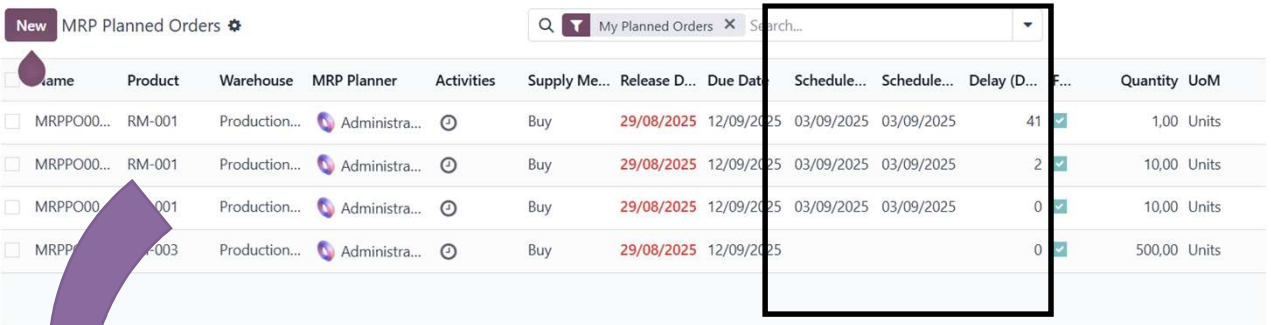
MRP Planning Engine Capacity Load

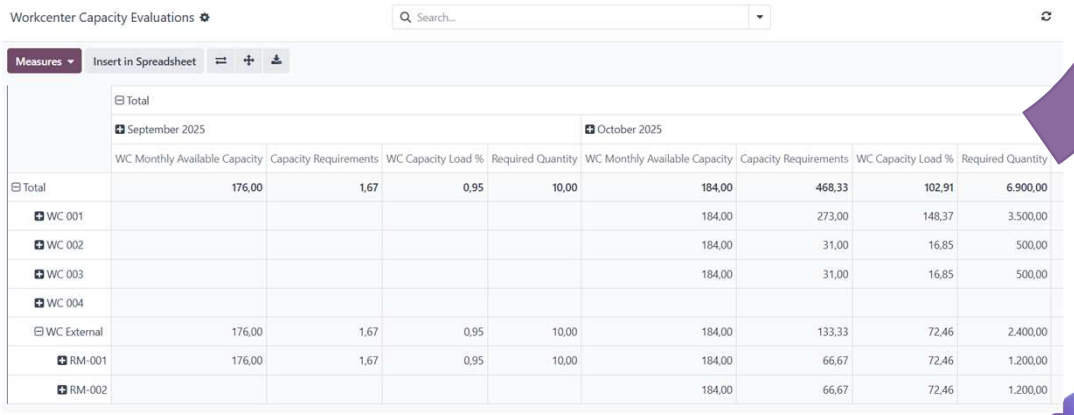
For critical products (make, buy and subcontracted) capacity load is calculated by scheduling planned orders.

Overloaded Work Centers are to be managed to achieve a Capacity Constrained Demand Plan.

Real-time simulations are possible to assess the impacts of changes in available capacity (calendar and installed capacity) Monthly Overloaded Work Centers can be filtered.



Monthly Workcenter Capacity Evaluation



Capacity evaluation: available vs requirements

Raw materials Quantity forecasting for procurement

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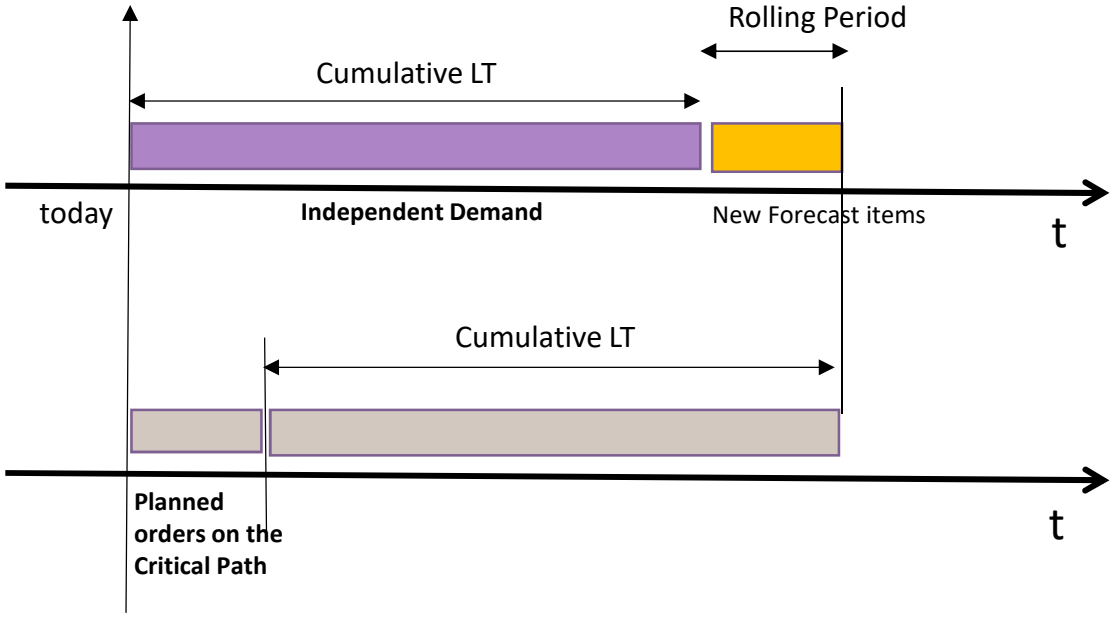
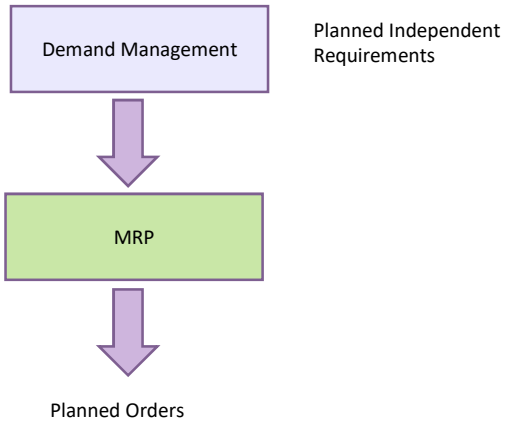
MRP Planning Engine Capacity Load

In the Demand Management, it is essential to enter new forecast items with a rolling approach while protecting the current plan before the planning time fence.

The Cumulative lead time can be estimated using **the Planning Engine BoM DLT report**.





The **Total Replenishment Lead Time** (Planning Time Fence) is managed at the MRP Parameter level. Creating a Demand Item inside the pre-planning fence window triggers a warning about potential plan infeasibility. This is the basis for implementing a proper **Demand Management** process.

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The BoM Decoupled Lead Time Report

Print BoM explosion DLT

Product PF-001

BoM PF-001 Manufacture this product

Warehouse Production Plant

Quantity 1,00 Units

MRP Planning Parameter ☑

Supply Method Produce

LT (days) 5,00

DLT (days) 25,00

CLT (days) 25,00

BoM Level	Product	Qty	UoM	Is Storable?	Supply Method	MRP Plannin...	Reorder Point	BoM	LT (days)	DLT (days)	CLT (days)	Critical Path
1	SF-001	1,00	Units	☑	Produce	☑	☐	PF-001	5,00	15,00	15,00	☐
2	RM-001	1,00	Units	☑	Buy	☑	☐	SF-001	10,00	10,00	10,00	☐
2	RM-002	1,00	Units	☑	Buy	☑	☐	SF-001	10,00	10,00	10,00	☐
2	Consumable 001	1,00	Units	☐		☐	☐	SF-001	10,00	10,00	10,00	☐
1	Sub_001	1,00	Units	☑	Subcontracting	☑	☐	PF-001	10,00	20,00	20,00	☑
2	RM-001	1,00	Units	☑	Buy	☑	☐	Sub_001	10,00	10,00	10,00	☑
2	RM-002	1,00	Units	☑	Buy	☑	☐	Sub_001	10,00	10,00	10,00	☑
2	Consumable 001	1,00	Units	☐		☐	☐	Sub_001	10,00	10,00	10,00	☑
1	RM-003	1,00	Units	☑	Buy	☑	☑	PF-001	10,00	10,00	10,00	☐

Decoupled Lead Time
Cumulative Lead Time

Stock position determination

Critical Path determination

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MRP Planning Engine Availability Check

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The promise delivery date determination

In bidding process, the availability check for determining the promise delivery date in customer quotation phase is one of the biggest issues.

The “MRP Planning Engine Availability Check” tool supports production feasibility check of customer requested quantity based the projected stock availability at all BoM’s levels.

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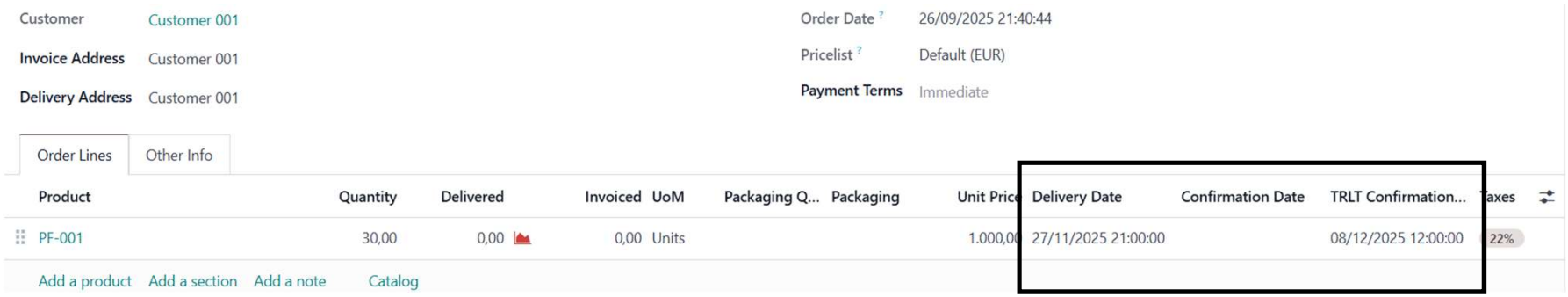
Sales order delivery date confirmation

At sales order item level the customer's request **delivery date** is managed. The management of its confirmation is crucial. The **confirmation date** is handled at the sales order line level and is relevant for material requirements planning. The **Total Replenishment Lead Time Confirmation Date** supports the customer order confirmation process.



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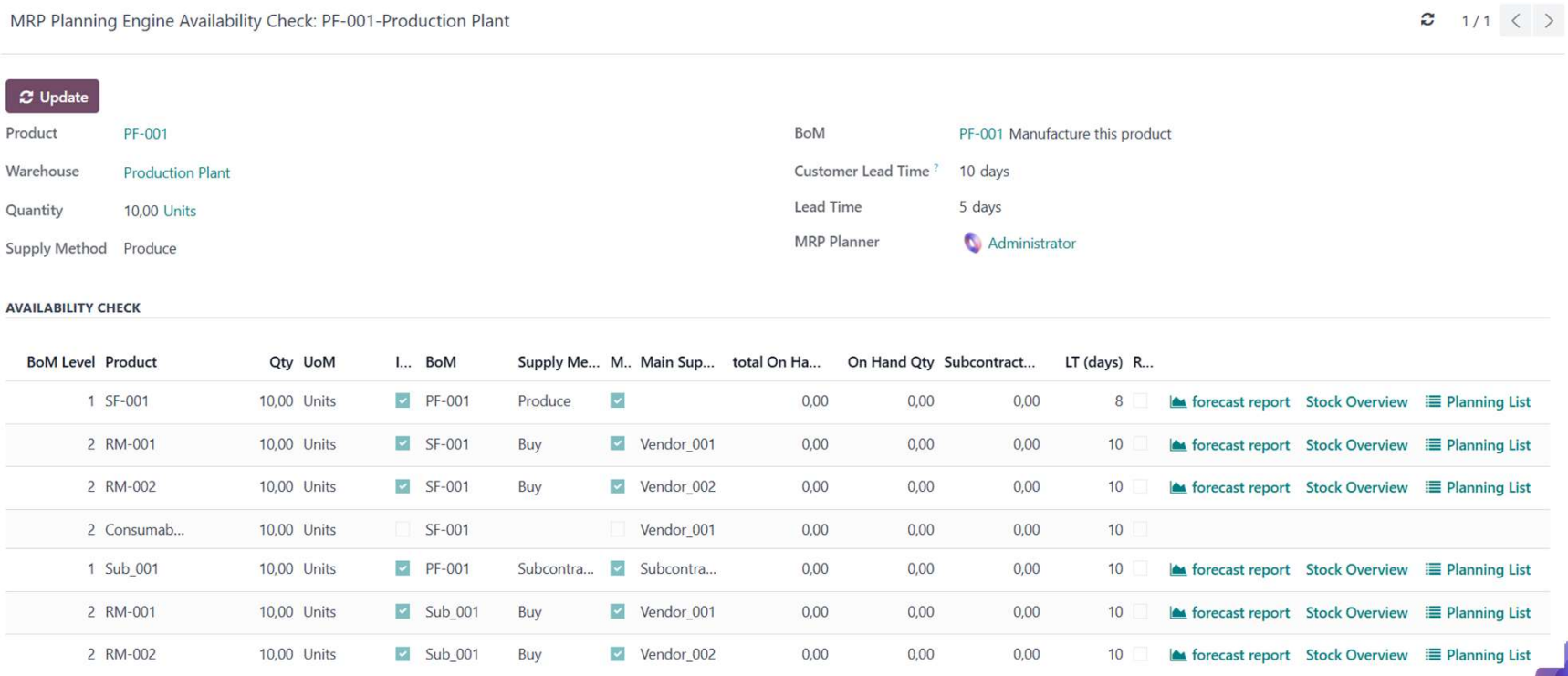
Planning Engine Availability Check report

In case of material unavailability on the customer's requested date, or for managing delivery delays, it is essential to manage the delivery date confirmation process. The **Planning Engine Availability Check report** supports the customer delivery confirmation process providing full visibility across the entire BoM explosion with stock, ATP, and planning data


MRP Planning Engine Availability Check: PF-001-Production Plant

1 / 1

Update

Product	PF-001	BoM	PF-001 Manufacture this product
Warehouse	Production Plant	Customer Lead Time	10 days
Quantity	10,00 Units	Lead Time	5 days
Supply Method	Produce	MRP Planner	Administrator

AVAILABILITY CHECK

BoM Level	Product	Qty	UoM	I...	BoM	Supply Me...	M..	Main Sup...	total On Ha...	On Hand Qty	Subcontract...	LT (days)	R...			
1	SF-001	10,00	Units	☑	PF-001	Produce	☑		0,00	0,00	0,00	8	☐	forecast report	Stock Overview	Planning List
2	RM-001	10,00	Units	☑	SF-001	Buy	☑	Vendor_001	0,00	0,00	0,00	10	☐	forecast report	Stock Overview	Planning List
2	RM-002	10,00	Units	☑	SF-001	Buy	☑	Vendor_002	0,00	0,00	0,00	10	☐	forecast report	Stock Overview	Planning List
2	Consumab...	10,00	Units	☐	SF-001		☐	Vendor_001	0,00	0,00	0,00	10	☐			
1	Sub_001	10,00	Units	☑	PF-001	Subcontra...	☑	Subcontra...	0,00	0,00	0,00	10	☐	forecast report	Stock Overview	Planning List
2	RM-001	10,00	Units	☑	Sub_001	Buy	☑	Vendor_001	0,00	0,00	0,00	10	☐	forecast report	Stock Overview	Planning List
2	RM-002	10,00	Units	☑	Sub_001	Buy	☑	Vendor_002	0,00	0,00	0,00	10	☐	forecast report	Stock Overview	Planning List

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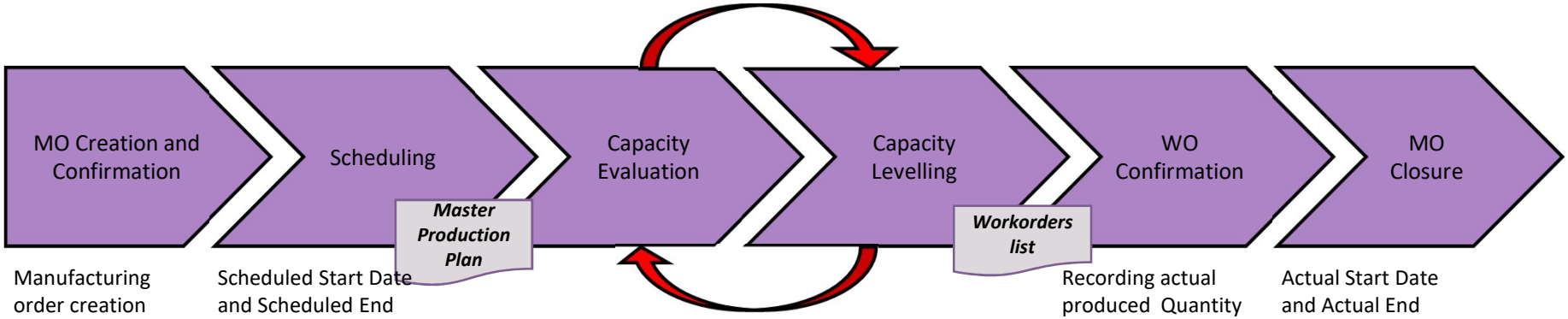
The Manufacturing Execution Solution

The Manufacturing Execution process



Manufacturing order creation manually or by converting planned orders (MRP Planning Engine)

Planned Start Pivot Date and Planned End Pivot Date determination at Manufacturing Order level

Material Availability Check

Scheduled Start Date and Scheduled End Date determination at single WorkOrder Level and the overall Manufacturing Order Level and

Capacity Loading at WorkCenter Level

Capacity Availability Check

Detailed Capacity Evaluation for determining capacity shortage issue

Capacity levelling by the Mid-Point Scheduling tool for WorkOrders Sequencing

Recording actual produced Quantity at single WorkOrder level

Recording actual duration times for single WorkOrder

Actual Scheduled Start Date and Actual Scheduled End Date determination at WorkOrder Level

Actual Start Date and Actual End Date determination at Manufacturing Order Level

The OpenValue Solution supports the E2E Manufacturing Execution process from the manufacturing order creation to its closure

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MRP Shop Floor Control

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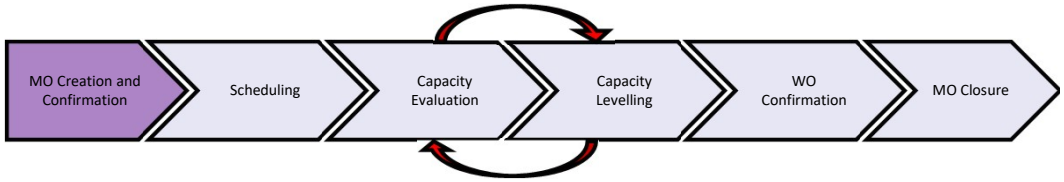
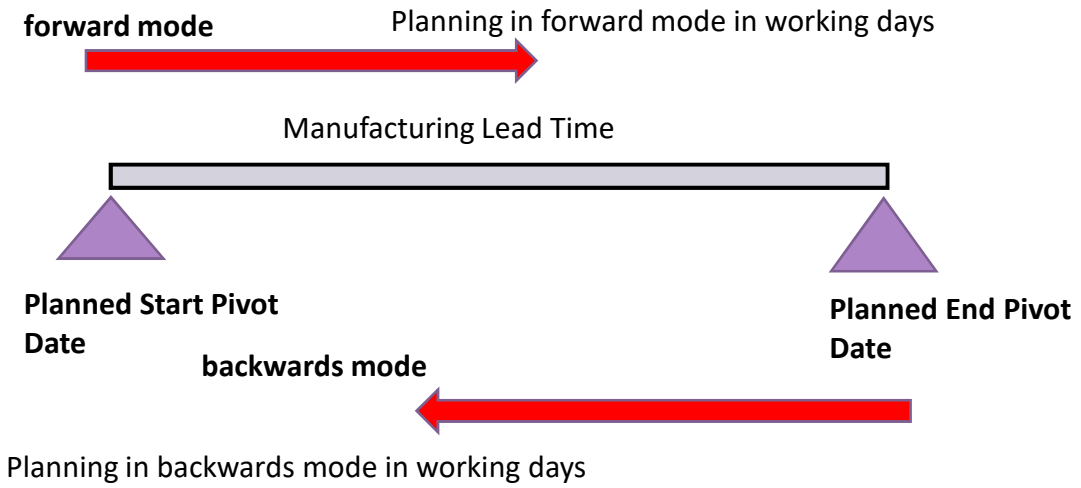
Manufacturing Order Creation and Confirmation



Planned Pivot Dates determination

- The planned pivot dates are determined by taking into account the **Manufacturing Lead Time** in product master data
- According to the "**planning mode**" indicator, the planning is performed in **forward mode** starting from the Planned Start Pivot date or in **backwards mode** starting from the Planned End Pivot date
- The planning is performed in working days based to the working calendar set at warehouse level



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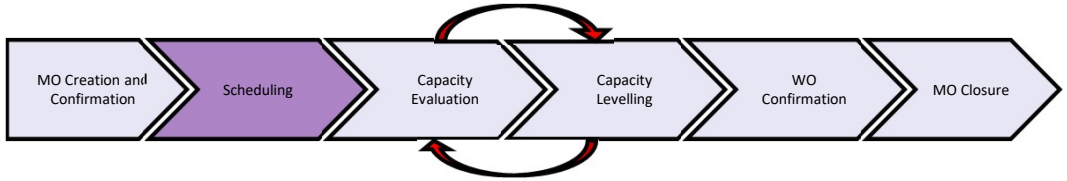
Workorders Scheduling and Work Center Capacity Loading



Scheduled Dates determination

the Workorder Scheduled Dates determination is performed in forward mode and based on the following times:

Queue time

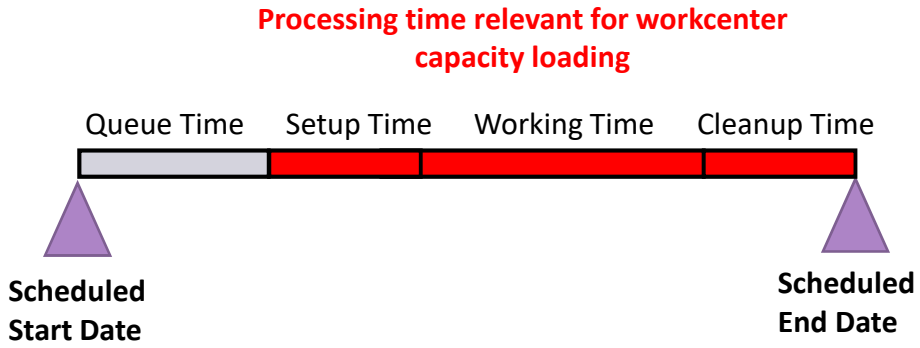
Cycle time

Setup time

Cleanup time

The scheduling is performed according the working calendar entered in the Work Center for each operation in BoM.

Rescheduling is possible until the next phase, the workorder confirmation, has not been started.



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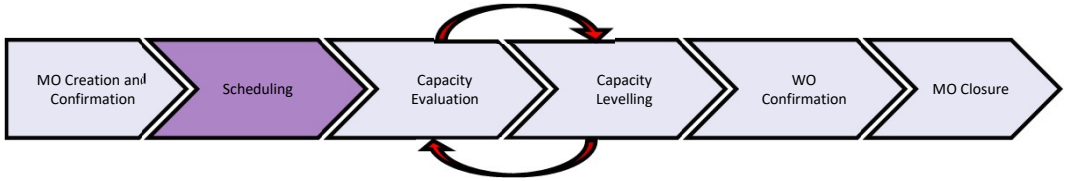
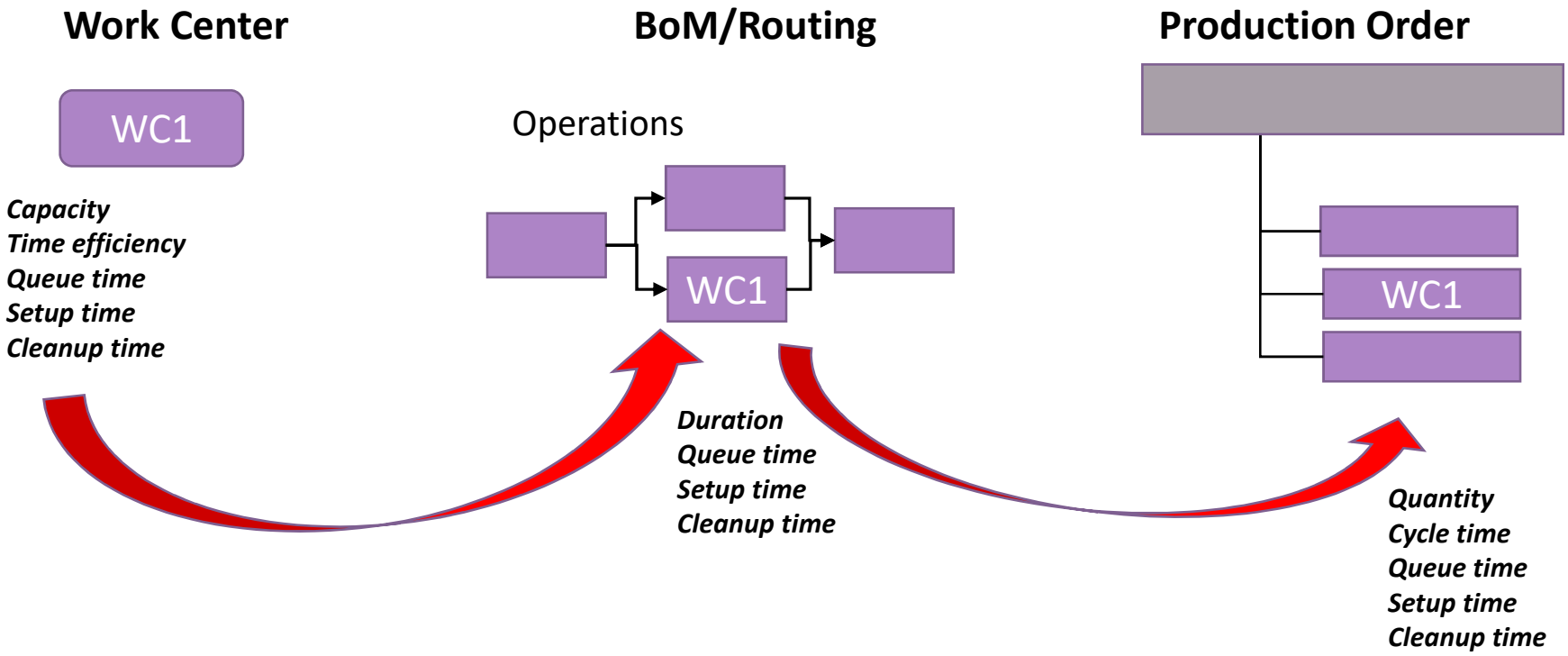
Operation Times



The operation times are set in work center master data as default and reported in the operations and workorders



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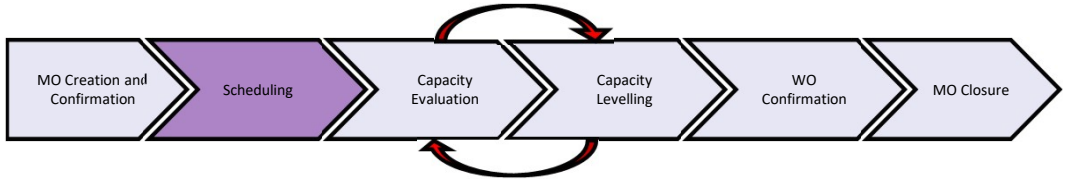
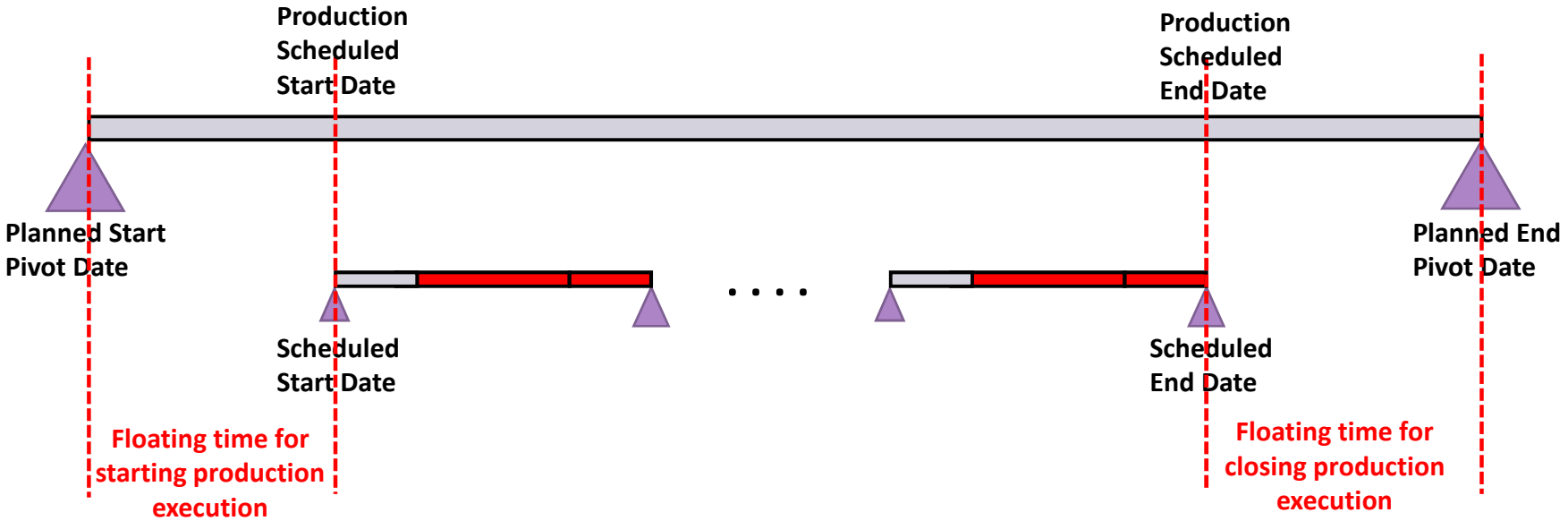
Workorders Scheduling and Work Center Capacity Loading



Planned dates and Scheduled dates

The comparison between the Planned Pivot Period and Scheduled Period is useful for checking the correctness of manufacturing master data (i.e. planned LT vs time cycles) and the delay in the overall supply chain planning



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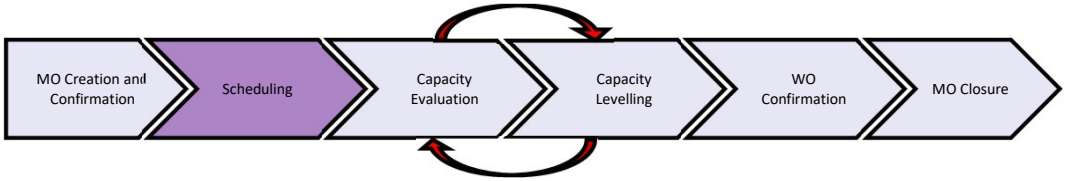
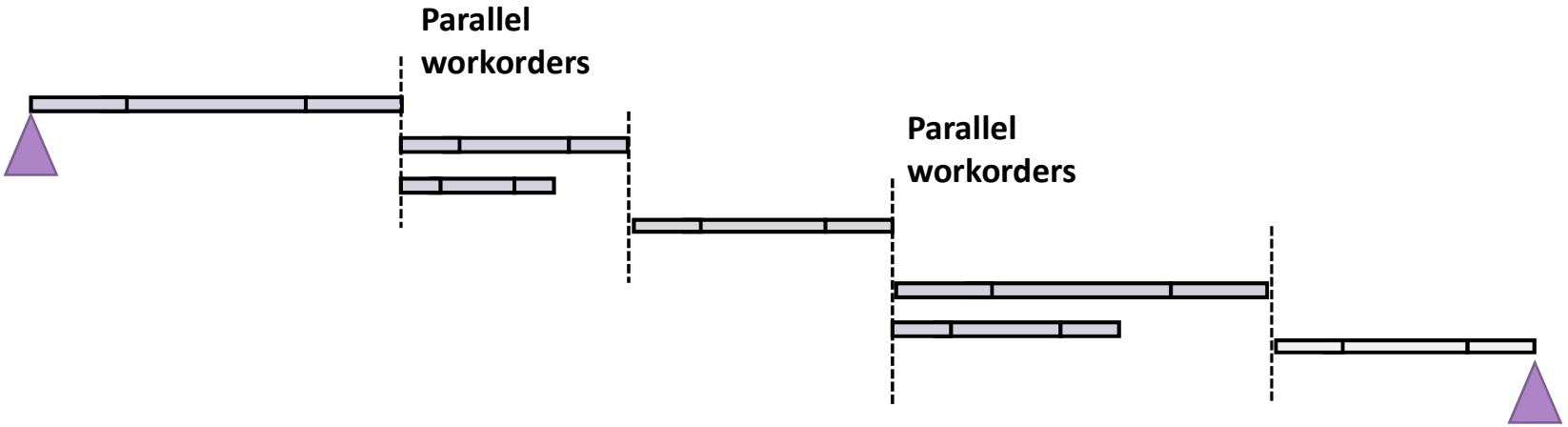
Workorders Scheduling and Work Center Capacity Loading



Workorders Sequencing

The workorders sequencing is based on the sequence assigned to each BoM's operation. The sequence can be changed in the manufacturing order.

Parallel workorders (operations with the same sequence in BoM's operations) are scheduled in overlapping with the same start scheduled date.



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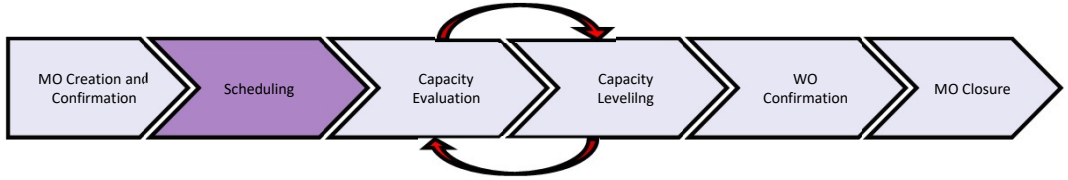
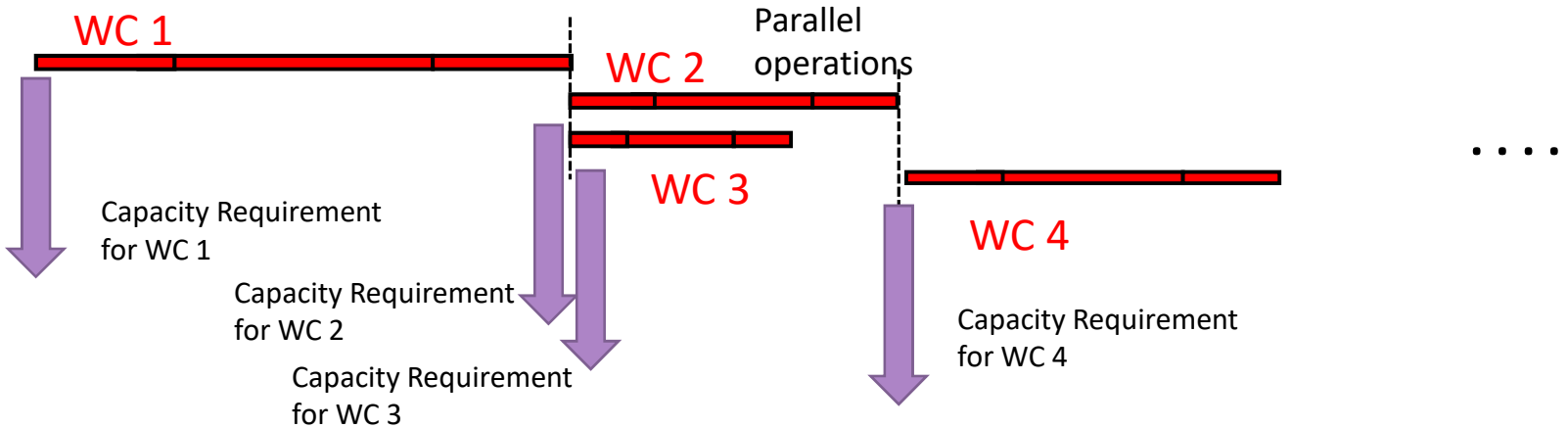
Workorders Scheduling and Work Center Capacity Loading



Work Center Capacity Loading

The Workorder Capacity Requirements are calculated in scheduling phase based on the scheduled working hours, hence capacity loading occurs for the corresponding Work Center.

The capacity requirements are to be compared with the available capacity in the subsequent capacity evaluation phase



Work Center

Capacity available
Capacity Requirements

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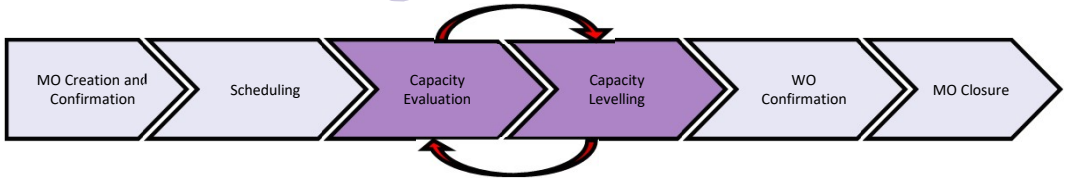
Capacity Evaluation and Levelling



Work Center Capacity Evaluation

To Evaluate the Manufacturing Plan feasibility for capacity point of view a Capacity Evaluation has to be performed for the bottlenecked Work Centers at least.

The following figures are provided:

- the weekly available capacity to be compared with the capacity requirements over the time, week by week, at Work Center level
- The work center capacity load in percentage and the remaining capacity are calculated for supporting the subsequent capacity levelling phase

The capacity load can be displayed in the manufacturing order to check immediately its feasibility

Capacity Levelling with Mid-Point Scheduling technique

Capacity levelling is achieved by moving workorders over the time so the corresponding capacity requirement is moved also. The **mid-point scheduling** logic has been implemented for determining new scheduled dates for all the remaining active workorders.

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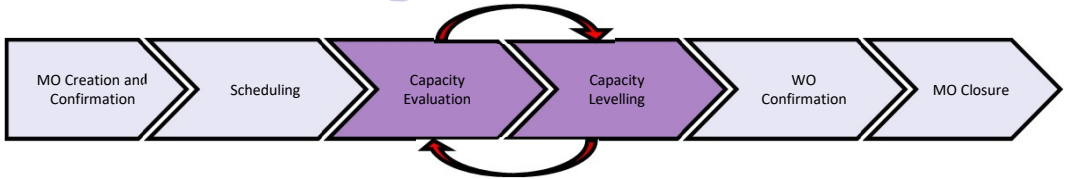
Capacity Evaluation and Levelling



Work Center Capacity Planning

A capacity planning process has to be carried out to check the capacity load.

Real-time simulations are possible to assess the impacts of changes in available capacity (calendar and installed capacity).

Overloaded work centers can be identified and selected.

Workcenter Capacity Evaluation

Work Center Capacity Evaluation

Search...

Measures | Insert in Spreadsheet

	Total					
	W42 2025			W43 2025		
	WC Weekly Available Capacity	Capacity Requirements	WC Capacity Load %	WC Weekly Available Capacity	Capacity Requirements	WC Capacity Load %
Total	40,00	28,00	70,00	40,00	82,00	205,00
WC 001	40,00	28,00	70,00	40,00	82,00	205,00
WC 002						
WC 003						
WC 004						

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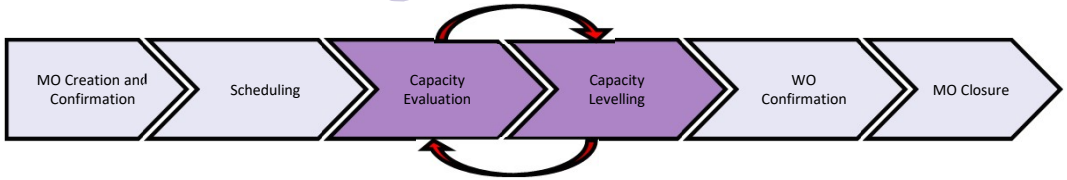
Capacity Evaluation and Levelling

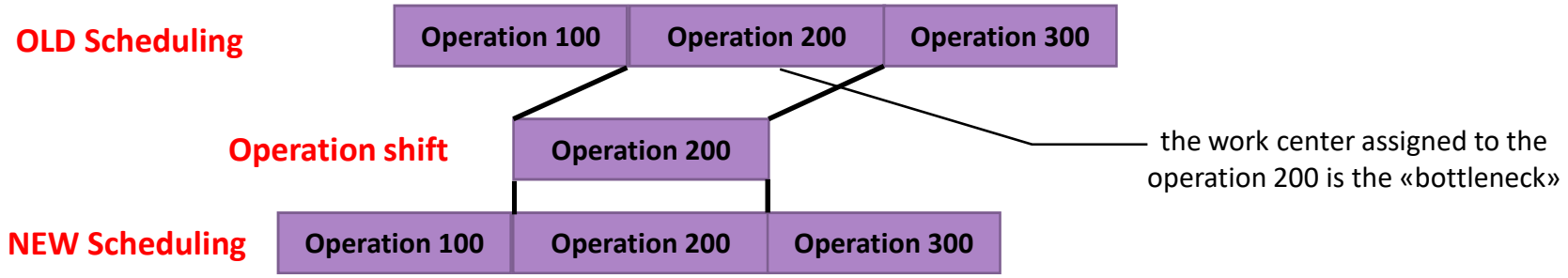


Mid-Point Scheduling tool

Operations placed on a work center overloaded (e.g. bottleneck) are to be moved over the time for determining new capacity loading.

By using the Mid-Point Scheduling tool, we have as follows:

- all other active workorders are moved in backward or forward scheduling according to if bottleneck is moved in backward or forward mode; therefore, all the capacity requirements are moved also
- Workorder in progress cannot be moved: check whether the new scheduling is compliant with the start date of workorders in progress
- Closed and cancelled workorders are not taken into account
- Parallel workorders are scheduled with the same scheduled start



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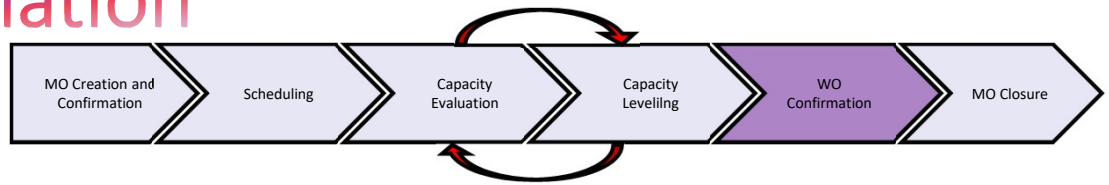
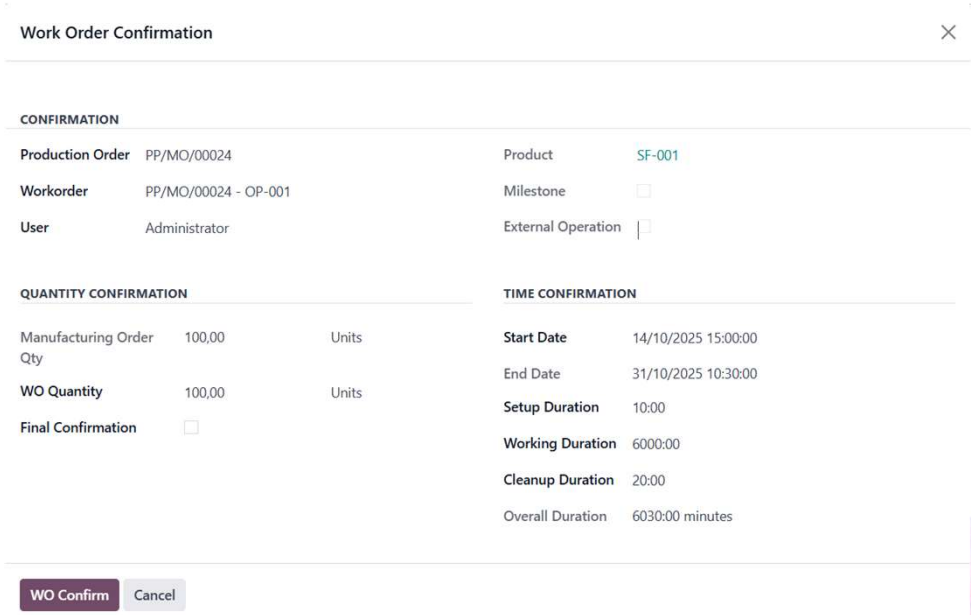
Workorder Confirmation



Workorder Confirmation

- Workorder confirmation phase is to record actual produced quantity for a single workorder and declaring actual times, i.e. actual working duration, actual setup duration and actual cleanup duration; therefore, the effective actual overall duration is calculated.
- All actual durations are reported in time tracking section at workorder level
- the overall duration is determined
- The actual duration are relevant for actual direct cost posting



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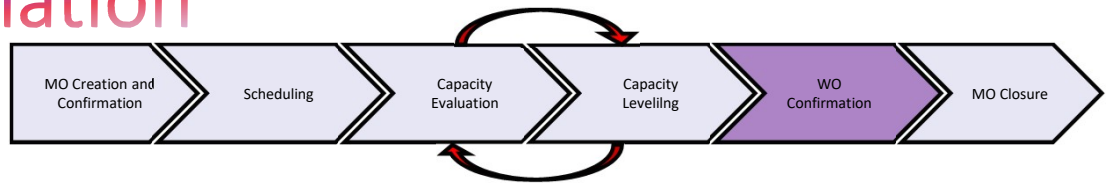
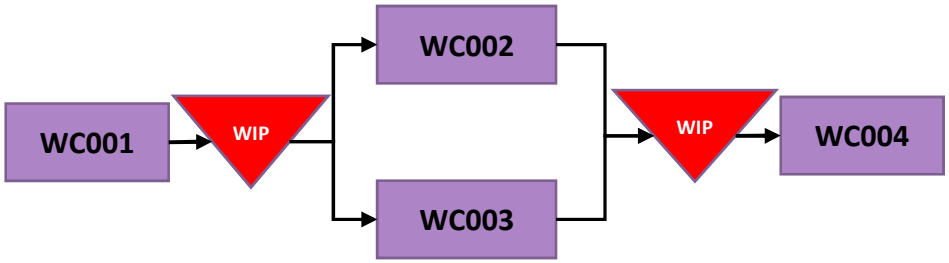
Workorder Confirmation



Workorder Confirmation: partial confirmation

By performing the workorder confirmation several times for partial quantities, the confirmed quantities are moved down in the production process as WIP quantity available for starting the next workorders. In this way, “one piece flow” procedure can be managed.



The WIP quantity is calculated on real time for each workorder based on its partial confirmations.

Capacity load overview

- Expected duration in working time
- Elapsed in calendar time
- Effective duration in working time

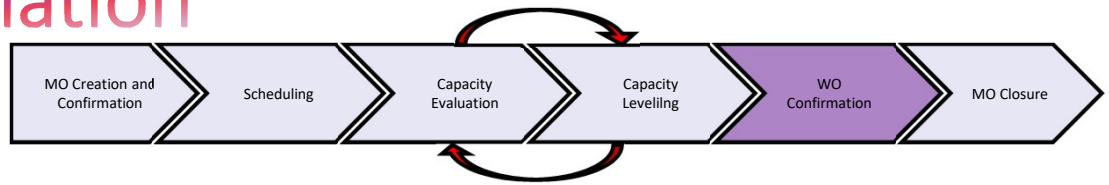
- WO queus quantity
- Wo processed quantity

Dates | Components | Work Orders | By-Products | Miscellaneous | Times | Tools | Production Unit Costs | Production Costs

Capacity Load

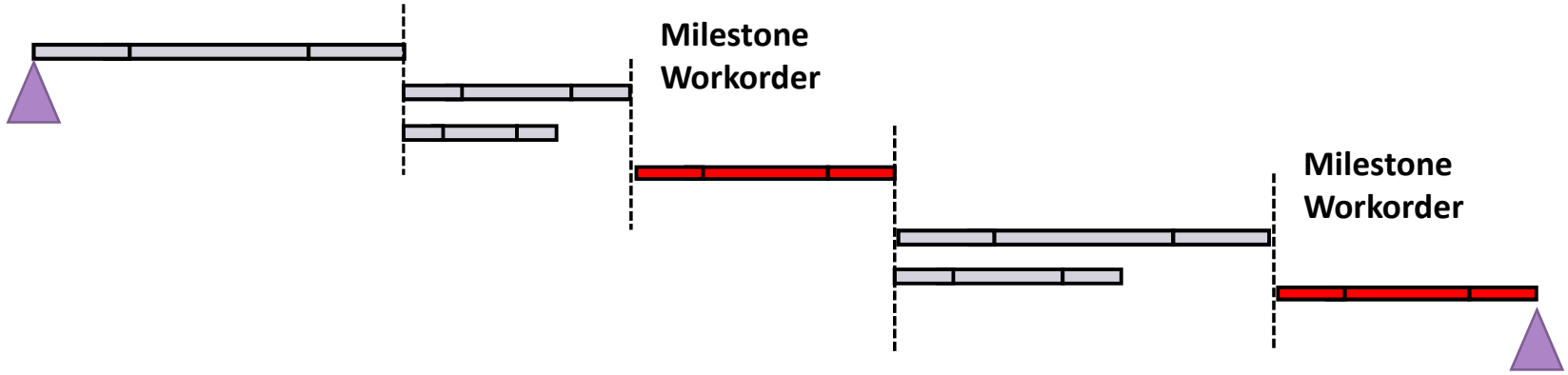
Work Cent...	Scheduled Start D...	Scheduled End Date	M..	F..	Expected ...	Elapsed	Effective Du...	WO Qty	Queue Qty	Previous ...	Purchase ...	Status	WC Status
WC 001	14/10/2025 15:00:00	31/10/2025 10:30:00			6030:00	5350:00	610,00	10,00	90,00			In Progre...	READY
WC 002	31/10/2025 10:30:00	18/11/2025 16:00:00			6030:00	00:00	0,00	0,00	10,00	PP/MO/00...		Waiting f...	READY
WC 003	31/10/2025 10:30:00	18/11/2025 16:00:00			6030:00	00:00	0,00	0,00	10,00	PP/MO/00...		Waiting f...	READY
WC 004	18/11/2025 16:00:00	05/12/2025 11:30:00	☑		6030:00	00:00	0,00	0,00	0,00	PP/MO/00...		Waiting f...	READY

Workorder Confirmation



Milestone Workorder

Usually all workorders are to be confirmed in their sequence; therefore, it is not possible to confirm a workorder without confirming all the previous ones. Through the milestone feature it is possible to confirm a milestone workorder without having confirmed all the previous ones**: all previous workorders not yet closed are confirmed with standard times.**



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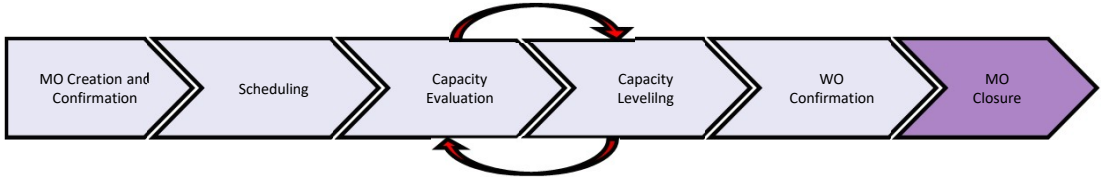
Manufacturing Order Closure



Manufacturing Order Closure

Manufacturing actual dates are determined based on times declaration in Work Order Confirmation phase; actual Dates are determined for production orders without workorders also.

The manufacturing order closure cannot be performed if any workorder has not been performed yet.

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Manufacturing Times classification

- ***Standard Times*** calculated based on the manufacturing data structure, i.e. BoM and workcerters; these are useful for engineering manufacturing dpt as reference for checking the correctness of scheduling data
- ***Planned Times*** calculated from operations in production order before their executing (freezing at production order confirmation phase) to provide a reference starting point to measure production department efficiency
- **Unplanned Times** calculated at confirmation phase from workorders created manually so without reference to operations
- ***Actual Times*** determined in real time during the manufacturing execution phase related to real workorders execution times

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Manufacturing Times figures

All times figures related to workorders scheduling and execution are reported at manufacturing order level

- ***Total setup time***
- ***Total working time***
- ***Total cleanup time***
- **Overall time = *Total setup time* + *Total working time* + *Total cleanup time***

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MRP SFC Master Production Plan

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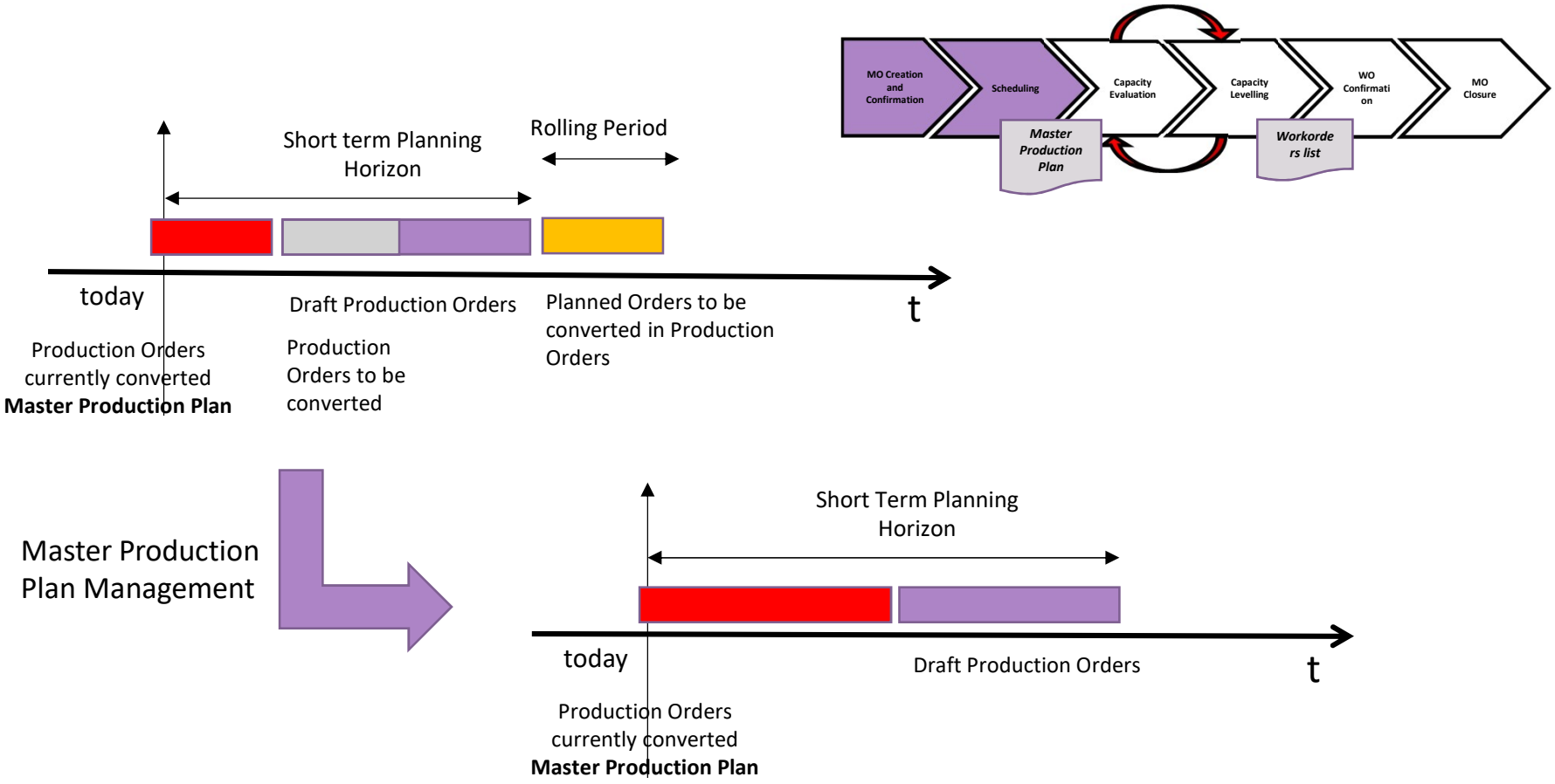
The Master Production Plan process overview



The correct execution of the Master Production Plan management process is essential to ensure its feasibility in terms of the availability of both components and production resources.

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Material Availability Check on production orders in Draft status

- A material availability check for production orders in draft status ensures that all components required for their execution are available.
- A system-supported organizational procedure is crucial for promptly resolving component shortages and allocating components to production orders according to priorities.

Reference	Release Date	Planned Start Pivot Date	Planned End Pivot Date	Product	Source	Components Availability in Draft	Component ...	Quantity	UoM	Company	State
PP/MO/00011	08/10/2025	15/10/2025 13:00:00	23/10/2025 02:00:00	SF-001	Engine: 2025...	Available		100,00	Units	OpenValue C...	Draft
PP/MO/00012	09/10/2025	16/10/2025 13:00:00	24/10/2025 02:00:00	SF-001	Engine: 2025...	Available		100,00	Units	OpenValue C...	Draft
PP/MO/00013	17/10/2025	24/10/2025 13:00:00	02/11/2025 01:00:00	PF-001	Engine: 2025...	Not Available		100,00	Units	OpenValue C...	Draft
PP/MO/00014	20/10/2025	27/10/2025 13:00:00	04/11/2025 01:00:00	PF-001	Engine: 2025...	Not Available		100,00	Units	OpenValue C...	Draft
PP/MO/00015	03/11/2025	10/11/2025 13:00:00	18/11/2025 01:00:00	SF-001	Engine: 2025...	Available		30,00	Units	OpenValue C...	Draft
PP/MO/00016	12/11/2025	19/11/2025 13:00:00	27/11/2025 01:00:00	PF-001	Engine: 2025...	Not Available		30,00	Units	OpenValue C...	Draft

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Material and Capacity Availability Checks on production orders conversion

- During the conversion of draft production orders, materials and capacity availability checks are performed to identify missing components and work center overloads on a weekly basis.
- In case components are not available for a production order, a message is issued upon conversion (**configurable via a setting to be not relevant, warning or error**).
- In case resources are not available for a production order, a message is issued upon conversion (**configurable via a setting to be not relevant or warning**).
- The subsequent production capacity management process addresses potential capacity spikes by leveling the capacity load and sequencing work orders.

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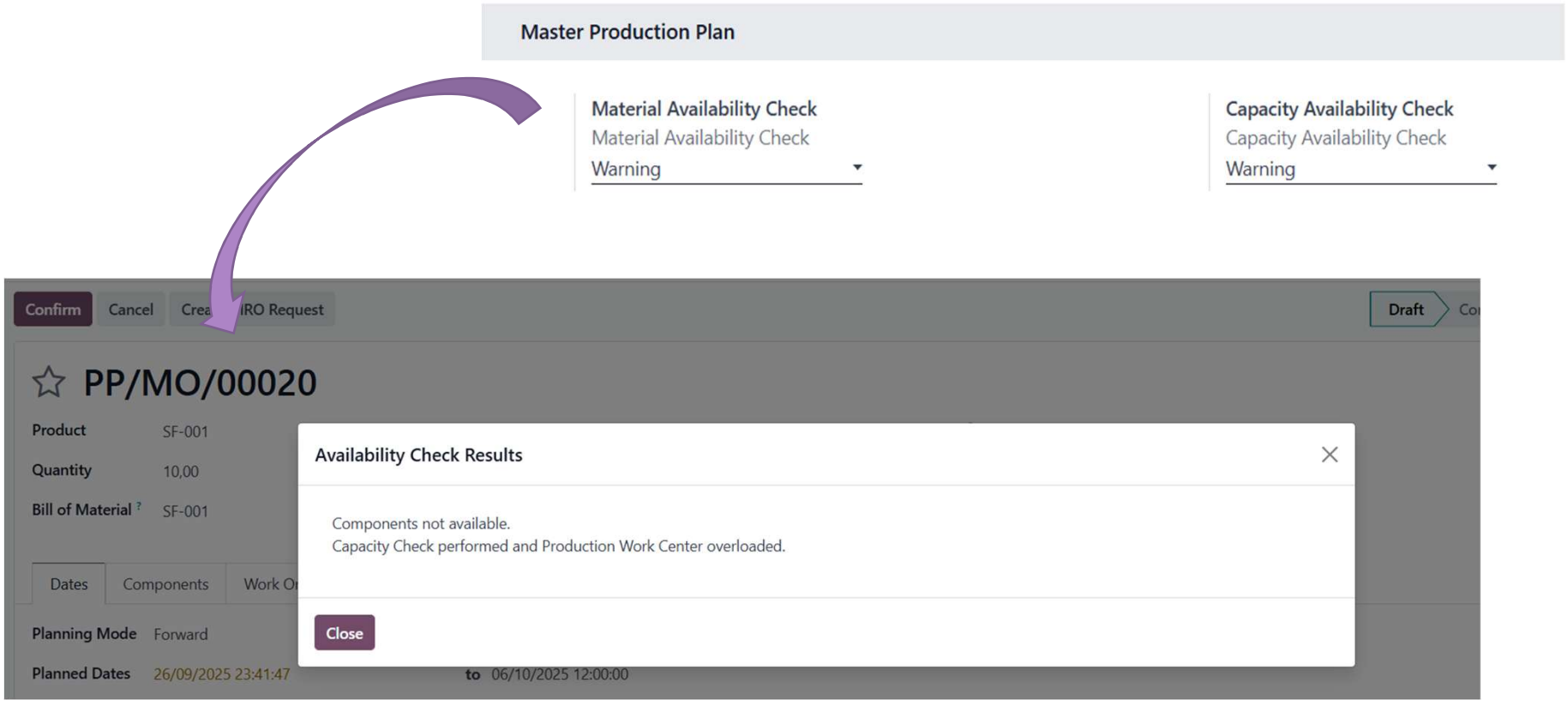
Material and Capacity Availability Checks on production orders conversion



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Production orders release process

An **Release Period i**n working days is defined for the management of production orders release. The **Release Date** determines when a production order must be release to shop floor control, the scheduling is performed following an ‘as soon as possible’ approach. A filter allows the selection of the production orders to be confirmed.

Reference	Release D...	Planned Start Pivot ...	Planned End Pivot ...	Product	Source	Componen...	Componen...	Quantity	UoM	Company	State
PP/MO/00...	19/09/2025	26/09/2025 23:39:07	06/10/2025 12:00:00	SF-001			Available	100,00	Units	OpenValue ...	Confirmed
PP/MO/00...	19/09/2025	26/09/2025 23:39:41	06/10/2025 12:00:00	SF-001			Not Availab...	1.000,00	Units	OpenValue ...	Confirmed
PP/MO/00...	19/09/2025	26/09/2025 23:41:07	06/10/2025 12:00:00	SF-001			Not Availab...	10,00	Units	OpenValue ...	Confirmed
PP/MO/00...	19/09/2025	26/09/2025 23:41:47	06/10/2025 12:00:00	SF-001			Not Availab...	10,00	Units	OpenValue ...	Confirmed
PP/MO/00...	19/09/2025	26/09/2025 23:43:21	06/10/2025 12:00:00	SF-001			Not Availab...	10,00	Units	OpenValue ...	Confirmed
PP/MO/00...	19/09/2025	26/09/2025 23:53:43	06/10/2025 12:00:00	SF-001		Not Availab...		10,00	Units	OpenValue ...	Draft
PP/MO/00...	08/10/2025	15/10/2025 13:00:00	23/10/2025 02:00:00	SF-001	Engine: 202...		Not Availab...	100,00	Units	OpenValue ...	Confirmed

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MRP SFC Scheduling Engine

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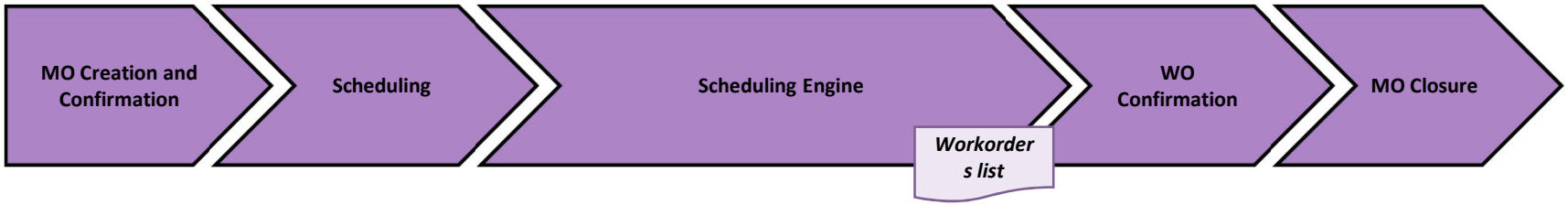
The Manufacturing Execution process supported by the Scheduling Engine



WorkOrders scheduling dates determination with finite capacity constraint methods for capacity leveling goal

Scheduling sequence is assigned to each workorder for sequencing their processing per workcenter

The “MRP Schedule Engine” provides a comprehensive tool for managing workorders finite-capacity scheduling.

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The Scheduling Engine

An **Optimizer** performs **finite capacity scheduling** of the all open Workorders

Objective Functions (KPI):

- **LENGTH MOs – WIP**
- **MAKESPAN**
- **SUM COMPLETITION**:
- **TARDINESS**

Scheduling Engine

Capacity Leveling
Workorder
Sequencing

The outcome is **daily resources capacity leveling** (the master production plan is feasible) and the assignment of the **processing sequence** to workorders. In this way, operations are assigned to production resources without conflicts.

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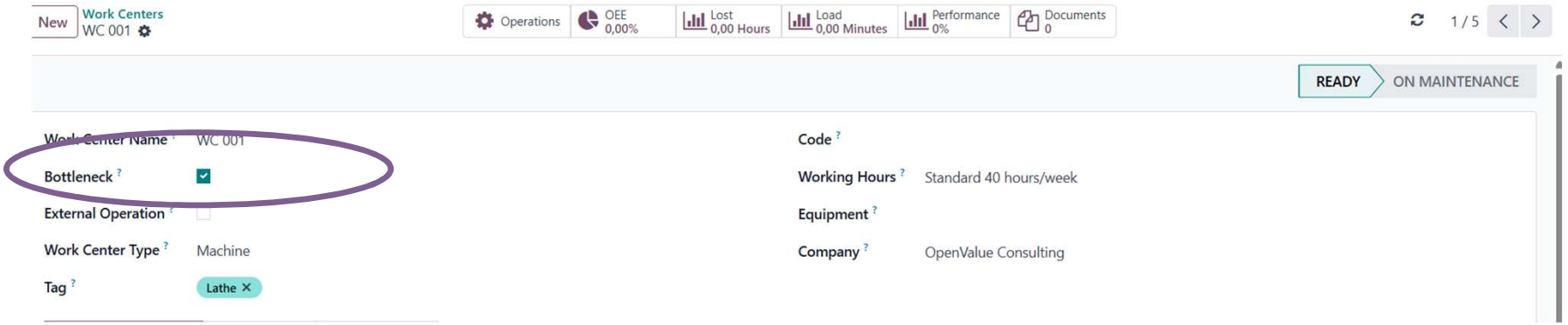
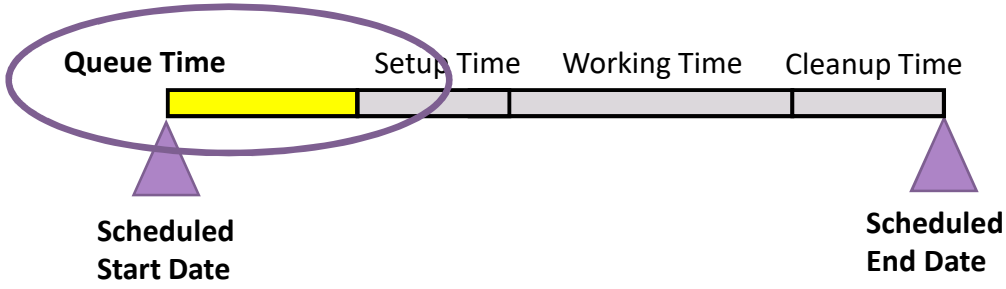
The Bottleneck Work Center

- A work center can be marked as a bottleneck.
- A check ensures that there can only be one bottleneck in a routing or in a production order



- The queue time of a bottleneck work center is considered as a time buffer and therefore is not modified by the scheduler.
- The queue times of the other work centers are optimized.



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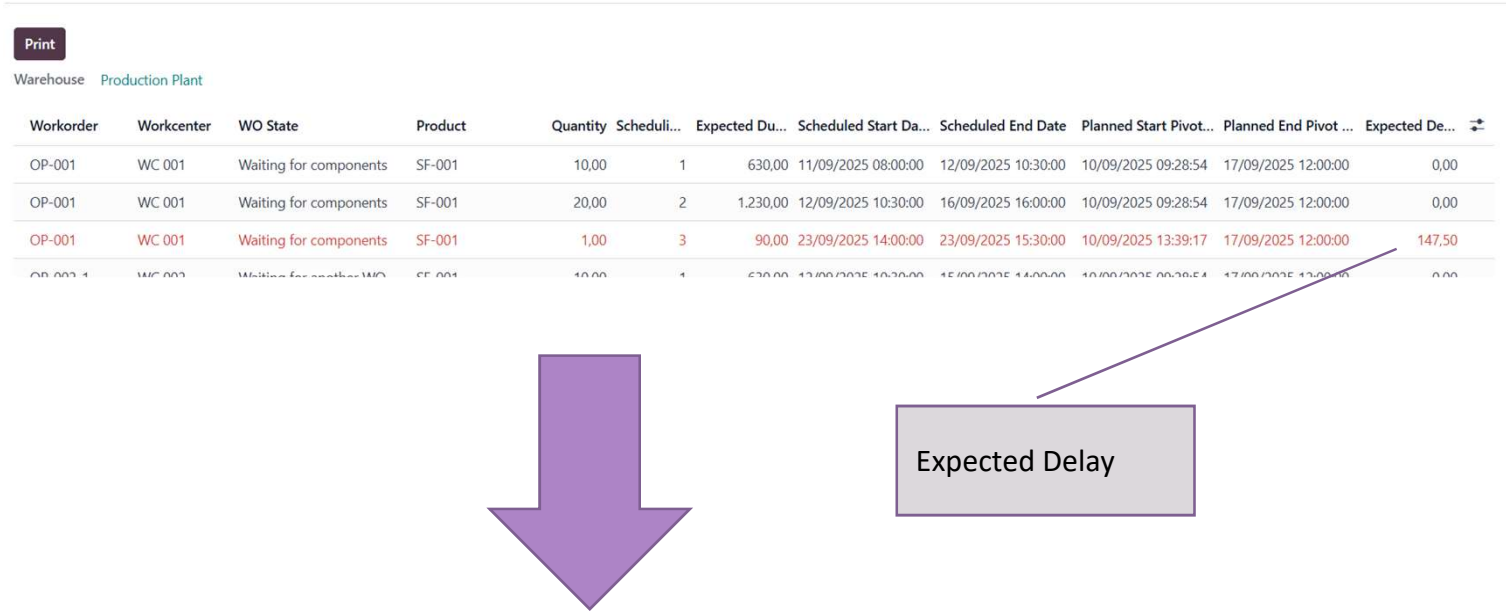
The Delay Analysis in scheduling process

The **Scheduling Engine List** report allows to evaluate the scheduling results, highlighting delays respect to the planned end date

Scheduling Engine List



Expected Delay

Based on delays in the scheduling process, the sales order delivery date confirmation process is to be triggered.

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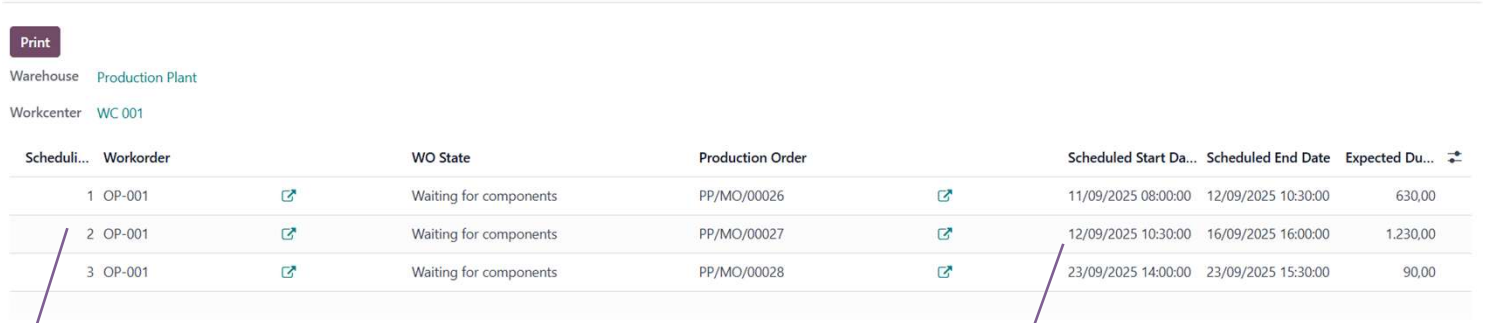
Publish master production plan

The **Scheduling Work Center List** report enables communication to the shop floor by production departments, i.e. work centers - of the respective workload (open work orders), the scheduled dates and the scheduling sequence

Scheduling Work Center List



Scheduling Sequence

Scheduling Dates

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The daily capacity work center load

A chart is available in the work center master to visualize its daily capacity load compared to its available capacity

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MRP Shop Floor Control External Operation

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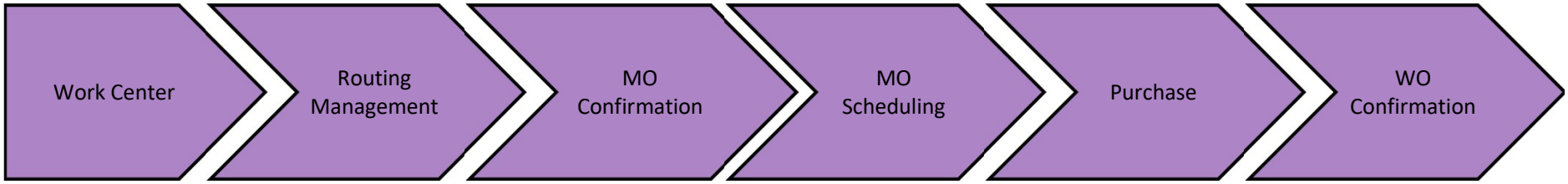
Shop Floor Control External Operation Process



Set a work center as external operation for managing production outsourcing activities

Checks are performed for operation times

A routing activity is set as external by assigning an external workcenter and an outsourced service product

Checks are performed for operation times

When confirming a Manufactiring Order, checks are performed to ensure full integration with purchase

Check is performed to avoid to cancel or reset the scheduling for MOs with confirmed purchase orders for external activities

In manufacturing order scheduling, a RfQ is automatically created for outsourced activities.

Manufacturing order scheduling is performed by taking into account purchase lead times

Purchase order automatically created reporting the reference to the MO.

The order and delivery dates are derived from order scheduling

Work Order Confirmation is designed specifically for external activity management.

An E2E process is supported from purchasing and production master data to purchase order invoice and work order confirmation

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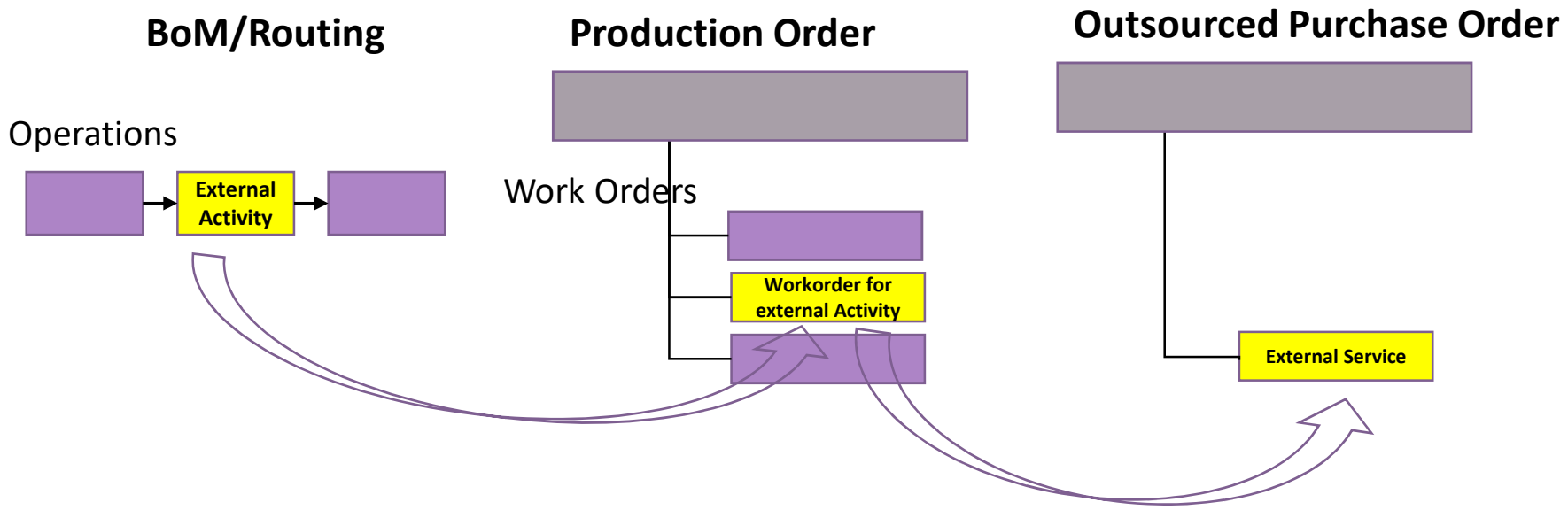
Shop Floor Control External Operation Process

Due to capacity constraints or technological specialization, some production activities (workorders) are to be outsourced to suppliers



For an effective solution in managing the outsourced production activities process, shop floor management is fully integrated with purchasing

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MRP SFC BoM Component Substitution

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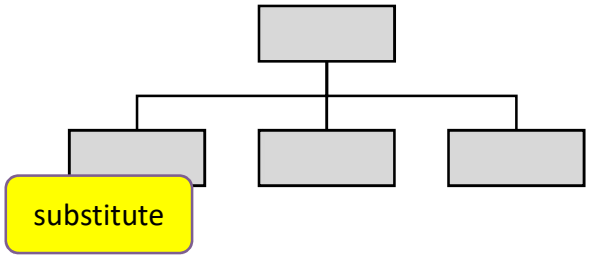
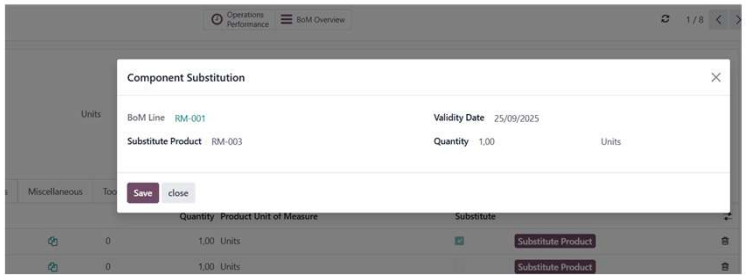
BoM Components Substitute or Alternative Components management

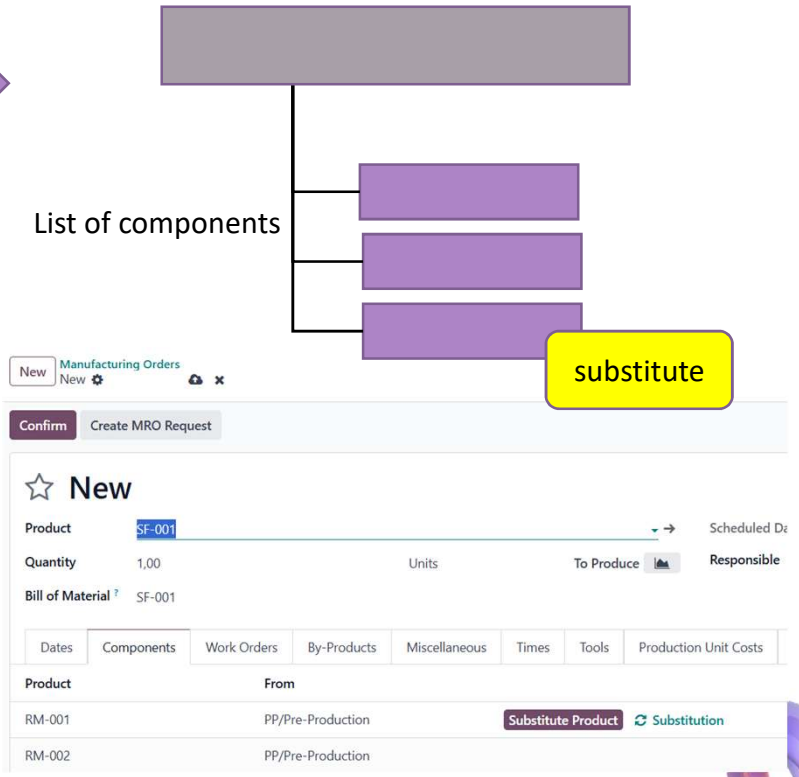
- It is possible to enter a substitute for each BoM item, detailing its code, quantity, unit of measure and Validity Date
- When processing manufacturing orders, single component can be substitute: this is useful for managing equivalent components with the main one, entered in the BoM line, in stockout or **Discontinued Parts process**

Bill of Materials





Production Order



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MRP SFC BoM Comparison

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BoM Comparison

SFC BoM Comparison compares two Bills of Materials as:

- **Single-level** comparison
- **Multi-level level-by-level** comparison (subassemblies/semifinished items included)
- **Multi-level summarized** comparison (components only)

Print BoMs Comparison **Multi-level Comparison:** Level by Level

BoM 1	PF-001	**BoM 2**	sub case: PF-001
BoM Type	Manufacture this product	BoM Type	Manufacture this product
Product Variant		Product Variant	

DIFFERENCES BOM 1

Product	Quantity	Unit of Measure	Apply on Variants
Consumable 001	2,00	Units	
RM-001	2,00	Units	
RM-002	2,00	Units	
RM-003	1,00	Units	
SF-001	1,00	Units	

DIFFERENCES BOM 2

Product	Quantity	Unit of Measure	Apply on Variants
Consumable 001	1,00	Units	
RM-001	1,00	Units	
RM-002	1,00	Units	

It supports the transition from **Engineering BoM (EBoM)** to **Manufacturing BoM (MBoM)**, helping engineering and operations align faster and reduce shop-floor issues.

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MRP Product Costing

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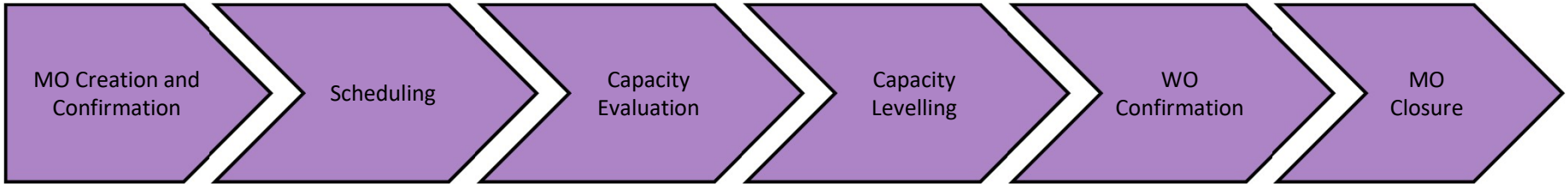
The Product Costing in the Manufacturing Execution Process



Standard Costs calculation

Planned Costs calculation and their freezing at manufacturing order confirmation phase

Actual Variable and Fixed Direct Costs determination

Financial and Analytic Postings for Actual Direct Costs

WIP calculated at Manufacturing Order Level

Variances Costs calculation

Financial and Analytic postings for Variances Costs

Overhead Costs and Full Industrial Cost determination

Analytic postings for Overhead Costs

The **OpenValue Product Costing** module supports the decision-making process in manufacturing execution providing with all necessary manufacturing costing figures

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Manufacturing Costs classification

- ***Standard Costs*** calculated based on the manufacturing data structure, i.e. BoM and standard costs in product master data; these are useful for engineering manufacturing dpt as reference to design costs

- ***Planned Costs*** calculated from components and operation in production order before its executing (freezing at production order confirmation phase) to provide a reference starting point to measure production department efficiency

- ***Actual Costs*** determined in real time during the manufacturing execution phase related to real components consumption and real workorders execution times; variances costs are determined and posted at production order closure

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Manufacturing Cost figures

All costing figures are provided both as unit and overall amount at manufacturing order level

- ***Component Consumption Cost***
- ***Variable Direct Cost***
- ***Fixed Direct Cost***
- ***ByProduct Amount***
- **Full Direct Cost =** Component Consumption Cost + Variable Direct Cost + Fixed Direct Cost - ByProduct Amount
- ***Full industrial Cost*** = Full Direct Cost + Overhed Costs

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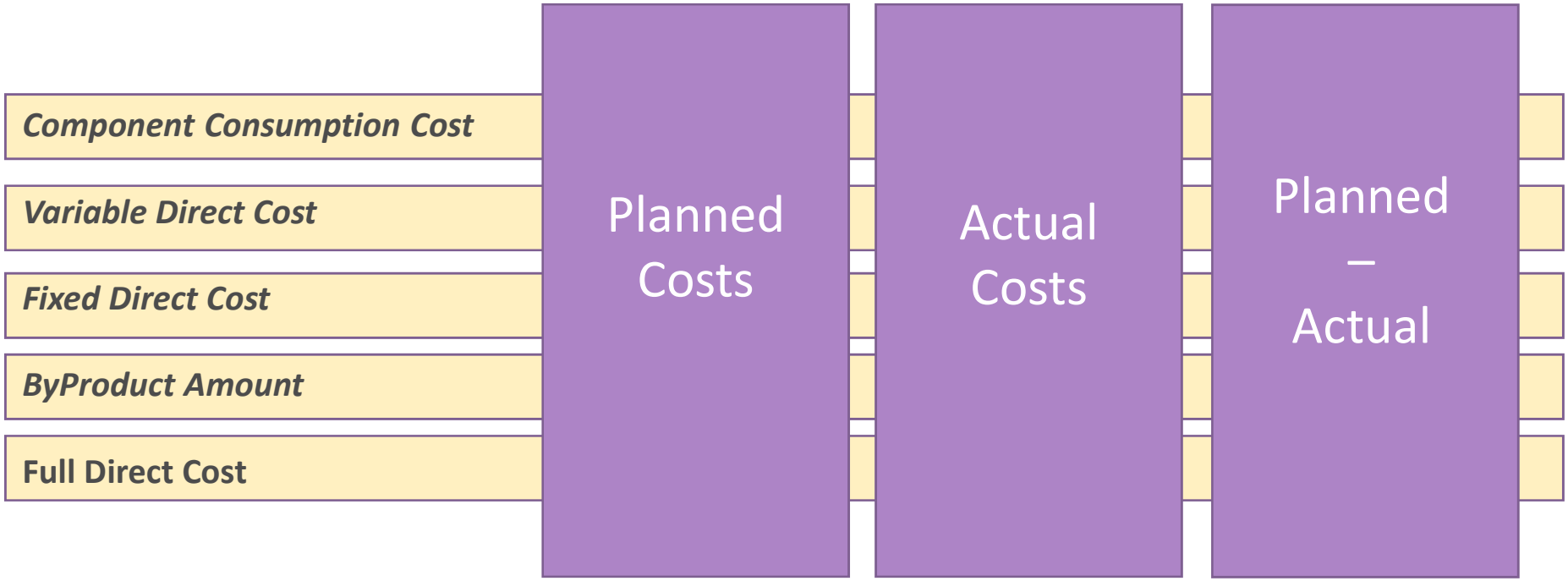
Production Cost delta analysis

delta analysis between planned costs and actual ones related to all direct costing figures at manufacturing order level



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Overhead Costs

- ***variable direct overhead costs*** calculated from actual workorder variable direct costs
- ***fixed direct overhead costs*** calculated from actual workorder fixed direct costs
- ***components consumption overhead costs*** calculated from actual components consumption costs

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WIP Calculation

WIP evaluation in real time by taking into account the following cost components:

- raw material consumption allocation at planned values (cancelled at order closure)
- components consumption overhead costs at planned values (cancelled at order closure)
- direct costs
- variable direct overhead costs
- fixed direct overhead costs
- raw material consumption cost

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Cost Variances

- ***Planned Costs Variance:*** standard cost compared to full planned direct cost
- ***Material and By-Products Variance:*** actual components consumption costs to the planned ones
- **Direct Costs Variance:** actual workorder times costs to the planned ones

Financial postings are to balance WIP account at manufacturing order closure

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The Plant Maintenance Solution

MRO Maintenance

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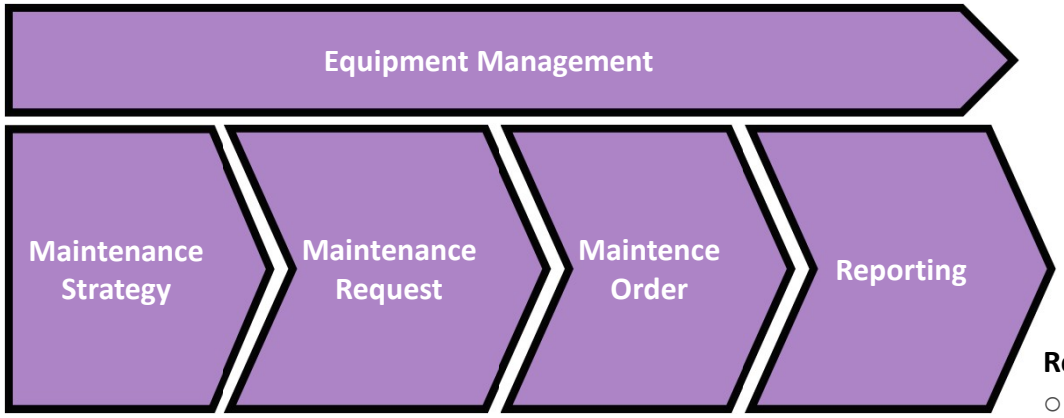
The Maintenance management overview

Maintenance master data
- Functional location
- Meter management
- Gauge management
- Spare parts
- Tool management
- Check list
- Maintenance task

Maintenance Team
- Dashboard
- Team members assignment
- Cost management

Equipment master data
- Location assignment
- Equipment status management
- equipment hierarchy
- Document management



Maintenance strategies
- Corrective
- Preventive
- On condition
- Periodic
- Maintenance Plan
- Inspection
- Retrofit

Integration features
- Priority management
- Accounting integration
- Email communication
- Activity management
- Document management

Reports
- equipment cost analysis
  equipment hierarchy cost analysis
- maintenance cost analysis
- tool utilization analysis

The “MRO Maintenance” supports maintenance processes management with different maintenance strategies.

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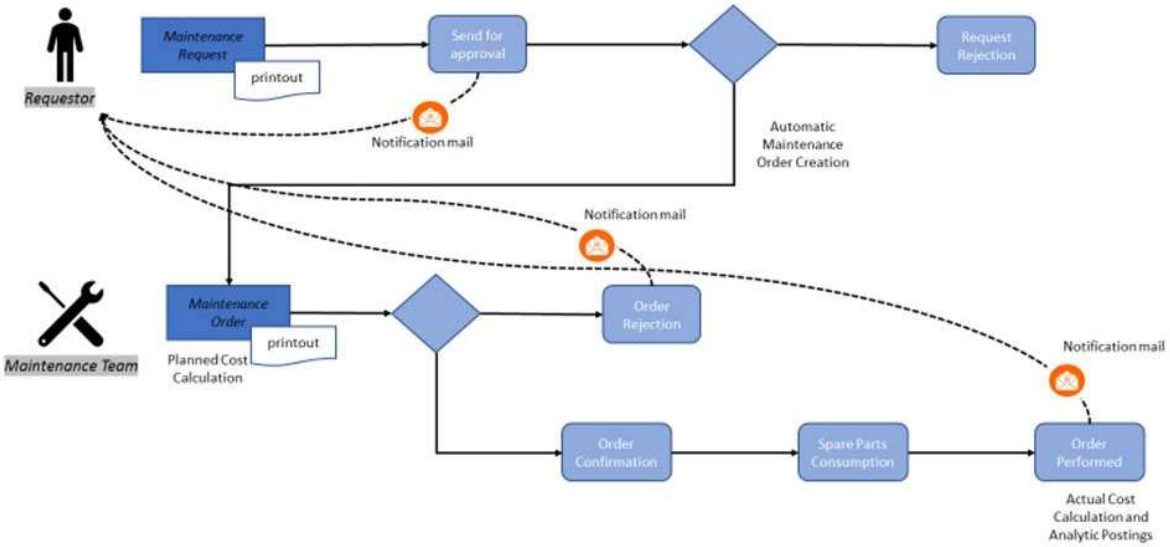
The main maintenance process



Remarks

- The maintenance request is for requesting maintenance job for the corrective, inspection and retrofit maintenance strategies.
- Maintenance orders can be created manually without any maintenance request as reference or automatically as result of maintenance procedures run (on condition, periodic and maintenance plan)

The maintenance process steps

- maintenance request creation and its printout
- approval request (communication via email)
- maintenance order automatic creation after approving maintenance request
- spare parts, tools and check list assignment to maintenance order
- scheduling execution dates with planned duration
- maintenance order printout
- maintenance order confirmation and maintenance planned cost automatic calculation
- execution of maintenance job checking material availability and reserving tools
- maintenance order closing and actual cost calculation and analytic account postings

Equipment management

- An Equipment is assigned to a Functional Location as:
  - Scrap location
  - Operative location with hierarchical structure
  - Warehouse location

- The Equipment Status management with the possible following values:
  - Warehouse,
  - Breakdown,
  - in Maintenance (maintenance order running),
  - Operative (installed) and
  - Scrapped (no maintenance order creation)

- The equipment status is automatically determined based on its functional location and its maintenance orders in progress

- Hierarchical representation of complex equipments' structure

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Key performance indicators

At equipment level, the following KPIs are available:

- **Mean Time To Repair (MTTR)** is an average time for performing corrective maintenance
- **Mean Time Between Failure (MTBF)** is an average time between corrective maintenance order actual closure dates and next corrective maintenance order planned request dates
- **Next maintenance date** from the next open maintenance order
- **Last failure data** from the last corrective maintenance order
- **Estimated time before next failure** calculated as Last failure data + MTBF

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Maintenance Request

Process steps:

- The maintenance request is created detailing equipment, request date, maintenance type, requester, priority and cause (detailed description of maintenance request, reported in the related maintenance order)
- After saving, a mail is sent out to the requester for maintenance request approval
- the requestor can approve it and a maintenance order with reference to this request is automatically created
- or reject it detailing the rejection reason, reported into the related maintenance request
- the maintenance order confirmation moves the maintenance request state in execution
- after performing the maintenance job, so closing the maintenance order, the maintenance request will be automatically closed (state done)

State management with the possible following values:

- Draft → initial creation state
- Confirmed → requester approval performed
- Execution → maintenance order running
- Done → maintenance order closed
- Rejected → maintenance request rejected
- Cancelled → maintenance request cancelled

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Maintenance Order 1/2

Process steps:

- A maintenance order is created manually or automatically by approving a request
- maintenance request is reported into the related maintenance order
- scheduling by entering the end schedule date and the planned duration (backward scheduling)
- maintenance manager can approve or reject maintenance order
- in case order rejection, a mail is sent out to the maintenance requester
- spare parts, tools, planned duration and check lists are suggested by default by selecting the proper task
- maintenance order printout (with all needed information for performing it)
- at order confirmation, the planned costs are automatically calculated and actual start execution date is set
- the order closing sets the end execution date, calculate the actual costing figures and performing analytic posting; a mail is sent out to the requestor to inform him/her the maintenance job has been performed
- analytic postings on analytic account set in maintenance team master data for spare parts costs, labor costs and tools utilization costs

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Maintenance Order 2/2

State management with the possible following values:

- Draft → initial creation state
- Released → order approved with waiting parts
- Ready → order approved with available parts
- Done → maintenance order closed
- Cancelled → maintenance order cancelled/rejected

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The maintenance procedures

- **On Condition Maintenance**
- **Periodic Maintenance**
- **Maintenance Plan**

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On condition maintenance procedure

- On condition maintenance is based on actual measures provided by a gauge installed to an equipment.
- A maintenance order is automatically created whether a measure is out of the allowed interval.
- Therefore, the process is triggered for “not processed” measures outside the allowed interval/thresholds for gauge assigned and installed to an equipment and an active maintenance order is not already running
- A new on condition maintenance order is created and all not processed measured are set as processed
- The reference to the new maintenance order is recorder on the related measure for tracking purposes

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Periodic maintenance procedure

- Periodic maintenance is based on actual equipment utilization provided by a meter installed to an equipment.
- A maintenance order is automatically created whether cumulated utilization or working time spent from the last maintenance order exceeded defined threshold.
- the process is triggered based on the following conditions:
  - the actual time calculated from the last periodic maintenance order (if none, meter installment date) is upper than a threshold
  - the actual utilization calculated as actual measure – “utilization from the last periodic maintenance order” is upper than a threshold
  - an active maintenance order maintenance order is not already running
- a new periodic maintenance order is created#
- the reference to the new maintenance order is recorder on the related measure for tracking purposes

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Maintenance plan procedure

- The Maintenance Plan defines a list of planned maintenance jobs for a specific equipment as a list of planned date, planned utilization and maintenance task.
- A meter has to be assigned to an equipment subjected to maintenance plan.
- Based on actual utilization and the current date compared with planned utilization and maintenance planned date a maintenance order is created.
- The process is triggered when one of the following two conditions occurs for a maintenance plan item and an maintenance order is not already running:
    - the planned date is in the past
    - the actual utilization calculated as actual is upper than the planned utilization
- a maintenance plan order is created and its reference is recorded on the related maintenance plan item for tracking purposes
- after processing the maintenance plan order the maintenance plan item is closed
- Maintenance plan procedure can be performed manually and reporting the maintenance order on the corresponding maintenance plan item.

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MRP MRO Maintenance Integration

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Maintenance integration in Work Center master data

- Workcenter can be assigned to an Equipment; therefore, all maintenance activities can be performed with reference to a workcenter
- A periodic maintenance as maintenance policy can be activated and collect automatically workorder confirmations as meter measures
- Maintenance Requests can be raised from the Workcenter master data; the user should have maintenance permission
- Maintenance Requests and Maintenance Orders with reference to the equipment linked to a workcenter are collected in the related Workcenter master data
- In case a Maintenance Order is running, the Workcenter status is automatically set from “Ready” to “On Maintenance”

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Maintenance integration in Manufacturing Order process

- Maintenance Request can be raised when Manufacturing Order is running
- All Maintenance Requests created for maintenance activities related to a manufacturing order processing are collected in the manufacturing order
- It is not possible to confirm a workorder when the related workcenter is “on maintenance” status
- It is not possible to confirm a milestone workorder whether a previous workorder to be closed is linked to a workcenter in “on maintenance” status
- In case periodic maintenance indicator has been activated at workcenter level, workorder confirmation creates automatically a meter measure
- Workcenter status is reported in the workorders list.

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