Maximize the Value from Production Capacity Planning, Scheduling, Sequencing, and Leveling in Your Integrated Supply Chain

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Reveal USA
In This Session

- Learn standard yet powerful techniques to improve production capacity planning by more than 10%. Find out how to fully exploit your SAP technology to:
  - Decipher the options between process, repetitive, and discrete manufacturing decisions
  - Establish the best manufacturing strategy and set the rules to automatically dispatch and sequence a variety of products and strategies onto a production line
  - Ensure production activities are aligned with capacity constraints, customer service demands, and raw material supply
What We’ll Cover

- Manufacturing flows available in SAP
- Key differences in the repetitive and discrete environments
- Connecting with the strategic focus of the business
- Planning strategies within the integrated supply chain
- Foundational dynamics for capacity planning and scheduling
- Governance process to protect supply chain performance
- Competitive priorities to increase upper-quartile performance
- Wrap-up
Manufacturing Flow

- SAP has three manufacturing flows:
  - Repetitive Manufacturing → time-based/rate-based flow
  - Discrete Manufacturing → order-based flow
  - Process Manufacturing → order-based flow

In process manufacturing, a product typically cannot be disassembled to its constituent parts, e.g., a soft drink or packaged fruit juice cannot be broken down into its ingredients.

- Choice of manufacturing flow
  - Influences Shop Floor Control and, less, Production Planning
  - This means you can use the following SAP Planning Tools in each of the above manufacturing flows:
    - SCM-APO Demand Planning and Supply Network Planning
    - ECC Demand Management
    - ECC Long-Term Planning
Type of Execution: Simply Put ...

- Industry
- Execution Type
  - Repetitive
  - Discrete
- Type of Costing
  - Order Based
  - Period Based
- Production Orders
- Process Orders
- Cost Collector
- Planned Orders
  - Not converted to Production Orders

1. Production (PP)
2. Process (PP-Pi)
3. Type of Execution: Simply Put ...
Repetitive Manufacturing

- Simple routings – one operation / one work center
- Simple BOM – one or two levels
- Semi-finished products processed immediately not put into an interim storage
- No confirmations, or if needed, they are less detailed, and the recording of actual data is very simplified
- Usually, there is no Quality Control in SAP in a REM process
- REM can be used for make-to-stock or make-to-order albeit that we usually see it in a MTS business.

- Generally easiest flow for producing in SAP
- Plnd orders not converted to Production orders
- No reservations for raw material
- Shop Floor must know what to put on the line
- Components consumed anonymously during backflush
- Traceability reporting possible only through the batch number of the FG
- No finite scheduling of the orders
- Costing is done on cost collector.

- Cost collector is an ‘open’ order for a specific combination of FG or product version which collects all costs and revenues for a long period of time (even indefinitely)
- Each time we produce the FG or product version, revenues and costs (via backflush and confirmation) are posted on this CO-objects. Cost follow up is simple usually too simple for complex production.
Rpetitive Manufacturing: Process Flow

**Material Staging**
- Interactive pull list is to inform you of components whose stock levels have to be replenished at the production storage location.
- From the missing quantities screen, you can directly trigger a stock transfer from the central warehouse to the production storage location.

**Processing the Master Plan:**
- Planned orders created in the MRP run for a material in a planning table.
- Here, you no longer refer to planned orders but to run schedule quantities.
- You can then change these run schedule quantities in the planning table taking the capacity situation into account, if necessary.
- Production is now controlled on the basis of these run schedule quantities.
- System generates purchase requisitions for externally procured material components or services.

**Production Execution and Backflushing:**
- Product is usually manufactured in a constant flow over the production line.
- You record actual data (backflush) at regular intervals for production quantities manufactured.
- The system posts the component consumption and production activities with the goods receipt of the finished product.
- If you work with longer lead times, you can also backflush at reporting points on production line.
- This means you can post component consumption closer to the actual time that the components were consumed.
Discrete Manufacturing based on Production Orders

Production by Lot Size

- Grouping requirements into lots during requirements planning
- Planning with existing basic data
- Independent of a particular sales order.

Make to Order

- Produce products with reference to a particular sales order
- Quantities managed, in terms of stock for individual sales order
- Assemblies and components can also be procured for the sales order that generates the requirements, and managed in stock for this sales order
- A sales order BOM can then be generated for sales order → BOM is used to produce the product
- Planning with existing basic data independent of a particular sales order.

Assembly Processing

- Form of MTO where Assembly order is created with the SO
- Components for the product have already been produced and now only need to be assembled
- Availability check is carried out for the components when SO created increases reliability with which dates can be confirmed
- Changes to the sales order are automatically made in the production order and vice-versa
- Planning with existing basic data independent of a particular sales order.
Discrete Manufacturing: Process Flow

**Creation / processing of production order:**
- Manually or by converting a planned order that was created in production planning and procurement planning
- Reservations are automatically generated for the necessary material components
- System generates purchase requisitions for externally procured material components or services.

**Production:**
- Components to produce the product are withdrawn from stock for the production order and the goods issue is posted
- Required product is produced according to the production order
- Quantities produced and the times needed to do so are confirmed for the production order
- Products are placed into stock and the goods receipt is posted
- Quality Inspection aligned to production process

**Capacity Management:**
- Capacity requirements are generated in the work centers that are to process the production order
- Evaluation of capacity and if necessary levelling capacities at any stage in production order processing before production starts
- Preliminary costing carried out to determine the planned costs
- Relevant materials and capacities are available to release the production order and print the relevant shop floor papers.
Process Manufacturing

Process Manufacturing → Process Orders similar to Production Orders

No Disassembly into Constituent Parts

- In process manufacturing a product typically cannot be disassembled to its constituent parts
- Once it is produced, a soft drink or packaged fruit juice cannot be broken down into its ingredients
- Range of Products include solder, chemicals, coatings, pharmaceutical goods, bio-engineered products, and fuels such as petrol.

Processing is what makes the difference

- Typically, process manufacturing involves things of a liquid or once-liquid form that went through some kind of “processing”
- Processing usually means adding energy or some kind of conditional change - say, adding thermal energy - for chemical conversion
- Processing usually means exposing a mixed substance to heat, cold, time, pressure or other conditional changes. These changes permanently create an entirely new thing.

Factors highlighting differences

Key Differentiators:
- Ingredients, rather than parts or assemblies
- Formulas, rather than BOMs (chemicals, food and beverage, gasoline, paint and pharmaceutical)
- Typically produced in Bulk, rather than discrete countable units that can be labeled on an individual basis.
Generic Criteria That Suggest Selection of ERM

- The same or similar products are produced over a lengthy period of time
- The products produced are not manufactured in individually defined lots. Instead, a total quantity is produced over a certain period at a certain rate per part-period.
- The products produced always follow the same sequence through the machines and work centers in production
- Routings tend to be simple and do not vary much
- Primarily in an MTS type environment
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## Detailed Comparison

<table>
<thead>
<tr>
<th>Order-Based Production (Discrete)</th>
<th>Repetitive Manufacturing (REM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. PLANNING</strong></td>
<td></td>
</tr>
<tr>
<td>1. Capacity Planning is done at the work center level</td>
<td>1. MPS creates planned orders</td>
</tr>
<tr>
<td>2. Planned orders are transformed by Planning into Production Orders</td>
<td>2. Capacity planning is done against production Lines (Planning Table)</td>
</tr>
<tr>
<td>3. Reservations are created for the components</td>
<td>3. Thus, there is no release of production orders, nor reservation for raw material</td>
</tr>
<tr>
<td>4. Finished products are typically manufactured in individual lots, and the sequence on the work centers can vary between different finished products</td>
<td>4. The same product is produced on a certain production line over a longer period of time</td>
</tr>
<tr>
<td><strong>2. MASTER DATA</strong></td>
<td></td>
</tr>
<tr>
<td>1. Bills of material and routings are more complex</td>
<td>1. Routings tend to be very simple</td>
</tr>
<tr>
<td>2. Production versions optional</td>
<td>2. Usually simple bills-of-material (one or two levels maximum)</td>
</tr>
<tr>
<td></td>
<td>3. Production versions required</td>
</tr>
</tbody>
</table>
Order-Based Detailed Comparison

MRP

Planned Order

Create Production Order
Release Production Order
Completion Confirmation
FG Receipt
Back flush Material

Planning Table (Run Schedule)

Back flush

Repetitive Manufacture
Production Orders: Processes

- Order settlement
- Order proposal
- Warehouse receipt
- Order creation
- Confirmations
- Availability check
- Execution
- Capacity planning
- Material withdrawal
- PRTs
- Costs
- Order print
- Order release
- Operations
**Structure: Master Data**

- **Materials**
- **BoM**
- **Production Version**
  - Read PP Data
  - Copied into Planned Order
  - Copied into Routing
  - BoM Components must be allocated to the required Operation. If no allocation, default is 1st Op.
- **Routing**
  - Operation
  - Operation
  - Operation
  - Operation
- **Work Center**
- **Cost Center**
  - Activity rates at this level
- **Activity Type**
- **Finance**

**Production Version**

**Planned Order**

**Production Order**
### Detailed Comparison

#### Order-Based Production (Discrete) vs. Repetitive Manufacturing (REM)

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<td>1. Discrete manufacturing is characterized by requirements that occur on an irregular basis and a</td>
<td>1. Products are not manufactured in individual lots (lot is typically one shift)</td>
</tr>
<tr>
<td>workshop-oriented process</td>
<td>2. The semi-finished products are processed immediately, without being put into an interim storage location</td>
</tr>
<tr>
<td>2. Semi-finished products are usually put into an interim storage location prior to further processing</td>
<td>3. There is no confirmation, or if needed, they are less detailed, and the recording of actual data is very simplified</td>
</tr>
<tr>
<td>3. Confirmations are usually based on actual quantities (labor, machine, energy, etc.)</td>
<td>4. Traceability reporting is possible, but only through the batch number of the finished product</td>
</tr>
<tr>
<td>4. Confirmations are done at Production Order Operation level or at Order level</td>
<td>5. Confirmation will be without ref to planned orders</td>
</tr>
<tr>
<td>5. Better shop floor visibility</td>
<td></td>
</tr>
<tr>
<td>6. Production lines are thus replenished via the production orders</td>
<td></td>
</tr>
<tr>
<td>7. Back flush is possible, but often, the actual quantities of components are issued by production order</td>
<td></td>
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3. **SHOP FLOOR CONTROL**

- Discrete manufacturing is characterized by requirements that occur on an irregular basis and a workshop-oriented process.
- Semi-finished products are usually put into an interim storage location prior to further processing.
- Confirmations are usually based on actual quantities (labor, machine, energy, etc.).
- Confirmations are done at Production Order Operation level or at Order level.
- Better shop floor visibility.
- Production lines are thus replenished via the production orders.
- Back flush is possible, but often, the actual quantities of components are issued by production order.
Shop Floor Control

- MRP Related Update of Expected Yield
- Confirmation
- Quantity Processed in Operation (scrap and Yield)
- Activity Used to Carry out Operation
- Actual Start and Finish Date
- Resource information
- Who carried out the Operation
- Update of the Order Data
- Backflushing
- Automatic GR for FG
- Reduction of Capacity on Resources
- Update of cost
Comparison: Shop Floor Control

Discrete STD SAP Reports

- Production
  - Product group
  - Material
    - MCPW - Lead times
    - MCPF - Dates
    - MCPO - Quantities
    - MCRI - Product costs
    - MCRE - Material consumption
  - Production order
    - CO24 - Missing parts
  - Work center
    - MCPY - Lead times
    - MCPH - Dates
    - MCPQ - Quantities
    - Operation analysis
      - MCPS - Lead times
      - MCPB - Dates
      - MCPF - Quantities
  - CM01 - Load
  - CM02 - Orders
  - CM03 - Pool
  - CM04 - Backlog
  - CM05 - Overload

Repetitive STD SAP Reports

- Repetitive Manufacturing
  - MCP6 - Goods receipts
  - MCRM - Reporting pn1 stats
  - MCRP - Material Consumption
  - MCRJ - Product costs
## Detailed Comparison

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<td><strong>4. ORDER INFORMATION SYSTEM</strong></td>
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<tr>
<td>Target vs. Actual Analysis at different levels</td>
<td>The visibility offered by standard SAP reporting functionality for discrete Manufacturing to analyze the shop floor from a lead time and schedule adherence perspective is far superior than Repetitive. Repetitive assumes that you don’t need this level of control, as it is period based.</td>
</tr>
<tr>
<td>• Work Center</td>
<td></td>
</tr>
<tr>
<td>• Operation</td>
<td></td>
</tr>
<tr>
<td>• Order</td>
<td></td>
</tr>
<tr>
<td>• Material</td>
<td></td>
</tr>
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### 5. INVENTORY MANAGEMENT

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<th>Order-Based Production (Discrete)</th>
<th>Repetitive Manufacturing</th>
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<tbody>
<tr>
<td>1. Requirements dates for Purchasing from MRP output</td>
<td>1. Requirements dates for Purchasing from MRP output</td>
</tr>
<tr>
<td>2. Reservations are generated for raw materials</td>
<td>2. No reservation for raw materials</td>
</tr>
<tr>
<td>3. Component materials are staged with specific reference to the individual production orders or to storage locations</td>
<td>3. Material staging to the Shop Floor not order-specific</td>
</tr>
<tr>
<td>4. Consumption takes place by goods issue or back flush</td>
<td>4. Raw materials are put in a staging storage location as total requirements</td>
</tr>
<tr>
<td>5. Components are order-specific</td>
<td>5. Material handlers must know what to put on the production line</td>
</tr>
<tr>
<td></td>
<td>6. Back flush takes place at the goods receipt of the finished product</td>
</tr>
<tr>
<td></td>
<td>7. Components are consumed anonymously from the staging storage location during the back flush</td>
</tr>
</tbody>
</table>
### Detailed Comparison (cont.)

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<thead>
<tr>
<th>Order-Based Production (Discrete)</th>
<th>Repetitive Manufacturing (REM)</th>
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<tbody>
<tr>
<td><strong>6. CONTROLLING</strong></td>
<td></td>
</tr>
<tr>
<td>1. Order-based</td>
<td>1. Period-based</td>
</tr>
<tr>
<td>2. Detailed controlling for each order by comparing plan and actual figures</td>
<td>2. Costing is done on cost collector level</td>
</tr>
<tr>
<td>3. Settlement is done at the Production Order level</td>
<td>3. Settlement is at Material level</td>
</tr>
<tr>
<td>4. Actual production costs at Order level</td>
<td>4. Cost follow up is really simple in REM; usually too simple for complex production</td>
</tr>
</tbody>
</table>

- **Routing**
  - Routings are valued with activity prices at standard
    - Primary costs on cost center divided by planned activities from Long-Term Planning as an example
  - Bill of Material
    - Consumption of raw material, packaging at moving average price
    - Consumption of semi-finished or finished goods at standard
  - Month-end
    - Revaluate the activities at actual price
    - WIP calculation based on Production Order Status
    - Calculated Variances are charged to P&L
    - Settlement of Variances at month-end or at close status
  - Costing runs for standard cost can be done on a monthly basis
    - Can break down costs by component, i.e., packaging, steel, molding (up to 46)
    - Can use additives for various costs, such as forwarding freight between plants
    - Overhead cost as a % or quantity of a component
    - Costing templates for complex calculation

- **Similar functionalities as production orders, except:**
  - Only visible at product level
  - Settlement happens at month-end
## Comparison Summary

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<tr>
<th><strong>Order-Based Production (Discrete)</strong></th>
<th><strong>Repetitive Manufacturing (Period/Rate-Based)</strong></th>
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</thead>
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<tr>
<td>1. There is frequent switching from one product to another</td>
<td>1. The same product is produced on a certain production line over a longer period of time</td>
</tr>
<tr>
<td>2. Each product is manufactured in individually defined lots</td>
<td>2. In production, a total quantity is produced according to a certain production rate over a certain period of time</td>
</tr>
<tr>
<td>3. Costs are calculated per order</td>
<td>3. Costs are collected periodically at a product cost collector</td>
</tr>
<tr>
<td>4. Usually has a changing sequence of work centers where the products are processed</td>
<td>4. Usually involves a relatively constant flow through production lines</td>
</tr>
<tr>
<td>5. The order of work centers is determined in routings, which can often be very complex</td>
<td>5. The routings of the individual products are very similar</td>
</tr>
<tr>
<td>6. Semi-finished products are frequently placed in interim storage prior to further processing</td>
<td>6. Semi-finished products often directly processed without interim storage</td>
</tr>
<tr>
<td>7. Component materials are staged with specific reference to the individual production orders</td>
<td>7. Components are often staged at the production lines without reference to a particular order</td>
</tr>
<tr>
<td>8. Confirmations for the various steps and orders document the work progress and can be used for fine control</td>
<td>8. The confirmations (back flushes) are usually executed periodically with no reference to an order (for example, all the quantities produced in one shift)</td>
</tr>
</tbody>
</table>
What We’ll Cover

- Manufacturing flows available in SAP
- Key differences in the repetitive and discrete environments
- Connecting with the strategic focus of the business
- Planning strategies within the integrated supply chain
- Foundational dynamics for capacity planning and scheduling
- Governance process to protect supply chain performance
- Competitive priorities to increase upper-quartile performance
- Wrap-up
Connect to the Strategic Business Focus

Typical Business Cycle

- Strategic
- Supply
- Make
- Distribution
- New Products

Typical Areas of Optimization

- Production and Capacity Planning process often relies on information outside of SAP
- To close the gap and ensure “Visibility in System,” it is essential to “use standard available functionality”

Challenge

1. Data Integrity
   - Housekeeping
2. Business Rules
   - Integration

Pull Demand with S&Op

Cycle Time

Inventory

Scheduling in SAP

Reduce Safety Stock

Master Data

KPI Measures
# Information Maturity Drives Value

## Housekeeping
- Overdue Transactions
- Real-time transactions
- Single Data Source
- Data Cleansing
- Inside the System
- Communications
- Cooperation
- Data Accuracy
- Data and Process Accountability
- User Confidence

## Integration
- Data Grouping
- Stocking Strategy
- Master Data Rules
- Lead Time Accuracy
- Service levels – internal & external
- Exception Management
- Inventory Accuracy
- Business Measures
- Design Measures
- Purchasing & Financial Integration

## Functionality
- Trusted Automation
- Enhance existing functionality
- Next Generation Technology
- Supplier Performance
- Benchmarking
- Management Dashboard
- Global Standardization
- Supplier & Customer Collaboration

## Business Value
- Increase Service
- Increase Revenue
- Optimize
- Inventory Value
- Improved Inventory Turns
- Reduce Operating Costs
- Improved Management
- Information (Visibility)
- Increase process optimization & flexibility

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## Ownership, Accountability, and Governance

- Get what was implemented to work as intended. Get the processes integrated.
- Get the system to work for you, rather than you working for the system.
- Get the system to work for your business. Set VALUE targets and achieve those targets, using your system.
Integrating the Supply Chain
Managing Capacity Constraints Is Critical

1. Rough Cut Check

2. Capacity Evaluation

3. Sequencing, Capacity Leveling, Scheduling

Sales Forecast

Sales & Ops Planning

Demand Management

Master Prod Sched

Mat Req. Planning

Production/Process Order Execution

Supply Chain Exception Monitoring for End-to-End Visibility essential

SO ATP

Prod ATP

External Procurement

Raw Materials Inventory

Planned Orders

Finished Goods Inventory

Customer Sales Orders

Supplier Purchase Orders

Requisitions

Quantities and Dates

Sales & Ops Planning

SO ATP

Create Sales Forecast based on Historic Demand

Actual Orders consume forecast

Tactical

Strategic
Integrating the Supply Chain
Managing Capacity Constraints Is Critical (cont.)

1. Rough Cut Resource Planning
   - Supply Chain Exception Monitoring
   - End-to-End Visibility essential

2. Rough Cut Check
   - Capacity Evaluation functionality available and not used effectively in SAP, resulting in move to introduce external systems to compensate

3. Capacity Evaluation
   - Sequencing, capacity leveling, and scheduling functionality to be used

Strategic
- Align S&OP in SAP – Sales Forecast, CO-PA, RCCP, Business Plans, and simplify process, e.g., Planning Books

Tactical
- Sales Order ATP set up to align to business needs
- Poor Data Integrity/Housekeeping negatively impact S/D planning
- Planning strategies/business rules aligned/adjusted
- Create Sales Forecast based on Historic Demand
- Component availability for production orders
- Conversion of Production Orders at opening period
- Quantity and Dates aligned/adjusted

Master Prod Sched
- Capacity Evaluation
- Sequencing, capacity leveling, and scheduling functionality to be used

Mat Req. Planning
- Conversion of Production Orders at opening period
- Requisitions

Prod ATP
- External Procurement

Sales & Ops Planning
- Demand Management

Sales Forecast
- Sales Forecast

Prod ATP
- Product Availability for production orders

Production/Process Order Execution
- Supply Chain Exception Monitoring for End-to-End Visibility essential

Customer
- Sales Orders

Supplier
- Purchase Orders

External Procurement
- Requisitions

Raw Materials Inventory
- Supplier

Finished Goods Inventory
- Customer

SO ATP
- Sales Order ATP set up to align to business needs

Provisional Sales Order (PSO)
- Sales Order ATP set up to align to business needs
Bringing It All Together

Customer demand driven in product hierarchies from S&OP through demand management supported by product allocation and available-to-promise

Strategic

Supply

Make

Distribution

New Products

Areas of Strategic Focus

- Pull Demand with S&OP
- Rough Cut Resource Planning
- Rough Cut Check
- Capacity Evaluation
- Sequencing, Capacity Leveling, Scheduling
- Conversion of Production Orders at opening period Procurement
- Ext. Orders
- Supplier Purchase Orders
- Raw Materials Inventory
- Production / Process Order Execution
- Supply Chain Exception Monitoring for End-to-End Visibility essential
- Supplier

New Products

- Align S&OP in SAP – Sales Forecast; CO-PA; RCCP; Business Plans; and simplify process e.g. Planning Books
- Sales Order ATP setup to align to business needs and in APO use SATP (COO)
- Poor Data Integrity/Housekeeping negatively impact S/D planning
- Planning strategies / business rules aligned / adjusted
- Component availability for production orders
- Customer Sales Orders
- Finished Goods Inventory
- Fair Share allocations
What We’ll Cover

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Correct Planning Strategies  
Key to Driving Your Advantage

• We need the planning strategy for a product to create the demand program. Planning strategies:
  - Represent the methods of production for planning and manufacturing or procuring a product
  - Provide the business procedures for planning production quantities and dates – MTS/MTO/FTO

• By using these correctly, we can:
  ▶ Use sales orders and/or sales forecast values to create the demand program
  ▶ Move the stocking level down to the assembly level, so that final assembly is triggered by the incoming sales order
  ▶ Carry out Demand Management specifically for the assembly

• We can combine planning strategies at, say, the finished good level (40) and still apply a different strategy for an assembly (70) in the Bill of Materials (BOM)
Planning Strategies and Available to Promise (ATP)

- Consider carefully which Planning Strategy and ATP check to use for each Material to be planned in S&OP → Demand Management
  - To select Planning Strategy and ATP checking group, ask:
    - At which level of the Bill of Materials will stock be held?
    - Will sales orders that exceed the Demand plan add to the plan or be ignored?
    - Will Replenishment lead time be taken into account in the ATP check if Stock and Production/Process orders do not exist?
    - Will ATP be performed based on “Scope of Check” or simply against the Plan (Planned Independent Requirements)
Making the Decision – MTS vs. MTO vs. FTO

Does Procurement/Production Take Place Before/After Sales Order?

- **Make to stock** means you make and procure in anticipation of actual orders
  - This supply plan is generated by MRP based on forecasted demand
  - Stock purchased or manufactured is placed in free available stock and issued to actual demand as required

- **Make to Order** means your procurement plan is generated based upon the entry of actual orders only
  - You can be MTO for a finished product, but still be MTS for the sub-assemblies and/or raw materials

- **To procure or produce sub-assemblies** based on plans which are independent of finished products, you use strategies for the planning of components

\[ \text{FG Forecast Driver} \]

\[ \text{Production} \rightarrow \text{WIP} \rightarrow \text{Sales Order} \rightarrow \text{FP Inv} \]

\[ \text{Forecast} \rightarrow \text{WIP} \rightarrow \text{Sales Order} \]

\[ \text{FG Forecast Driver excl 20} \]

\[ \text{Production} \rightarrow \text{WIP} \rightarrow \text{Sales Order} \rightarrow \text{FP Inv} \]

\[ \text{SO-Specific Stock} \]

\[ \text{FG Forecast Driver excl 20} \]

\[ \text{Production} \rightarrow \text{WIP} \rightarrow \text{Sales Order} \rightarrow \text{FP Inv} \]

\[ \text{Sub-Assembly Forecast Driver} \]

\[ \text{Production} \rightarrow \text{WIP} \rightarrow \text{Sales Order} \rightarrow \text{FP Inv} \]

\[ \text{Generic Stock} \]

\[ \text{FTO Planning Material} \]

\[ \text{FG Forecast Driver excl 20} \]

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\[ \text{Sub-Assembly Forecast Driver} \]

\[ \text{Production} \rightarrow \text{WIP} \rightarrow \text{Sales Order} \rightarrow \text{FP Inv} \]
Business Decisions on MTS/MTO/FTO Strategies
Planning Strategies to Align the Plan to Execution

Using a Make-to-Stock Strategy

Using a Make-to-Order Strategy

Using a Finish-to-Order Strategy

Plan, Schedule, Actual

Purchase RAW material to the Forecast

Lead time to customer

Purchase RAW material to the Forecast

Including Kanban

Lead time to customer

Plan

Schedule

Actual

How well do we follow the plan?
Balancing Supply and Demand Across the Supply Chain

1. Production Schedule
2. Schedule Firming
3. Expedite
4. Purchase Requisition
5. BOM
6. Integration
7. Over/Under
8. Can’t plan

MRP

Forecast (S&OP)
Sales
Production
Maintenance

Rules

Start

Process/Production Order
Purchase Order

Inventory

Proposition

Supply Schedule

Start

Exception Monitoring (EM) Wheel®
Exception Messages Measure Process Efficiency

If you are getting the product out the door to the customer on time...

...you are “recovering” at the last minute from your red light situation

...but with what level of effort?
EM Aligns Supply Chain: Plan → Schedule → Actual

**Plan**
- Forecast
- Ind Req
  - Planned Order
  - Dep Req
  - Purchase Requisition

**Finished Product**
- Finished Product

**Semi-Finished Product**
- Semi-Finished Product

**RAW Material**
- RAW Material

**Schedule**
- Sales Order
  - Production Order
  - Reservation
  - Purchase Order

**Actual**
- Customer Del
  - GR
  - GI
  - GR

**FG Inventory**
- FG Inventory

**Vendor**
What We’ll Cover

- Manufacturing flows available in SAP
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Capacity Planning Links with Business Goals and S&OP

Capacity planning is the process of determining the production capacity needed by an organization to meet changing demands for its products.

“Capacity” is the maximum amount of work that an organization is capable of completing in a given period of time.

The main purpose of capacity planning is to reduce cost and improve productivity.

Associated Goals
- Maximize profits & Customer Service
- Minimize costs, inventory levels, changes in work force, overtime, use of subcontracting, change in production rates, number of machine setups, idle time for plant, and personnel
Capacity Planning Is …

Factors affecting capacity include:

- Number of workers and ability of workers
- Number of machines
- Waste, scrap, defects, errors
- Productivity
- Suppliers
- Government regulations
- Preventive maintenance

Process to determine how much and when capacity is needed to produce new or more product

Relevant in the long-term and the short-term, although there are different issues at stake for each

Link back to S&OP

Issues facing Capacity Planning over a Time Horizon

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<th>Intermediate Term Planning</th>
<th>Short Term Planning</th>
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<td>Add Facilities</td>
<td>Sub-Contract</td>
<td>Schedule Jobs</td>
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<td>Add long lead time equipment</td>
<td>Add Equipment</td>
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<td>Redesign Product to increase throughput</td>
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<td>Limited Options to impact the near term</td>
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Capacity Planning and Bottleneck Management

- **Capacity** = the “throughput” or # of units a facility can hold, receive, store, or produce in a period of time:
  - **Bottlenecks** control throughput of products processed – SO
  - Schedule work centers at a rate that prevents bottlenecks
  - Use time buffer inventory (where appropriate) to eliminate bottlenecks

The Bottleneck is the priority for optimization. Optimizing features in “A” or “C” will not bring about change in overall performance until the performance issues in “B” are addressed.

- **Capacity planning helps overcome bottlenecks:**
  - Uses information to produce a load profile for each capacity
  - Compares planned orders with capacity of work center
  - Identifies under loads and overloads, enabling proactive action
What Is Capacity Planning in SAP?

Capacity Resource Planning (CRP) in SAP ECC provides a fully integrated view of resource utilization across the organization. It is a process to ensure the economic use of work centers ...

Capacity Planning is both:

- **Evaluation**
  - Available capacity & capacity requirements are determined & compared with each other in lists or graphics
  - Planner manually makes changes to the demand and/or supply and rechecks the evaluation (an iterative process)

- **Leveling**
  - Optimal capacity commitment is made automatically to all capacities (e.g., labor and machine)
  - Optional: sequence like orders together to spend less time setting up and more time producing
Capacity Information

- **The SUPPLY of Capacity** is held in the Work Center’s Capacities
  - Work Centers can have one or more Capacities, e.g.:
    - Machine hours (aka, Processing unit hours)
    - Labor hours

- **The DEMAND on Capacity** comes from the Routings or Recipes copied into Planned, Production, or Process Orders

Capacity Evaluation Enables comparison of capacity requirements to available capacity

1. Available capacity defined within capacity categories in the work center master data
2. Capacity requirements generated through detailed scheduling in MRP or mass processing (COHV)
3. Capacity evaluation – overview of capacity load and available capacity. Can be accumulated into hierarchy to evaluate group of work centers.
Elements of Capacity Evaluation
Comparison of Capacity Requirements to Available Capacity

Defining available capacity
- **Capacity category**
  - Physical resource assigned (machine, labor, etc.)
- **Available capacity (standard)**
  - Calculated from daily operating time, breaks, efficiencies, and utilizations
- **Capacity version**
  - Use of capacity maintained, by period, that differs from the standard available capacity (e.g., utilizing shifts/intervals to model work schedule)

Generating capacity requirements (load)
- **Capacity requirement**
  - Represents the capacity load and is calculated using formulas from the work center, dates, and quantities from planned and production orders
- **Load distribution**
  - Determines how a capacity requirement for a given capacity type, which spans multiple days, is distributed across each day in the time interval
- **Capacity requirement reduction**
  - Progress-based reduction of planned capacity load

Evaluating available capacity
- **Capacity evaluation**
  - Provides an overview of the capacity load and available capacity
- **Hierarchy/accumulation**
  - Available capacity, load, and evaluation for a group of work centers
Multiple Capacities at One Work Center

- Business need: Ability to evaluate labor and machine capacity at a given work center
  - SAP allows us to define and create as many capacity categories as needed within a work center
    - Each capacity category can only be created once within a work center
  - To meet the business need, set up individual labor and machine capacity categories for the work center
    - Either one or both of these capacity categories can point to a pooled capacity, if relevant
  - When performing capacity evaluation for the work center, we have visibility into the capacity situation for each capacity category
Multiple (Pooled) Capacity Category Evaluations
Capacity Planning During Sales & Operations Planning

Outcomes of Rough Cut Capacity Check

1. Prevent an impossible demand plan from being sent to Demand Management/MPS (MRP)

2. Provide Senior Supply Chain directors with a mid-term view (3 months-3 years) of the capacity situation so they can react, e.g.:
   - Add additional shifts in upcoming months
   - Purchase additional equipment
   - Re-engineer the product to require fewer capacity resources
   - Qualify subcontract vendors so some production can be subcontracted
Outcomes of Capacity Evaluation of the MPS run

1. **Balance the Capacity Load in the mid-term (2 weeks-3 months)**
   - Sales Orders will ATP against this plan in weekly buckets
   - Component materials will be procured to meet this plan

2. **Demand and Supply Planners will:**
   - Adjust forecast (Planned Independent Requirements) to keep plan under 100% capacity
   - Make a strategic decision to subcontract some production

3. **Production Managers will:**
   - Add additional shifts of capacity and/or overtime
Near-Term Sequencing, Leveling, and Scheduling of Planned Orders

Outcomes of Sequencing, Leveling, and Scheduling

1. The system will sequence like setups together for the next 1 day-2 weeks. Spend less time setting up and more time producing.

2. This process “fine tunes” the near-term schedule from weekly buckets to the exact date/time the order will run; it considers both machine capacity and labor capacity.

3. Provides a final requirements date for component materials.

4. The one and only Production Schedule is in SAP – can print a production schedule with one button!
Sequence and Capacity-Level Bottleneck Work Center

- Dispatch the operations from the lower pool to the upper work center, taking into consideration the capacity and working times.
Capacity Adjustment Decisions

**Overloaded Capacity:**
- **Increase capacity by:**
  - Adding extra shifts
  - Scheduling overtime or weekends
  - Adding equipment and/or personnel
- **Reduce load by:**
  - Reducing lot sizes
  - Holding work in Production Control (WIP)
  - Subcontracting work outside

**Under-Loaded Capacity:**
- **Reduce capacity by:**
  - Temporarily re-assigning people
  - Reducing the length of shifts
  - Eliminating the # of shifts
- **Increase load by:**
  - Releasing orders early
  - Increasing lot sizes
  - Making items normally outsourced
Capacity Evaluation Links Back to Integrated Planning

1. Rough Cut Resource Planning
   - Capacity Evaluation functionality available not used effectively in SAP resulting in move to introduce external systems to compensate

2. Capacity Evaluation
   - Sequencing, Capacity Leveling, Scheduling
     - Sequencing, capacity levelling and scheduling functionality to be used

3. Conversion of Production Orders at opening period
   - Ext. Procurement
     - Requisitions

Supplier
- Purchase Orders

Raw Materials Inventory

Production / Process Order Execution
- Supply Chain Exception Monitoring for End-to-End Visibility essential

Sales Forecast

Sales & Ops Planning

Demand Management

Master Prod Sched

Mat Req. Planning

Sales Order ATP setup to align to business needs and in APO use GATP Orders

Sequencing, capacity levelling and scheduling functionality to be used

Planning strategies / business rules aligned / adjusted

Component availability for production orders

Create Sales Forecast based on historic demand

Finishing Goods Inventory

Customer
- Sales Orders

Defining available capacity

Evaluating available capacity

Generating capacity requirements (load)

Standard available capacity
- Start: 06:00:00
- Finish: 22:00:00
- Length of breaks: 00:00:00
- Operating time: 14,72

Capacity utilization: 92%

No. of indiv. cap.: 1

Capacity: 14,72

Align S&OP in SAP - Sales Forecast; CO-PA; RCCP; Business Plans; and simplify process e.g. Planning Books
Analysis Helps Drive Us to Predictability

Past consumption based on historic activity

Make changes and rerun the future plan to find the ideal fit

Future plan based on independent requirements
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Grouping the Data: Swim Lanes

- Critical
- Repairable
- Regular
- Strategic
- Slow Moving
- A, B, C
- Obsolete
- Value Stream

Photo of swimmers on blocks.

Photo of a person working on a laptop.
Data Hierarchy and Ownership

ONE OWNER

GROUP

Machines
Spares
Consumables
Obsolete

PRIORITY

Strategic
Regular
Slow
Integrated Supply to Demand

Gate Control

Crowd Control

Logistics

MRP Master Data

Demand signal comes from the RDC

Demand signal comes the BOM and the Production Plan

Routings
Work Centers
BOMs
Integrated Supply to Demand (cont.)

Gate Control

- Produce Later than Planned
  - Schedule In
    - Impacting Customer Orders
  - Schedule Out
    - Inflating Inventory

Crowd Control

- Breaks down trust and reliability of the data

Logistics
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5 Competitive Priorities That Add Value to Decisions
Increase Upper-Quartile Performance

1. **Cost** – *standardized products enabling economies of scale*
2. **Quality** – *conform to requirements or fitness for use*
3. **Delivery** – *speed and reliability*
4. **Flexibility** – *product range, volume capability, introduce new*
5. **Innovation** – *focus on target market segments with tailored mix*

Set precise and explicit performance goals based on priorities
Impact on Upper Quartile Performance: S&OP
Benefits to the Organization

• Effectively implemented and applied, S&OP delivers significant benefits to the organization:
  - Aberdeen Group cited best in class S&OP yields:
    1. 14% increase in Operating Margin
    2. 4% increase in Gross Margin Dollars
    3. 55% reduction in Inventory write-offs
    4. 17% increase in new product revenues
    5. 35% reduction in lost sales
  - Oliver Wight Group reports:
    1. Increased Forecast Accuracy by: 18% to 25%
    2. Increased Sales Revenue by: 10% to 15%
    3. Increased On-Time Delivery by: 10% to 50%
    4. Inventory Reduction by: 18% to 46%
    5. Safety Stock Reduction by: 11% to 45%
    6. Increased Productivity by: 30% to 45%
Impact on Upper Quartile Performance: Capacity Planning

- **Clear financial benefits from efficient capacity plans with MRP:**
  - Insufficient capacity quickly leads to:
    - **Deteriorating delivery performance** – loss of sales revenue
    - **Unnecessary increase of WIP** – more carrying costs/higher inventory
    - **Frustration of sales personnel and those in manufacturing:**
      - *Demand → Supply disconnect*
  - Excess capacity can be costly and unnecessary

- **Manage capacity properly to reduce barriers to:**
  - Achievement of maximum/optimum company performance
  - Introduction of new products into production, stunting growth

- **Capacity directly influences company’s decisions on:**
  - Technology
  - Facilities and Equipment
  - Human Resources
  - Outsourcing

- **Cost of Doing Business**
“You cannot improve what you cannot measure ... The emerging best metrics, such as gross margin, encompass the two-way impact of demand and supply decisions, rather than having separate and unrelated metrics for each.”

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Where to Find More Information

  - www.referenceforbusiness.com/management/Bun-Comp/Capacity-Planning.html

• Dr. Karl Knapp, “Competitive Priorities” (KarlKnapp.com).
  - http://karlknapp.com/resources/wikisummaries/supplychain_mgt/competitive_priorities.html

• “Competitive Priorities of Amul” (StudyMode, November 2011).

• Mike Herald, “Systematically Eliminating Manufacturing Bottlenecks” (First Edge Solutions, September 2012).
  - www.firstedgesolutions.com/systematically-eliminating-manufacturing-bottlenecks/#!prettyPhoto
Where to Find More Information (cont.)

  - [www.amazon.com/Orchestrating-Success-Business-Operations-Planning/dp/0471132276/ref=la_B001KCD3B0_1_1?s=books&ie=UTF8&qid=1425407412&sr=1-1](http://www.amazon.com/Orchestrating-Success-Business-Operations-Planning/dp/0471132276/ref=la_B001KCD3B0_1_1?s=books&ie=UTF8&qid=1425407412&sr=1-1)
    - Book about improving control of the business with sales and operations planning
  - Wikipedia’s definition for Sales and Operation Planning with reference to APICS
  - “S&OP for Business Orchestration: Four Requirements for Making the Transformation” (Kinaxis).
7 Key Points to Take Home

- Understanding the key differences between manufacturing flows is key to deciding the best application to your business.
- Planning strategies control the MTS/MTO/FTO relationships, and your organization should be educated on their use and impact.
- Capacity Planning is done in an iterative way, making sure that each department’s resources are considered.
- How we stock material to meet the plan and which dates we promise our customers are significantly influenced by the Planning Strategy and ATP checking rules, so these must be chosen carefully.
- Strive for an accurate plan. If the schedule deviates from the plan, it may be necessary to correct the plan. Consider how to best control the integration from S&OP to execution to ensure stability in the supply chain based on capacity performance.
- Apply exception management on a daily basis with the objective to reduce exceptions to zero.
- Ensure an owner for S&OP with the authority to influence integration and who is accountable to the head of the organization.
Questions?

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Please remember to complete your session evaluation
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