Overview

Basic Concepts
Organizational levels relevant to production process
Master data relevant to production process
The Production Process
A Basic Production Process

Types of Manufacturing

**Discrete**: making units of countable products
- Individual or separate unit production.
- Cars, toys, consumer electronics, auto parts

**Process**: making continuous ‘batches’ of products
- Continuous production of paint, chemicals, liquids, etc.

**Repetitive manufacturing**
- Same or similar products produced over a period of time
- Specified quantity produced during a given period of time
- Process decomposed into simple steps
### Manufacturing strategies

**Make-to-stock**: production output not directly order related.

**Make-to-order**: production driven by sales orders.

### Organizational Data relevant to Production

- Client
- Company code
- (Production/Storage) Plant
- Storage location
Master Data

Material Master
Bill of Material
Work Center
Product Routing/Task List
Production Resource Tools (PRT)

Material Master

Previously discussed views:
- Basic data
- Purchasing related
- Sales related
- Accounting related

Additional view needed for production
- Work scheduling – plant specific execution data
- MRP – plant specific planning data

Additional views that may be used
- Quality Management, Forecasting, and Classification
Bill of Materials

Identifies components needed to make the material

All BOMs in SAP ERP are single level.

- A component can have its own BOM (multi-level-BOM-like structure)

BOMs are used in

- Material planning (MRP)
- Production
- Procurement
- Product costing

Single-level BOMS
BOM Structure

Bill of Materials - Header

Applies to entire BOM

Elements:

- **Status**: active or inactive
- **Base quantity**: material specified are to make the base quantity (typically 1 unit).
- **Usage**: production, engineering, costing, etc.
- **Plant**: plant BOM belongs to.
  - Each plant can have a different BOM
- **Validity**: date range BOM is valid

It is possible for a single material to have multiple BOMs in a given context. (Often, for example, for making different base quantities.)
Bill of Materials - Items

Apply to the specific item in the BOM

Item category:
- **Stock item** – must have a material master
- **Non-stock Item** – no material master
- **Variable-sized Item** – must specify size
- **Document Item** – diagrams, additional instructions

Material number
Quantity

Work Center

**Basic data**
- Name, description
- Person responsible for maintaining master data
- Task list usage (which routings can use this work center)

**Capacities**
- A measure of how many units of a material a work center can produce within a given timeframe
- Data source for production planning

**Scheduling**
**Cost center**
**HR assignment**
Work Center Data

Steps necessary to produce a material

Operations
Sequence
  Standard
  Alternate
  Parallel
Work center
Times
  Setup, machine, labor
Component assignment
  Assignment of materials to an operation
Relationship between a Bill of Materials and Routing
If not assigned assumed to be assigned to the first operation
Structure of a Routing

Routing RI

Header
- Status, usage, person responsible, validity

Sequences 1 (standard)
- Operation 1
- Operation 2
- ...
- Operation n

Sequences 2 (alternate)
- Operation 2
- Operation 1
- ...
- Operation n

GBI Routing

Header

Sequences 1 (standard)
- 10: Material staging
- 20: Attach seat to frame
- 30: Attach handle bar
- ...
- 80: Test bike
- ...
- 100: Pack bike
- 110: Move to storage

Routing And Work Centers

Routing

Operation 80
- Test bike

Standard value
- Setup
- Machine
- HR
- Variable 1

Work center INSP 1000
- Cap. 001
- 002

Scheduling formula
- 2 min.
- 1. Setup
- 5 min.
- 5 min.
- 2. Processing
- 3. Tear down

Operation standard values implemented in the scheduling formulas of the work center result in:
- Fixed time elements (independent of lot size)
- Variable time elements (dependent on lot size)
Component Assignment

Routing
- Op. 10
- Op. 20
- Op. 30

BOM
- Mat. A
- Mat. B
- Mat. C

- Procurement and consumption of components occur at the beginning of the operation to which they are assigned.

Operations sequence
- Op. 10
- Op. 20
- Op. 30

- Mat. A
- Mat. B
- Mat. C

Sample Production Plan

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>T</th>
<th>F</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>T</th>
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<td>Wheels inventory</td>
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<td>Bikes production</td>
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<td>19</td>
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<td>15</td>
<td>10</td>
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<tr>
<td>Bikes inventory</td>
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<td>25</td>
<td>35</td>
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<td>60</td>
<td>75</td>
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<td>135</td>
<td>150</td>
<td>160</td>
<td>175</td>
<td>185</td>
</tr>
</tbody>
</table>

Assumptions
- Number of shifts: 1
- Bikes per week: 50
- Hours per shift: 8
- Bikes per year: 2500
- Days per week: 5
- Wheels per week: 100
- Weeks per year: 50
- Wheels per year: 5000
### Material Master – MRP Views

<table>
<thead>
<tr>
<th>Material Master – MRP Views</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MRP type</strong></td>
</tr>
<tr>
<td>How a material should be planned</td>
</tr>
<tr>
<td>MRP, consumption-based, or no planning</td>
</tr>
<tr>
<td><strong>Lot size</strong></td>
</tr>
<tr>
<td>Lot size of each procurement proposal</td>
</tr>
<tr>
<td><strong>Procurement type</strong></td>
</tr>
<tr>
<td>How to procure the material--In house vs. external</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Master – MRP Views</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-house production time</strong></td>
</tr>
<tr>
<td>Time needed to produce material</td>
</tr>
<tr>
<td><strong>Planned delivery time</strong></td>
</tr>
<tr>
<td>Time needed to acquire externally</td>
</tr>
<tr>
<td><strong>Safety stock</strong></td>
</tr>
<tr>
<td><strong>Strategy group</strong></td>
</tr>
<tr>
<td>Procedure used for planning</td>
</tr>
<tr>
<td>Make to stock, make to order</td>
</tr>
<tr>
<td><strong>Availability check group</strong></td>
</tr>
<tr>
<td>How the system checks for material availability when planning</td>
</tr>
<tr>
<td>Include planned orders? Purchase orders? Reservations?</td>
</tr>
</tbody>
</table>
Production Resource Tools (PRTs)

Movable objects required for production. Shared among different work centers
- Documents (instructions)
- Materials (calibration tool)
- Equipment (machine that is not in a fixed location)
- Miscellaneous

The Production Process
Request Production

**Planned order**
- What material?
- How many?
- When?

**Generated by other processes**
- Fulfillment, Project management, Material planning

Can be created manually

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Data In A Planned Order

**Organizational data**
- Client
- Company code
- Plant
- Storage location

**Master data**
- Material master
- Bill of materials
- Routings

**User input**
- Order type
- Procurement type
- Material number
- Quantity
- Dates (start or finish)
Authorize Production

With planned order: convert to production order
Without planned order: create production order

Production order
  - What material is to be produced?
  - How many?
  - When?
  - Where will they be produced?
  - What resources are to be used?
  - How much is it expected to cost?

Elements Of The Authorize Production Step

<table>
<thead>
<tr>
<th>Trigger</th>
<th>Data</th>
<th>Task</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Planned order</td>
<td>• Organizational data</td>
<td>• Create production order</td>
<td>• Scheduling</td>
</tr>
<tr>
<td>• Need for materials</td>
<td>• Master data</td>
<td>• Routing selection</td>
<td>• Availability checks</td>
</tr>
<tr>
<td></td>
<td>• User input</td>
<td>• BOM selection</td>
<td>• Reservations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Component assignment</td>
<td>• Preliminary costing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• PRT assignment</td>
<td>• Purchase requisitions</td>
</tr>
</tbody>
</table>

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Data In A Production Order

**Organizational data**
- Client
- Company code
- Plant
- Storage location

**User input**
- Order type
- Procurement type
- Material number
- Quantity
- Dates (start or finish)

**Master data**
- Material master
- Bill of materials
- Routing
- Work center
- PRTs

**Planned order**
- Material
- Quantity
- Dates

---

Structure Of A Production Order

**Header**
- Order number
- Plant
- Scheduler
- Status

**Operations**
- Work center
- Control keys
- Standard values

**Sequences**
- Standard
- Alternate
- Parallel

**Capacity splits**
- Machine
- Person

**Components**
- Material number
- Quantity

**PRTs**
- PRT number
- Quantity

**Trigger points**
- Functions

**Costs**
- Planned
- Actual

**Settlement rule**
- Settlement profile
- Settlement receiver

**Document link**
- Document number
- Document type

**Confirmations**
- Quantities
- Times
Cost Estimates in a Production Order

<table>
<thead>
<tr>
<th></th>
<th>Planned (estimate)</th>
<th>Actual (debit)</th>
<th>Target (credit)</th>
<th>Variance (debit-credit)</th>
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</thead>
<tbody>
<tr>
<td>Material</td>
<td>$14,500.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor</td>
<td>$625.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>$15,125.00</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Authorize Production - Outcomes

- Scheduling
- Availability checks
- Reservations
- Preliminary costing
- Purchase requisitions
Order Release

On creation order status is “created” CRTD

Order must be released (REL) to permit steps
  Goods movement
  Confirmations
  Document printing
  Settlement

Automatic or manual
  If no time is needed between creation and release for preparation, then release automatically

Release at different levels
  Header: all operations are released
  Operations: release specific operation
    Operations status: REL
    Order status: PREL (partially released)
Goods Issue

Movement type 261

Impact

- Material, FI, CO documents
- G/L accounts updated
- Inventory updated
- Reservations updated (reduced)
- Costs updated (actual cost in order)

Elements Of The Goods Issue Step
Data In A Good Issue Step

Organizational data
- Client
- Company code
- Plant
- Storage location

User input
- Production order number
- Quantities
- Dates
- Storage locations

Master data
- Material master

Goods issue

Production order
- Components
- Quantities
- Reservations
- Status

Financial Impact Of A Goods Issue

Inventory-RM
- Debit: 9,237.50
- Credit: 9,237.50

Inventory-SFG
- Debit: 5,750.00
- Credit: 5,750.00

RM Consumption expense
- Debit: 9,237.50
- Credit: 9,237.50

SFG Consumption expense
- Debit: 5,750.00
- Credit: 5,750.00

Actual costs per bike:
- RM: $369.50
- SFG: $230.00

Production order

<table>
<thead>
<tr>
<th>Planned</th>
<th>Actual (debit)</th>
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<th>Variance (debit-credit)</th>
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<tr>
<td>Material</td>
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<td>Labor</td>
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<tr>
<td>Total</td>
<td>$15,125.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Elements Of The Confirmation Step

Order level confirmation
Operations level confirmation

Data In A Confirmation

User input
- Order number
- Quantity
- Activities
- Duration/dates
- Work center
- Personnel
- Variance

Production order
- Planned values
- Operations
- Control keys
Financial Impact Of A Confirmation

**Work center (cost center)**

- Labor cost: $645.83
  - Accumulated when incurred

**Actual labor**
- Total order: 775 minutes
- Per bike: 31
- Pay rate: $50

**Production order**

<table>
<thead>
<tr>
<th></th>
<th>Planned</th>
<th>Actual (debit)</th>
<th>Target (credit)</th>
<th>Variance (debit-credit)</th>
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<td>Material</td>
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</tr>
<tr>
<td>Labor</td>
<td>$625.00</td>
<td>$645.83</td>
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<tr>
<td>Total</td>
<td>$15,125.00</td>
<td>$15,633.33</td>
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</tbody>
</table>

Elements of the Goods Receipt Step

**Trigger**
- Confirmation

**Data**
- Organizational data
- Master data
- User input

**Task**
- Receive goods into inventory
- Transfer requirement

**Outcomes**
- Material, FI, CO Documents
- Update material master
- Update GL Accounts
- Update production order
- Update actual costs

**Goods receipt into storage**

**Movement type 101**

**Impact**

- Material, FI, CO documents
- Material master update (quantity and value)
- Production order update (quantity, date, costing)
### Data In A Goods Receipt

**Organizational data**
- Client
- Company code
- Plant
- Storage location

**User input**
- Production order number
- Quantities
- Dates
- Locations

**Goods receipt**

---

### Financial Impact Of A Goods Receipt

**Production order**

<table>
<thead>
<tr>
<th></th>
<th>Planned</th>
<th>Actual (debit)</th>
<th>Target (credit)</th>
<th>Variance (debit-credit)</th>
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</thead>
<tbody>
<tr>
<td>Material</td>
<td>$14,500.00</td>
<td>$14,987.50</td>
<td>$14,500.00</td>
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<td>Labor</td>
<td>$625.00</td>
<td>$645.83</td>
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<td>$20.83</td>
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<tr>
<td>Total</td>
<td>$15,125.00</td>
<td>$15,633.33</td>
<td>$15,125.00</td>
<td>$508.33</td>
</tr>
</tbody>
</table>

**Inventory-FG 200100**

**Mfg. output settlement 741600**

Debit: 15,125.00
Credit: 15,125.00
Periodic Processing

Overhead calculation
Work In Progress determination
Settlement

Overhead Calculation

Indirect costs
   Supervisor, manager, other salaries
   Utilities
Accumulated in cost centers
Periodically allocated to production orders based on pre-determined rules
## Work In Progress Determination

**Work-in-progress inventory**
- Inventory between GI and GR

**Periodically the value of what is in the production process is calculated and posted to the general ledger**

**Not essential**
- For short production processes
- Value of materials is not high

**Essential**
- When value of materials are high
- Production takes weeks, months, or years
- Aircraft production, construction.

## Settlement

**Settle the difference between planned and actual costs (variance)**
- Only planned costs are posted in the GR step
- Variance is settled in this step
Financial Impact Of A Settlement

<table>
<thead>
<tr>
<th>Production order</th>
<th>Planned</th>
<th>Actual (debit)</th>
<th>Target (credit)</th>
<th>Variance (debit-credit)</th>
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<tr>
<td>Material</td>
<td>$14,500.00</td>
<td>$14,987.50</td>
<td>$14,500.00</td>
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<tr>
<td>Total</td>
<td>$15,125.00</td>
<td>$15,633.33</td>
<td>$15,125.00</td>
<td>$508.33</td>
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</tbody>
</table>

Mfg. output settlement variance 200100 Debit 508.33 Credit

Mfg. output settlement 741600 Debit 15,125.00 Credit 508.33

Reporting

General SAP reporting options
- Online lists
- Work lists
- Analytics

Production specific reporting options
- Stock/requirement lists
### Production Information System - Components

<table>
<thead>
<tr>
<th>Order</th>
<th>Material</th>
<th>Current Date</th>
<th>Quantity</th>
<th>Material Description</th>
<th>Plant</th>
<th>Status</th>
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<tbody>
<tr>
<td>11/04/02</td>
<td>TRXAS002</td>
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<td>20</td>
<td>Touring Aluminum Wheel Assembly</td>
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<td>REL</td>
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<td>11/04/02</td>
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<td>05/23/2010</td>
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<td>Touring Frame-Red</td>
<td>CLR0</td>
<td>REL</td>
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<tr>
<td>11/04/02</td>
<td>CWM1003</td>
<td>05/23/2010</td>
<td>10</td>
<td>Derailleur Gear Assembly</td>
<td>CLR0</td>
<td>REL</td>
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<tr>
<td>11/04/02</td>
<td>TRK1003</td>
<td>05/23/2010</td>
<td>10</td>
<td>Touring Headset</td>
<td>CLR0</td>
<td>REL</td>
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<tr>
<td>11/04/02</td>
<td>TRS00102</td>
<td>05/23/2010</td>
<td>10</td>
<td>Touring Handlebar</td>
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<td>Warranty Document</td>
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<td>Packaging</td>
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### Production Information Systems - Operations

<table>
<thead>
<tr>
<th>Order</th>
<th>Operator</th>
<th>Operation center</th>
<th>Operation short text</th>
<th>Ob.</th>
<th>Actual start</th>
<th>Actual finish</th>
<th>System Status</th>
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</thead>
<tbody>
<tr>
<td>11/0001</td>
<td>1001</td>
<td>ASBY1000</td>
<td>Material staging</td>
<td>10</td>
<td>06/22/2010</td>
<td>06/22/2010</td>
<td>CHF</td>
</tr>
<tr>
<td>11/0001</td>
<td>1002</td>
<td>ASBY1000</td>
<td>Attach seat to frame</td>
<td>10</td>
<td>06/22/2010</td>
<td>06/22/2010</td>
<td>CHF</td>
</tr>
<tr>
<td>11/0001</td>
<td>1003</td>
<td>ASBY1000</td>
<td>Attach handle bar assembly</td>
<td>10</td>
<td>06/22/2010</td>
<td>06/22/2010</td>
<td>CHF</td>
</tr>
<tr>
<td>11/0001</td>
<td>1004</td>
<td>ASBY1000</td>
<td>Attach derailleur gear assembly to wheel</td>
<td>10</td>
<td>06/22/2010</td>
<td>06/22/2010</td>
<td>CHF</td>
</tr>
<tr>
<td>11/0001</td>
<td>1005</td>
<td>ASBY1000</td>
<td>Attach hubs and real wheels to chain</td>
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<tr>
<td>11/0001</td>
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<td>Install handlebar</td>
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Stock Requirements List

Stock/Requirements List as of 16:26 hrs

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