Grundzüge der Wirtschaftsinformatik
*Introduction to Business Information Systems*

Unit 9

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http://www.heppnetz.de/teaching/gwi/

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**Structure of the Lecture**

**Unit 1:** Introduction  
**Unit 2:** Central Processing Units  
**Unit 3:** Storage and Data Structures  
**Unit 4:** Input and Output Devices  
**Unit 5:** Software  
**Unit 6:** Networks, Data Interchange, and the Internet  
**Unit 7:** Design, Development, Deployment, and Operations of Information Systems  
**Unit 8:** Office Applications  
**Unit 9:** Enterprise Applications  
**Unit 10:** Supply Chain Applications and E-Business  
**Unit 11:** Management Support Systems  
**Unit 12:** Exam Review
Assignment from last week

• WI1, pp. 525-605; IBIS, pp. 93-168
• Review the slides

WI1 = Hansen/Neumann: Wirtschaftsinformatik 1; WI2 = Hansen/Neumann: Wirtschaftsinformatik 2; IBIS = Wigand et al: Introduction to Business Information Systems.

Link to the Previous Unit

• Last Unit:
  – What kinds of application software exist for typical office tasks?
• Today:
  – Which are key transactions in industrial enterprises?
  – How can software support such business transactions?
  – What is Enterprise Resource Planning (ERP) Software?
Structure of the Unit

• Overview
• Transaction Processing Systems (TSPs)
• Material Requirements Planning (MRP)
• Manufacturing Resource Planning (MRPII)
• Enterprise Resource Planning (ERP)

Transaction Processing

Data Entry → Processing → Documents and reports

Internally or externally generated transactions

Database

Cf. Stair / Reynolds

http://www.heppnetz.de/teaching/gwi/
Example: Materials Requirements

Pending Orders:
1. 200 wooden toy cars in blue
2. 12 unpainted metal items with 100 holes and 2 welded joints each
3. 100 m of fence, 4 welded joints per 15 cm

- Which parts, raw materials, and supplies do we have in order?
- What is the ideal date for ordering?
- What is the ideal ordering quantity, taking into account future consumption, lot sizes, and quantity discounts?

Example: Scheduling and Resource Usage

Pending Orders:
1. 200 wooden toy cars in blue, due Dec 10
2. 12 unpainted metal items with 100 holes and 2 welded joints each, due Dec 31
3. 100 m of fence, 4 welded joints per 15 cm, due Dec 20

Workshop
Drilling Station
Painting and Varnishing Station
Welding Station
Assembly Station
Example: Scheduling and Resource Usage

- **Input**
  - Quantities of output objects
  - List of tasks per object
  - Constraints on the order of execution of a task
    - Some tasks require completion of other task, some don’t
  - Throughput per station per task
    - Example: One welded joint of 10 cm length blocks the welding station for 10 minutes
  - Promised delivery dates

- **Output: Production Plan**
  - What should be done when on which station?
  - Can we meet the promised delivery dates?

Evolution of Integrated Business Information Systems

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single business functions</td>
<td>Selected functional areas</td>
<td>All internal business processes</td>
<td>All internal business processes plus selected processes between multiple enterprises</td>
<td>Comprehensive integration of internal and external business processes</td>
</tr>
</tbody>
</table>

Single business functions
- Example: Paychecks

Selected functional areas
- Example: Manufacturing

All internal business processes

All internal business processes plus selected processes between multiple enterprises

Comprehensive integration of internal and external business processes

Based on Hansen/Neumann p. 529

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Structure of the Unit

- Overview
- **Transaction Processing Systems (TSPs)**
- Material Requirements Planning (MRP)
- Manufacturing Resource Planning (MRPII)
- Enterprise Resource Planning (ERP)

Transaction Processing Systems

Data Entry → Processing → Documents and reports

Internally or externally generated transactions

Database

Cf. Stair / Reynolds

http://www.heppnetz.de/teaching/gwi/
Batch versus On-Line Transaction Processing

(a) Batch Processing
- Data entry of accumulated transactions
- Input (batches)
- Terminal
- Processing
- Output

(b) On-Line Transaction Processing
- Terminal
- Central computer (processing)
- Immediate processing of each transaction
- Output

Integration of a Firm’s TPSs

Cf. Stair/Reynolds
http://www.heppnetz.de/teaching/gwi/
Structure of the Unit

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Inventory Planning: Stochastic vs. Deterministic

• **Stochastic**: Based on *past consumption*
  – requires a rather stable demand
• **Deterministic**: Based on *pending orders*
  – for varying demand or costly parts
  – more precise
  – delays production (why?)
Safety Stock

- Minimum inventory level; inventory should never fall below that limit
- Keeps production running
- Determined based on experience and statistical analysis

Inventory Management: Reorder Time

cf. Wigand et al. (2003)

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ABC Analysis

• Classification of Products and Parts into
  – A: Important and huge part of the inventory value
  – B: Medium importance and impact on the inventory value
  – C: Low importance, low impact on the inventory value
• Can be done automatically
• Important for Sourcing Strategy
  – Single vs. multiple sourcing
  – Type of reordering approach (stochastic vs. deterministic)
  – Focus of improvement efforts to category A parts

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XYZ Analysis

• Idea: Classify goods by the amount and cause of variance in demand

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount and cause of variance</th>
<th>Predictibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Rather constant demand</td>
<td>High</td>
</tr>
<tr>
<td>Y</td>
<td>More significant variation in demand, often due to seasonal effects</td>
<td>Medium</td>
</tr>
<tr>
<td>Z</td>
<td>Lack of pattern in demand; “chaotic”</td>
<td>Low</td>
</tr>
</tbody>
</table>

Cf. Mertens

MRP – Material Requirements Planning

• Idea: Use a computer to determine the amount of parts and raw materials, based on
  – pending orders and
  – inventory levels

• Demand between products can be interrelated
  – An item can be both a final product and a component for another type of product
MRP – Input

- Pending Orders
- Bill of Material (BOM): A list of all the parts that are needed for assembling a certain product
- Inventory status data

Example: Material Requirements Planning

**Pending Orders**
- 10 blue ball pens
- 20 black ball pens
- 10 assorted pens (2 blue, 3 black, gift box)

**Inventory**
- 17 springs
- 1 m of spring wire
- 20 ink cartridges blue
- 10 ink cartridges black
- 10 body upper part
- 5 gift boxes

**Bill of Materials**
- Blue pen: 1 spring, 1 body, 1 blue ink cartridge
- Black pen: 1 spring, 1 body, 1 black ink cartridge
- Spring: 10 cm of spring wire
- Assorted pens: 2 blue pens, 3 black pens, 1 gift box
Material Requirements Planning

1. Decompose Master Production Schedule into required components
   - E.g. 5 Pens -> 5 pen bodies, 5 springs, 5 blue ink cartridges
2. Deduct available parts from resulting quantities
3. If a part cannot be further decomposed, take the respective quantity as a gross ordering quantity
   - might be adjusted due to lot size and more economical ordering quantities
4. If a part can be further decomposed, go through steps 1 and 2 until step 3 is reached.

Example: Material Requirements Planning

**Pending Orders**
- 10 blue ball pens, 20 black ball pens
- 10 assortment of pens (2 blue, 3 black, gift box)

**Bill of Materials**
- Blue ball pen: 1 spring, 1 pen body, 1 blue ink cartridge
- Black ball pen: 1 spring, 1 pen body, 1 black ink cartridge
- Spring: 10 cm of spring wire
- Assortment of pens: 2 blue ball pens, 3 black ball pens, 1 gift box
- Pen body: 1 body upper part, 1 pen tip

**Inventory**
- 17 springs
- 1 m of spring Wire
- 20 ink cartridges blue
- 10 ink cartridges black
- 10 body upper part
- 5 gift boxes

<table>
<thead>
<tr>
<th>ID</th>
<th>Part</th>
<th>Inventory</th>
<th>Pending orders</th>
<th>Net material requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blue ball pen</td>
<td>0</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Black ball pen</td>
<td>0</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Assortment of pens</td>
<td>0</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Spring</td>
<td>17</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Pen body</td>
<td>0</td>
<td>0</td>
<td></td>
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<tr>
<td>6</td>
<td>Spring wire</td>
<td>1 m</td>
<td>0</td>
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<td>7</td>
<td>Blue ink cartridges</td>
<td>20</td>
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<td>8</td>
<td>Black ink cartridges</td>
<td>10</td>
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<tr>
<td>9</td>
<td>body upper part</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Pen tip</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Gift box</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

http://www.heppnetz.de/teaching/gwi/
Special form of Bill of Materials: Variant Parts Lists

- Problem: The amount of BoMs can explode due to variants that are distinct only in a small detail
- Idea: Variants can be described by taking an existing part or final product and removing old and adding new parts
- Example:
  - Golf Turbo = 1 Golf Standard
    - 1 Standard Engine
    + 1 Turbo Engine

Advantages and Constraints of MRP

Advantages: Demand, inventory, ordering, and production is based on consolidated planning across all levels of production

Disadvantages:
- Correct inventory data is key
- Use of machinery, workstations, and human resources is not included
- No support for production scheduling
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MRPII – Manufacturing Resource Planning

- Includes requires workstation time, employees, and other resources.
- Capacity restrictions are included in the planning process.
Production Planning Problems

1. In which order should a stack of pending orders be produced?
2. Should pending orders be split into batches?
3. If there is choice in the sequencing of tasks, which is the ideal sequence?

Forward Scheduling

Goal: Determine earliest availability date if production run is started today

- Harvest Corn
- Grind Wheat
- Mix Dough
- Bake Bread

Today Availability

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Backward Scheduling

**Goal:** Determine latest production start for a given delivery date

![Diagram showing the process from Harvest Corn to Bake Bread with Today, Latest Production Start, and Promised Delivery indicated.]

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Enterprise-wide Planning Scope

• Due to the complexity and degree of interdependencies, local planning scope is inefficient. Examples:
  – ordering the same part for each order individually
  – ordering a part that is already on stock in another department
  – blocking one scarce workstation with an unimportant order

• Enterprise-wide planning will result in better decision-making regarding inventory, procurement, production, and scheduling.

But:

• This requires a consistent representation of all data in the enterprise.

Process Integration

Vertical Integration

Horizontal Integration

cf. Wigand et al. (2003), p. 80
The Idea of Enterprise Resource Planning (ERP)

- Planning of the usage of resources from the perspective of the overall enterprise.
- Capital, machinery, parts, human resources,…
- Usually on the basis of ERP software

ERP: One Integrated Planning System

- One database and data model across the enterprise
  - e.g. human resource data and staffing data for production planning come from the same database
- Consolidated and harmonized planning on all levels
- Best Practise Process Library
Advantages of ERP

- Eliminates costly, inflexible legacy systems
- Improved technology infrastructure
- Improved work processes
- Increased data access for decision making
The Hidden Costs of ERP Deployment

- Training
- Integration and testing
- Customization
- Data conversion
- Data analysis
- Consultants ad infinitum
- Replacing your best and brightest
- Implementation teams can never stop
- Waiting for ROI
- Post-ERP depression

http://www.cio.com/research/erp/edit/erpbasics.html

Assignment for Next Week

- WI1, pp. 607-770; IBIS pp 161-167
- Review the slides

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Thank you!

The slides and additional materials will be available at
http://www.heppnetz.de/teaching/gwi/