Material Requirements Planning

Learning Objectives

- Understand Basic Ideas of MRP, MRP II and ERP.
- Describe the Inputs and Outputs of MRP System

Material Requirements Planning

- Definition
  - MRP is a computer-based production planning system that specifies *what*, *how much*, and *when* materials (parts) are needed to produce end items
- When to Use MRP
  - Dependent demand
  - Assemble-to-order/stock environments
**MRP Introductory Example**

**Product Structure Tree for Product A**

- **A**
  - **B(4)**
  - **C(2)**
    - **D(2)**
    - **E(1)**
    - **D(3)**
    - **F(2)**

**Lead Times**
- A: 1 day
- B: 2 days
- C: 1 day
- D: 3 days
- E: 4 days
- F: 1 day

**Demand**
- Day 10: 50 A
- Day 8: 20 B (Spares)
- Day 6: 15 D (Spares)

*Create an inventory order schedule for all components and parts to satisfy demand requirements*

**Overview of MRP System**

- Firm orders from customers
- Forecasts of demand from customers
- Aggregate product plan
- Engineering design changes
- Master production schedule (MPS)
- Inventory transactions
- Bill of material file
- Material planning (MRP)
- Inventory record file
- Reports

**Inputs to MRP Master Production Schedule**

- **Master Production Schedule (MPS)**
  - Time-phased plan specifying how many and when each end item should be produced

<table>
<thead>
<tr>
<th>Week</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14 and so on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount</td>
<td>50</td>
<td>0</td>
<td>100</td>
<td>47</td>
<td>60</td>
<td>78</td>
<td>110</td>
<td>75</td>
<td>36</td>
</tr>
</tbody>
</table>

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Inputs to MRP

Bill of Materials (BOM)
- Bill of Materials (BOM)/Product Structure Tree
  -- A complete list of all components and the sequence to make the product

![Product Structure Tree for Item A]

Inventory Records File
- Inventory Records File
  - On-hand inventory
  - Orders outstanding
  - Lead time

MRP Outputs

Primary MRP Reports
- Planned Orders
  - schedule of amount and timing of future orders
- Order Releases
  - execution of planned orders
- Changes
  - revisions of due dates, order quantities, or cancellations of orders
**Evolution from MRP to ERP**

1960-70's  MRP  
Inventory and process time reduction with new production planning systems

1980's  MRP II  
Greater reductions due to the integration with accounting and human resource systems

1990's  ERP  
Optimizing the whole business network, including suppliers and clients real time transactions; Asset management

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**Extensions to MRP**

**Manufacturing Resource Planning (MRP II)**

- Goal: Plan and monitor all resources of a manufacturing firm:
  - manufacturing
  - marketing
  - finance
  - Engineering

- MRP is concerned primarily with manufacturing materials while MRPII is concerned with the coordination of the entire manufacturing production, including materials, finance, and human relations

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**MRP II**

Like today's ERP systems, MRPII was designed to integrate a lot of information by way of a centralized database. The goal of MRPII is to provide consistent data to all players in the manufacturing process as the product moves through the production line. However, the hardware, software, and relational database technology of the 1980s was not advanced enough to provide the speed and capacity to run these systems in real-time, and the cost of these systems was prohibitive for most businesses. Nonetheless, the vision had been established, and shifts in the underlying business processes along with rapid advances in technology led to the more affordable enterprise and application integration systems that businesses use today.
Enterprise Resource Planning (ERP)

- ERP attempts to integrate all departments and functions across a company onto a single computer system that can serve different departments’ particular needs.
- ERP systems encompass major functions in the manufacturing environment: order management, production planning, scheduling, inventory management and distribution, and product costing.

An Example: Order Fulfillment

Before ERP

Problems:
Delays, lost orders, keying into different computer systems, errors

An Example: Order Fulfillment (2)

Front-Office Functions

Back-Office Functions