Chapter 1

The Production Paradigm
Evolution of Production Systems

- **Ancient Systems**
  - basic planning, organizations and control
  - specialization of labor

- **Feudal Systems**
  - hierarchical system (delegation)
  - land and labor as production input

- **European System**
  - double entry bookkeeping, cost accounting
  - Industrial Revolution: specialization, mass markets, mass production

- **American System**
  - interchangeable parts
  - steam power
  - assembly lines
The Competitive Environment

- Status Quo of the American (and European) System (late 80s):
  - production driven system
  - cost efficient production as the main goal
  - high quality standardized goods
  - Market is taken as given

- Change towards a market-driven system
  - more sophisticated consumers
  - short product life cycles
  - product variety increases
  - global competition and heterogeneous markets
Production Systems

- Input \rightarrow Output
- manufacturing firms
- service companies: Universities

- flow process in two parts:
  - physical material
  - information

- coordination also with suppliers and distributors: supply chain management: recent emphasis on bi-directional information flow
Production Systems

Inventory Management

Production System

Production Floor

Work-in-process

Supplier

Purchasing

Raw Material Inventory

Finished Goods Inventory

Customer

Forecasting

Long-range capacity planning
Production planning
Short-range requirements (material capacity)
Scheduling

Cost Estimation and Quality Control

Production Management
The PPC function integrates material flow using the information system. Integration is achieved through a common database.
Building Blocks

- Objectives:
  - Quality
  - Cost
  - Time

- These might be seen as the fundamental objectives of the firm
- induced by these objectives one might observe various subordinate objectives at different levels and parts of the company
  - more variability, high inventory
  - low unit costs, low inventory
  - high throughput, less variability
  - short cycle times, high inventory
- Important to understand effects of individual incentives!
Building Blocks

Physical Arrangement
- production volume and
- product variety
- determine layout
  - job shop (low-volume, high customized)
    - process or functional layout
  - flow shop (high-volume)
    - product layout
Building Blocks

Organizational Arrangements

- **Functional Structure:** input oriented

- **Divisional Structure:** output oriented (projects, services, programs, locations) strategic business units

- **Matrix Structure:** one person-two bosses (input & output oriented)
Organizational Arrangements

Functional Structure

CEO

- Finance
- Marketing
- Production
- Purchasing
- Engineering
- Human Res.
Organizational Arrangements

Divisional Structure

CEO

- Product A
  - Engineering
  - Marketing
  - Control
- Product B
  - Engineering
  - Marketing
  - Control
- Product C
  - Engineering
- Purchasing
- Finance
- Production
- Hum. Res.

Production Management
## Organizational Arrangements: Matrix

<table>
<thead>
<tr>
<th>Marketing</th>
<th>Engineering</th>
<th>Prod. A</th>
<th>Procurement</th>
<th>Purchasing</th>
<th>Finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prod. A</td>
<td></td>
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<td></td>
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<tr>
<td>Prod. B</td>
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<td>Prod. C</td>
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Production Management
Production Planning and Control (PPC)

- Integrated-material-flow-based information system
- Based on a feedback loop (control theory)
- Management of deviations
- Art of selecting the appropriate mix of management technologies
- Impact of organizational structure, life-cycle effects
Building Blocks

Planning horizons

<table>
<thead>
<tr>
<th>Hour</th>
<th>Day</th>
<th>Week</th>
<th>Month</th>
<th>Year</th>
<th>Years</th>
</tr>
</thead>
</table>

Operational Planning

Strategic Planning

Tactical Planning
# Building Blocks

## Types of Decisions

<table>
<thead>
<tr>
<th></th>
<th>Long (strategic) top management</th>
<th>Intermediate (tactical) middle management</th>
<th>Short (operational) operational management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time</strong></td>
<td>three to ten years</td>
<td>six months to three years</td>
<td>one week to six months</td>
</tr>
<tr>
<td><strong>Unit</strong></td>
<td>dollars; hours</td>
<td>dollars; hours; product line; product family</td>
<td>individual products; product family</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td>aggregate forecast; plant capacity</td>
<td>intermediate forecast; capacity and production levels taken from long range plan</td>
<td>short range forecast; work force levels, processes; inventory levels</td>
</tr>
<tr>
<td><strong>Decisions</strong></td>
<td>capacity; product; supplier needs; quality policy</td>
<td>work force levels; processes; production rates; inventory levels; contracts with suppliers; quality level; quality costs</td>
<td>allocation of jobs to machines; overtime; undertime; subcontracting; delivery dates for suppliers; product quality</td>
</tr>
</tbody>
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