Learning Objectives

- Define Capacity and Best Operating Level
- Explain Economics and Diseconomies of Scale
- Understand Capacity Expansion Issues
- Calculate Capacity Requirements
- Relationship between Capacity Utilization & Service Quality
- Compare and Contrast Chase and Level Aggregate Planning Strategies of Meeting Demands
- Understand the Basics of Yield Management

Major Operations Planning Activities

Overview

Long Range
- Supply network planning
- Forecasting and Demand Mgmt

Medium Range
- Process Planning
- Strategic Capacity Planning
- Sales and Operations Planning
- Manufacturing
- Master Scheduling
- MRP
- Vehicle capacity planning
- Vehicle loading
- Vehicle dispatching
- Warehouse receipt planning

Short Range
- Logistics
- Weekly Workforce & Customer Scheduling
- Daily Workforce & Customer Scheduling
“You can’t build it if you don’t have the capacity”

Strategic Capacity Planning

- Planning for the overall capacity level of capital-intensive resources—facilities, equipment, and overall labor force size—to achieve a particular level of output potential

Capacity Planning

Basic Questions

- What kind of capacity is needed?
- How much is needed?
- When is needed?

What Is Capacity?

- The amount of output that a system is capable of achieving over a specific period of time
  - has a time frame
  - often measured in terms of resource inputs
  - cannot be stored for later use
Capacity Planning Concept

**Best Operating Level**

- Design capacity for which average unit cost is at the minimum

![Diagram showing average unit cost of output against volume, with Underutilization, Best Operating Level, and Overutilization regions]

**Capacity Utilization**

\[
\text{Utilization} = \frac{\text{Capacity used}}{\text{Best operating level}}
\]

- Capacity used
  - Rate of output actually achieved
- Best operating level
  - Capacity for which the process was designed

**Example**

- Design capacity = 50 trucks/day
- Actual output = 36 trucks/day
- \textbf{Utilization} = ?

\[
\text{Utilization} = \frac{36 \text{ trucks/day}}{50 \text{ trucks/day}} = .72 = 72\%
\]
Capacity Planning Concept

**Economies & Diseconomies of Scale**

Economies of Scale and the Experience Curve working

- 100-unit plant
- 200-unit plant
- 300-unit plant
- 400-unit plant

Diseconomies of Scale start working

Average unit cost of output

**Volume**

**Capacity Expansion Issues**

- Maintaining system balance
  - Inputs: Stage 1 200/hr → Stage 2 50/hr (bottleneck) → Stage 3 200/hr
  - External sources of capacity
  - Timing and frequency of capacity expansions

**Timing Strategy**

- Capacity leads demand
- Capacity lags demand

**Frequency of Capacity Expansion**

- Capacity level (infrequent expansion)
- Capacity level (frequent expansion)

**Volume vs. Years**

- Small chunk
- Large chunk

**Demand**

**Capacity Expansion Issues**

**Frequency of Capacity Expansion**
Planning Service Capacity

- Time
- Location
- Volatility of Demand

Capacity Utilization & Service Quality

- Best operating point is near 70% of maximum capacity for many services
- From 70% to 100% of service capacity, service quality usually gets worse.
- Best utilization rate may vary based on context specific tradeoff
  - Low rates are appropriate when both the degree of uncertainty and stakes are high
  - Relatively predictable services or service facilities without customer contact can operate much nearer 100 percent utilization

Aggregate Sales and Operations Planning

- Balance market demand to company resources (capacities)
- Medium-range: 3-18 months
- Goal: specify the optimal combination of
  - production rate
  - workforce level
  - inventory on hand
Balancing Aggregate Demand and Aggregate Production Capacity

The figure to the right represents forecast demand in units.
The lower figure represents the current aggregate capacity of the company.

What we want to do is balance out the production rate, workforce levels, and inventory to make these figures match up.

Required Inputs to the Production Planning System

Competitors' behavior
Raw material availability
Market demand
External capacity
Economic conditions

Planning for production

Current physical capacity
Current workforce
Inventory levels
Activities required for production

External to firm
Internal to firm

Strategies for Meeting Demand

- Level production - produce at constant rate & use inventory as needed to meet demand
- Chase demand - change workforce levels so that production matches demand
- Mixed strategy - Some combination of the two
Production Planning Strategies

**Level Production**

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**Chase Demand**

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Matching Capacity to Demand in Service

**Yield Management**

- Allocating the fixed capacity of service (airline seats, rental cars, hotel rooms etc.) to match potential demands in various market segments in the most profitable way

- Objective: sell the right capacity to the right customer segment at the right price to maximize the revenue or yield
Industries that Use Yield Management Techniques

- Transportation-oriented industries
  - Airlines
  - Railroads
  - Car rental agencies
  - Shipping
- Vacation-oriented industries
  - Tour operators
  - Cruise ships
  - Resorts
- Hotels, retailing, media, broadcasting, theaters, and sporting events

Business Environment for Yield Management

- Relatively fixed capacity but variable demand
- Ability to segment markets
- Perishable inventory
- Sales via reservations
- High fixed cost but low variable cost
- Accurate, detailed information Systems

Common Yield Management Techniques

- Reservation systems
- Overbooking
- Dynamic pricing
- Capacity allocation among customer groups or segments