Aggregate Production Planning

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Overview of Planning Levels

- Long-range plans
  - Product and service design
  - Location / layout
  - Long term capacity

- Intermediate plans (General levels)
  - Employment
  - Output and inventories
  - Subcontracting and backorders

- Short-range plans (Detailed plans)
  - Machine loading
  - Job assignments
  - Production lot size and order quantities
Aggregate Plan

Aggregate Plan: A statement of a company’s production rates, workforce levels, and inventory holding based on estimates of customer requirements and capacity limitations.

Service Industry
- Staffing Plan
  - Regarding staffs and labor related factors

Manufacturing Industry
- Production Plan
  - Regarding production rates and inventory

Aggregate Production Planning (APP)

- Determines resource capacity to meet demand
- For intermediate time horizon, 6-12 months
- Not feasible to build new facility
- May be feasible to hire/lay off workers, overtime, or subcontract
- Adjusting capacity OR managing demand
Aggregate Plan – Managerial Inputs

Operations
- Current machine capacities
- Plans for future capacities
- Workforce capacities
- Current staffing level

Distribution and marketing
- Customer needs
- Demand forecasts
- Competition behavior

Materials
- Supplier capabilities
- Storage capacity
- Materials availability

Accounting and finance
- Cost data
- Financial condition of firm

Human resources
- Labor-market conditions
- Training capacity

Engineering
- New products
- Product design changes
- Machine standards

Aggregate Plan – Outputs

Aggressive Alternatives
- Complementary Products
- Competitive Pricing

Reactive Alternatives
- Size of Workforce and Workforce Adjustment
- Units or dollars of Backlogs, Backorders, or Stockout
- Inventory Levels
- Production per month (in units or $)
- Units or dollars subcontracted
Aggregate Planning Strategies

- **Proactive**
  - Alter demand to match capacity

- **Reactive**
  - Alter capacity to match demand

- **Mixed**
  - Some of each
  
  Balancing demand and capacity over the entire planning horizon

Demand Options

- **Pricing**
- **Promotion**
- **Back orders**
- **New demand**
Capacity Options

- Hire and layoff workers
- Overtime/slack time
- Part-time workers
- Inventories
- Subcontracting
Chase Approach

• Advantages
  – Investment in inventory is low
  – Labor utilization in high (overtime)

• Disadvantages
  – The cost of adjusting output rates and/or workforce levels

Level Production

[Graph showing the relationship between production and demand over time]
Level Approach

• Advantages
  – Stable output rates and workforce

• Disadvantages
  – Greater inventory costs
  – Increased overtime and idle time
  – Resource utilizations vary over time

Mixed Strategy
### Aggregate Planning Strategies

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Possible Alternatives during Slack Season</th>
<th>Possible Alternatives during Peak Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chase #1: vary workforce level to match demand</td>
<td>Layoffs</td>
<td>Hiring</td>
</tr>
<tr>
<td>2. Chase #2: vary output rate to match demand</td>
<td>Layoffs, undertime, vacations</td>
<td>Hiring, overtime, subcontracting</td>
</tr>
<tr>
<td>3. Level #1: constant workforce level</td>
<td>No layoffs, building anticipation inventory, undertime, vacations</td>
<td>No hiring, depleting anticipation inventory, overtime, subcontracting, backorders, stockouts</td>
</tr>
<tr>
<td>4. Level #2: constant output rate</td>
<td>Layoffs, building anticipation inventory, undertime, vacations</td>
<td>Hiring, depleting anticipation inventory, overtime, subcontracting, backorders, stockouts</td>
</tr>
</tbody>
</table>

### Aggregate Plan to Master Schedule

1. **Aggregate Planning**
2. **Disaggregation**
3. **Master Schedule**
Disaggregating the Aggregate Plan

- **Master schedule**: The result of disaggregating an aggregate plan; shows quantity and timing of specific end items for a scheduled horizon.

- **Rough-cut capacity planning**: Approximate balancing of capacity and demand to test the feasibility of a master schedule.
Lessons

• Aggregate production planning is a powerful tool for resources management

• Suitable aggregate production planning strategy for an organization depends on various organizational and environmental factors

Management of Suppliers

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Supply Management: Objectives

• Support the operational requirements
• Effectively and efficiently manage the suppliers and related process.
• Understand the methodology for selection/evaluation of suppliers
• Develop strategies that improves supply chain efficiency and effectiveness

Process of Buying

• Obtaining the right material
• In Right quantities
• With right delivery (time and place)
• From the right source
• and at the right price
Sourcing Decisions: The Make-or-Buy Decision

• **Outsourcing** - buying materials and components from suppliers instead of making them in-house. The trend has moved toward outsourcing.

  *The Make or Buy decision is a strategic decision.*

Sourcing Decisions: The Make-or-Buy Decision- Cont.

Reasons for Buying or Outsourcing

1. Cost advantage
2. Insufficient capacity
3. Lack of expertise
4. Quality
Sourcing Decisions: The Make-or-Buy Decision- Cont.

Reasons for Making

- Protect proprietary technology
- No competent supplier
- Better quality control
- Use existing idle capacity
- **Control of logistics** - lead-time, transportation, and warehousing cost
- **Lower cost**

Economic Evaluation criteria: Make or Buy
Break Even Chart...1
Break Even Chart..2

Total Cost

F

Volume, X in units

Break Even Chart..3

Total Cost = F + VC*X

Volume, X in units (Volume manufactured = volume sold)
Break Even Chart..4

Total Revenue (TR) = Price * X

Volume, X in units

Break Even Chart..5

Total Revenue = Price * X

Total Cost = F + VC * X

Fixed Cost (F)

Variable Cost (VC)

Profit

Loss

TR, TC

F

0

X_L

BEP

X_P

Volume, X in units (Volume manufactured = volume sold)
Break Even point calculations

• At Break even point
  Total revenue = Total cost
  Thus,
  \[\text{Price} \times X = F + \text{VC} \times X\]
  \[\text{Break Even Volume (X)} = \frac{\text{Fixed cost (F)}}{(\text{Price} - \text{Variable cost})}\]

Type of Sourcing

a) **Sole Sourcing**: Only one supplier is available

b) **Single Sourcing**: Planned decision to select one supplier for an item where several suppliers are available

c) **Multiple sourcing**: More than one supplier for an item.
# How Many Suppliers to Use

Single-sourcing- a risky proposition. Although trends favor fewer sources, avoid single source.

<table>
<thead>
<tr>
<th>Reasons Favoring a Single Supplier</th>
<th>Reasons Favoring More than One Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>To establish a good relationship</td>
<td>Need capacity</td>
</tr>
<tr>
<td>Less quality variability</td>
<td>Spread risk of supply interruption</td>
</tr>
<tr>
<td>Lower cost</td>
<td>Create competition</td>
</tr>
<tr>
<td>Transportation economies</td>
<td>Information</td>
</tr>
<tr>
<td>Proprietary product or process</td>
<td>Dealing with special kinds of business</td>
</tr>
<tr>
<td>Volume too small to</td>
<td></td>
</tr>
</tbody>
</table>

# Supplier Selection and evaluation

The process of selecting suppliers, is complex and should be based on multiple criteria:

- Technical ability
- Manufacturing capability
- Quality
- Cost
- Reliability
- Order System and cycle time
- Capacity
- Price
- Location
- Service

OTHER PRACTICAL CONSIDERATIONS
Supplier Evaluation Cont.

### Table 3.3 Supplier Scorecard Used for the XYZ Company

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Rating</th>
<th>×</th>
<th>Weight</th>
<th>=</th>
<th>Final Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>80</td>
<td>0.10</td>
<td></td>
<td></td>
<td>8.00</td>
</tr>
<tr>
<td>Quality</td>
<td>90</td>
<td>0.25</td>
<td></td>
<td></td>
<td>22.50</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>95</td>
<td>0.15</td>
<td></td>
<td></td>
<td>14.25</td>
</tr>
<tr>
<td>Delivery</td>
<td>90</td>
<td>0.15</td>
<td></td>
<td></td>
<td>13.50</td>
</tr>
<tr>
<td>Cost</td>
<td>80</td>
<td>0.15</td>
<td></td>
<td></td>
<td>12.00</td>
</tr>
<tr>
<td>Environmental</td>
<td>90</td>
<td>0.05</td>
<td></td>
<td></td>
<td>4.50</td>
</tr>
<tr>
<td>Business</td>
<td>90</td>
<td>0.15</td>
<td></td>
<td></td>
<td>13.50</td>
</tr>
<tr>
<td><strong>Total score</strong></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td><strong>88.25</strong></td>
</tr>
</tbody>
</table>

*Note: Based on the total score of 88.25, the XYZ Company is considered a certified supplier.*

Some Recent Trends
Local or Global suppliers??
Reasons to Globalize Operations

Tangible
- Reduce costs (labor, taxes, tariffs, etc.)
- Improve the supply chain
- Provide better goods and services
- Attract new markets
- Learn to improve operations
- Attract and retain global talent

Intangible

Global Process Design & Technology

- Information technology enables management of integrated, globally dispersed operation
- Texas Instruments: 50 plants in 19 countries
- Hewlett-Packard - product development teams in U.S., Japan, Great Britain, and Germany
- Reduces time-to-market
Examples of Global Strategies

• Boeing – both sales and production are worldwide.

• Sony – purchases components from suppliers in Thailand, Malaysia, and around the world.

• GM is building four similar plants in Argentina, Poland, China, and Thailand

<table>
<thead>
<tr>
<th>Firm</th>
<th>Country</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alenia</td>
<td>Italy</td>
<td>Wing flaps</td>
</tr>
<tr>
<td>AeroSpace Technologies</td>
<td>Australia</td>
<td>Rudder</td>
</tr>
<tr>
<td>CASA</td>
<td>Spain</td>
<td>Ailerons</td>
</tr>
<tr>
<td>Fuji</td>
<td>Japan</td>
<td>Landing gear doors, wing section</td>
</tr>
<tr>
<td>GEC Avionics</td>
<td>United Kingdom</td>
<td>Flight computers</td>
</tr>
<tr>
<td>Korean Air</td>
<td>Korea</td>
<td>Flap supports</td>
</tr>
<tr>
<td>Menasco Aerospace</td>
<td>Canada</td>
<td>Landing gears</td>
</tr>
<tr>
<td>Short Brothers</td>
<td>Ireland</td>
<td>Landing gear doors</td>
</tr>
<tr>
<td>Singapore Aerospace</td>
<td>Singapore</td>
<td>Landing gear doors</td>
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</table>
Management of Suppliers and Distributors

- Plans to help achieve company mission
- Affect long-term competitive position
- Strategic options
  - Few suppliers
  - Keiretsu network
  - Local/Global Suppliers

Keiretsu network: Supplier as Partner
Case Volkswagen

- Brazilian plant employs 1000 workers
  - 200 work for VW
  - 800 work for other contractors:
    - Rockwell International, Cummins Engines, Deluge Automotiva, MWM, Remon and VDO, etc.

- VW responsible for overall quality, marketing, research and design

Learning's: Eicher Motors Pithampur
Suppliers to work on shop floor to deliver product
Strategic Alliance and Supplier Certification Programs

Supplier certification programs
-one way to identify strategic alliance candidates.

-Firms often develop their own formal certification programs, & most require ISO 9000 or similar certifications as one part of the certification process.

Early Supplier Involvement

Early supplier involvement (ESI) is perhaps one of the most effective supply chain integrative techniques.

Under ESI, key suppliers become more involved in the internal operations of the firm, particularly with respect to new product and process design and design for manufacturability techniques.

Value engineering activities help the firm to reduce cost, improve quality, and reduce new product development time.
e-Procurement Systems

*E-procurement systems* enable the concentration of a large volume of small purchases with a few suppliers in *electronic catalogues*, which are made available to the organization’s users.

*Reverse auctions*- suppliers enter Web site. At a pre-designated time and date, qualified suppliers try to underbid their competitors and can monitor the bid prices until the session is over.

Typical benefits of the e-Procurement System

- Time savings
- Cost savings
- Accuracy
- Real time
- Mobility
- Trackability
- Management
- Benefits to the suppliers
Lessons:: Key for successful partnerships

• Building Trust
• Shared Vision and objectives
• Personal Relationships
• Mutual benefits
• Commitment and Top management Support
• Change Management
• Information Sharing
• Shared Measurements
• Continuous Improvements

Summary and Learning’s

• Supplier plays an important role in improving the efficiency and effectiveness of supply chain

• Selection and evaluation is a strategic decision

• Effective and efficient partnership rests on the pillars of trust.
Thank you