The lead-time gap

Reducing the gap by shortening the logistics lead time while simultaneously trying to move the order cycle closer through improved visibility of demand.

Source: M. Christopher, Logistics & Supply Chain Management, 4th, 2011

The demand penetration point should be moved as far as possible upstream.

The demand penetration point should be moved as far as possible upstream.

Source: M. Christopher, Logistics & Supply Chain Management, 4th, 2011

Real demand is hidden from view and all we tend to see are orders!
Role of Forecasting in a Supply Chain

- The basis for all strategic and planning decisions in a supply chain
- Examples:
  - Production: scheduling, inventory, aggregate planning
  - Marketing: sales force allocation, promotions, new production introduction
  - Finance: plant/equipment investment, budgetary planning
  - Personnel: workforce planning, hiring, layoffs
- All of these decisions are interrelated

Characteristics of Forecasts

- Forecasts are always wrong!
- Should include expected value and measure of error
- Long-term forecasts are less accurate than short-term forecasts (forecast horizon is important)
- Aggregate forecasts are more accurate than disaggregate forecasts

Forecasting Methods

- Qualitative: primarily subjective; rely on judgment and opinion
- Time Series: use historical demand only
  - Static
  - Adaptive
- Causal: use the relationship between demand and some other factor to develop forecast
- Simulation
  - Imitate consumer choices that give rise to demand
  - Can combine time series and causal methods
Components of an Observation

Observed demand (O) = Systematic component (S) + Random component (R)

- **Level** (current deseasonalized demand)
- **Trend** (growth or decline in demand)
- **Seasonality** (predictable seasonal fluctuation)

- Systematic component: Expected value of demand
- Random component: The part of the forecast that deviates from the systematic component
- Forecast error: difference between forecast and actual demand

Forecasting Methods

- **Static**
  - Assumes that the estimates of level, trend and seasonality do not vary. Forecast is based on historical values and uses the same values for all future forecasts

- **Adaptive**
  - The estimates of level, trend, and seasonality are adjusted after each demand observation
    - Moving average
    - Simple exponential smoothing
    - Holt’s model (with trend)
    - Winter’s model (with trend and seasonality)

Basic Approach to Demand Forecasting

- Understand the objectives of forecasting
- Integrate demand planning and forecasting
- Identify major factors that influence the demand forecast
- Understand and identify customer segments
- Determine the appropriate forecasting technique
- Establish performance and error measures for the forecast
Forecasting in Practice

◆ Collaborate in building forecasts
◆ The value of data depends on where you are in the supply chain
◆ Be sure to distinguish between demand and sales

"... according to Terra Technology's benchmarking study, the error rate for CPG companies on estimated vs. actual sales is shockingly high. Even with the fastest-selling, most predictable products, the estimates are off by an average of more than 40 percent."

Andrew Winston in Harvard Business Review, August 2011

Role of Aggregate Planning in a Supply Chain

◆ Aggregate planning:
  – process by which a company determines levels of capacity, production, subcontracting, inventory, stockouts, and pricing over a specified time horizon
  – goal is to maximize profit
  – decisions made at a product family (not SKU) level
  – time frame of 3 to 18 months
  – how can a firm best use the facilities it has?

Role of Aggregate Planning in a Supply Chain

◆ Specify operational parameters over the time horizon:
  – production rate
  – workforce
  – overtime
  – machine capacity level
  – subcontracting
  – backlog
  – inventory on hand
◆ All supply chain stages should work together on an aggregate plan that will optimize supply chain performance

Information Needed for an Aggregate Plan

◆ Demand forecast in each period
◆ Production costs
  – labor costs, regular time ($/hr) and overtime ($/hr)
  – subcontracting costs ($/hr or $/unit)
  – cost of changing capacity: hiring or layoff ($/worker) and cost of adding or reducing machine capacity ($/machine)
◆ Labor/machine hours required per unit
◆ Inventory holding cost ($/unit/period)
◆ Stockout or backlog cost ($/unit/period)
◆ Constraints: limits on overtime, layoffs, capital available, stockouts and backlogs
Outputs of Aggregate Plan

◆ Production quantity from regular time, overtime, and subcontracted time: used to determine number of workers and supplier purchase levels
◆ Inventory held: used to determine how much warehouse space and working capital is needed
◆ Backlog/stockout quantity: used to determine what customer service levels will be
◆ Machine capacity increase/decrease: used to determine if new production equipment needs to be purchased
◆ A poor aggregate plan can result in lost sales, lost profits, excess inventory, or excess capacity

Aggregate Planning Strategies

◆ Trade-off between capacity, inventory, backlog/lost sales
◆ Chase strategy – using capacity as the lever
◆ Time flexibility from workforce or capacity strategy – using utilization as the lever
◆ Level strategy – using inventory as the lever
◆ Mixed strategy – a combination of one or more of the first three strategies

Chase Strategy

◆ Production rate is synchronized with demand by varying machine capacity or hiring and laying off workers as the demand rate varies
◆ However, in practice, it is often difficult to vary capacity and workforce on short notice
◆ Expensive if cost of varying capacity is high
◆ Negative effect on workforce morale
◆ Results in low levels of inventory
◆ Should be used when inventory holding costs are high and costs of changing capacity are low

Level Strategy

◆ Maintain stable machine capacity and workforce levels with a constant output rate
◆ Shortages and surpluses result in fluctuations in inventory levels over time
◆ Inventories that are built up in anticipation of future demand or backlogs are carried over from high to low demand periods
◆ Better for worker morale
◆ Large inventories and backlogs may accumulate
◆ Should be used when inventory holding and backlog costs are relatively low
Time Flexibility Strategy

- Can be used if there is excess machine capacity
- Workforce is kept stable, but the number of hours worked is varied over time to synchronize production and demand
- Can use overtime or a flexible work schedule
- Requires flexible workforce, but avoids morale problems of the chase strategy
- Low levels of inventory, lower utilization
- Should be used when inventory holding costs are high and capacity is relatively inexpensive

Aggregate Planning in Practice

- Think beyond the enterprise to the entire supply chain
- Make plans flexible because forecasts are always wrong
- Rerun the aggregate plan as new information emerges
- Use aggregate planning as capacity utilization increases

Responding to Predictable Variability in a Supply Chain

- Predictable variability is change in demand that can be forecast
- Can cause increased costs and decreased responsiveness in the supply chain
- A firm can handle predictable variability using two broad approaches:
  - Manage supply using capacity, inventory, subcontracting, and backlogs
  - Manage demand using short-term price discounts and trade promotions

1. Products with stable demand, i.e. butter, bread, etc.
2. Products with variable demand, i.e. ski jackets, sunlotion, etc.
Managing Supply

◆ Managing capacity
  – Time flexibility from workforce
  – Use of seasonal workforce
  – Use of subcontracting
  – Use of dual facilities – dedicated and flexible
  – Designing product flexibility into production processes

◆ Managing inventory
  – Using common components across multiple products
  – Building inventory of high demand or predictable demand products

Managing Demand

◆ Promotion

◆ Pricing

◆ Timing of promotion and pricing changes is important

◆ Demand increases can result from a combination of three factors:
  – Market growth (increased sales, increased market size)
  – Stealing share (increased sales, same market size)
  – Forward buying (same sales, same market size)

The Role of Pricing and Revenue Management in the Supply Chain

Revenue management is the use of pricing to increase the profit generated from a limited supply of supply chain assets

Supply assets exist in two forms: capacity and inventory

Revenue management may also be defined as the use of differential pricing based on customer segment, time of use, and product or capacity availability to increase supply chain profits

Most common example is probably in airline pricing

Conditions Under Which Revenue Management Has the Greatest Effect

The value of the product varies in different market segments (Example: airline seats)

The product is highly perishable or product waste occurs (Example: fashion and seasonal apparel)

Demand has seasonal and other peaks (Example: products ordered at Amazon.com)

The product is sold both in bulk and on the spot market (Example: owner of warehouse who can decide whether to lease the entire warehouse through long-term contracts or save a portion of the warehouse for use in the spot market)
Pricing and Revenue Management for Multiple Customer Segments

If a supplier serves multiple customer segments with a fixed asset, the supplier can improve revenues by setting different prices for each segment.

Prices must be set with barriers such that the segment willing to pay more is not able to pay the lower price.

The amount of the asset reserved for the higher price segment is such that the expected marginal revenue from the higher priced segment equals the price of the lower price segment.

Characteristics of lean and agile supply chains

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<th>Characteristic</th>
<th>Lean</th>
<th>Agile</th>
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<td>Logistics focus</td>
<td>Eliminate waste</td>
<td>Customers and markets</td>
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<td>Partnerships</td>
<td>Long term, stable</td>
<td>Fluid clusters</td>
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<tr>
<td>Key measures</td>
<td>Output measures like productivity and cost</td>
<td>Measure capabilities, and focus on customer satisfaction</td>
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<tr>
<td>Process focus</td>
<td>Work standardisation, conformance to standards</td>
<td>Focus on operator self-management to maximise autonomy</td>
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<tr>
<td>Logistics planning</td>
<td>Stable, fixed periods</td>
<td>Instantaneous response</td>
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Product design and supply chain complexity

- Increased manufacturing complexity reduces flexibility and responsiveness.
- Components should have commonality.
- Design decisions impact choice of suppliers and their delivery capabilities.
- High number of service parts impacts inventory levels.
- Postponement (late stage customisation) can be enhanced or constrained by product design.

Generic inventory and postponement

- Generic = having no particularly distinctive quality or application.
- Generic inventory are parts that can be used in multiple products (i.e. at Zara it is undyed fabric).
- Postponement (late assembly) refers to the delay of product differentiation until closer to the sale.