Supply Chain Analytics

Lecture 12: Time series analysis

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E-Procurement

- ✓ *Business-to-business commerce conducted on the Internet*
- ✓ *Benefits include lower transaction costs, lower prices, reduce clerical labor costs, and faster ordering and delivery times*
- ✓ *Currently used more for indirect goods*
- ✓ *E-Marketplaces service industry-specific companies and suppliers*

Purchasing

- ***Purchasing*** *is responsible for obtaining the materials, parts, and supplies and services needed to produce a product or provide a service.*
- ***Purchasing cycle:*** *Series of steps that begin with a request for purchase and end with notification of shipment received in satisfactory condition.*

IMPORTANCE OF PURCHASİNG

Purchasing is important because:

- it is a major cost center
- affect quality of final product
- aids strategy of low cost, response and differentiation

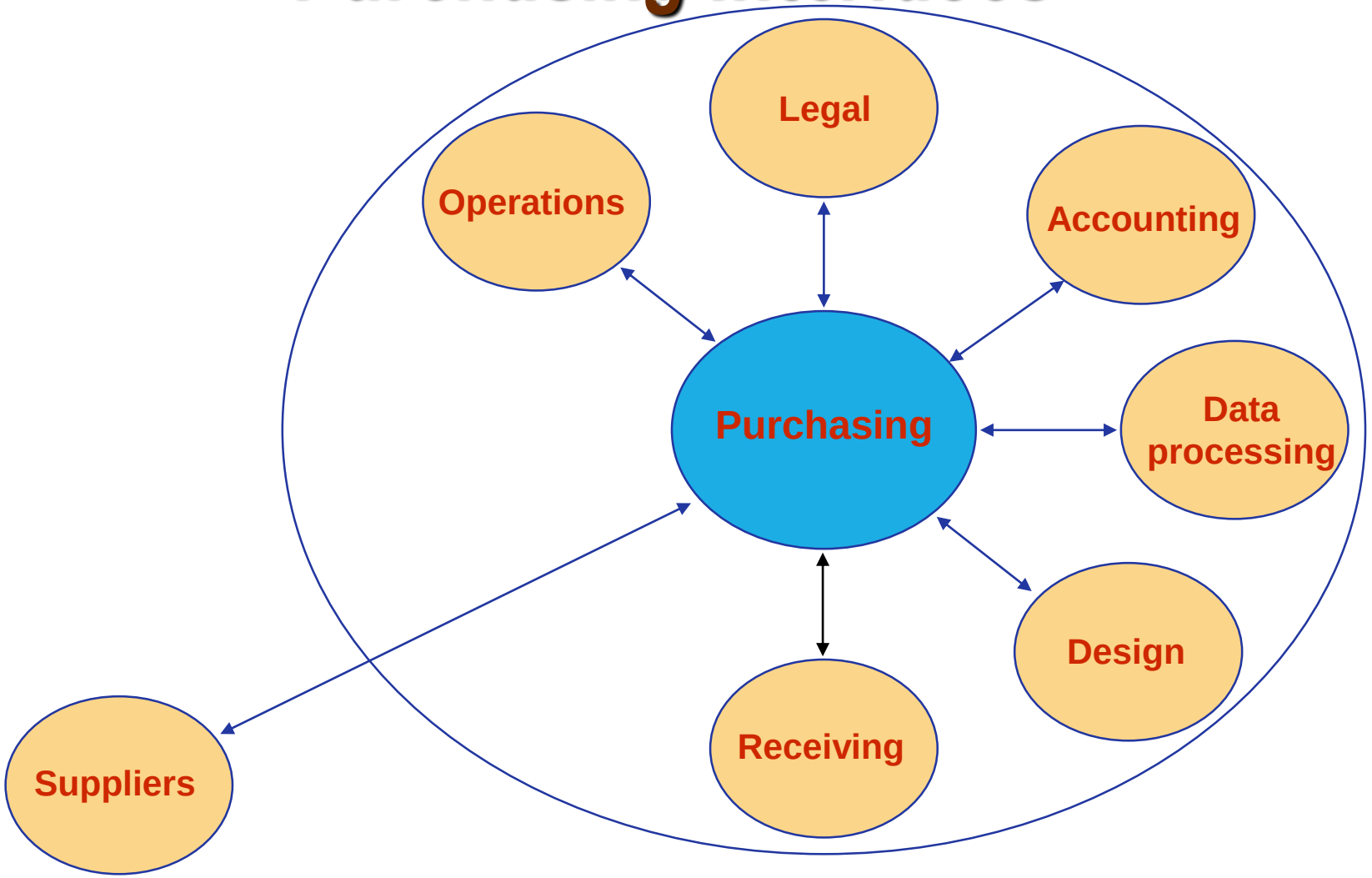
Goals of Purchasing

- *Develop and implement purchasing plans for products and services that support operations strategies.*
- *Develop, evaluate, and determine the best supplier, price, and delivery for the products and services that can be best obtained externally*

Duties of Purchasing

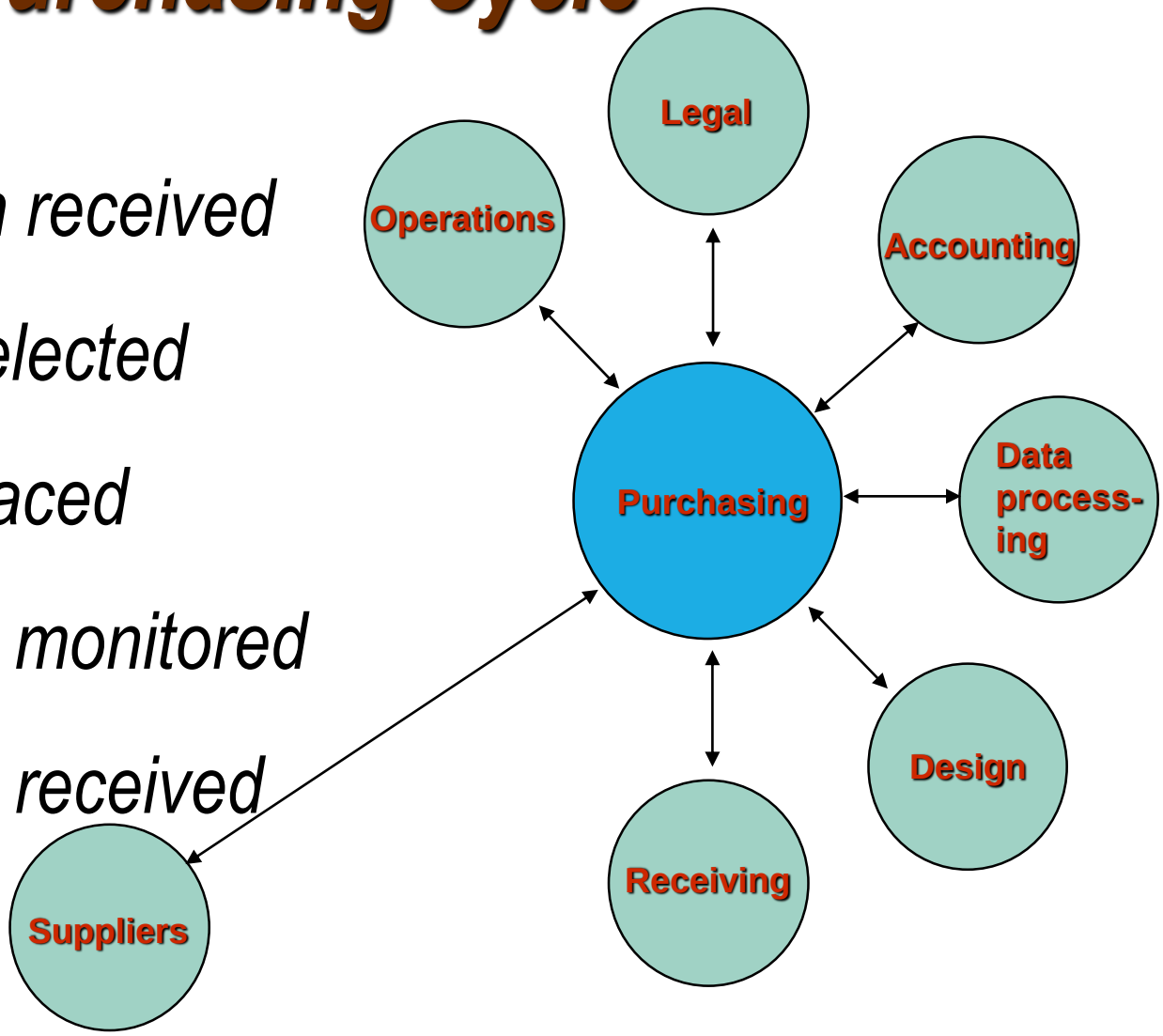
- *Identifying sources of supply*
- *Negotiating contracts*
- *Maintaining a database of suppliers*
- *Obtaining goods and services*
- *Managing supplies*

Purchasing Interfaces



Purchasing Cycle

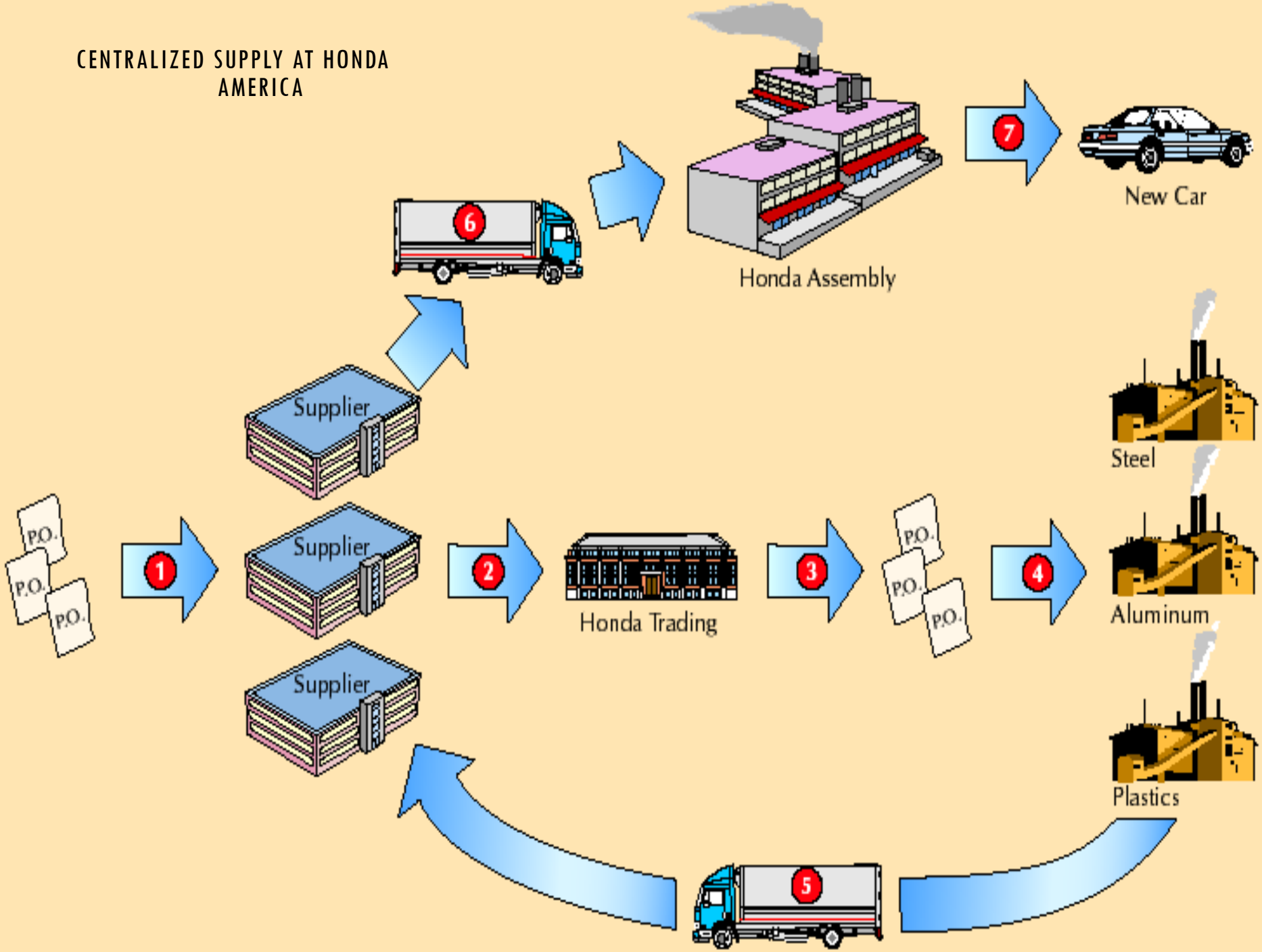
1. Requisition received
2. Supplier selected
3. Order is placed
4. Orders are monitored
5. Orders are received



Centralized vs Decentralized Purchasing

- **Centralized purchasing**
  - *Purchasing is handled by one special department*
- **Decentralized purchasing**
  - *Individual departments or separate locations handle their own purchasing requirements*

CENTRALIZED SUPPLY AT HONDA AMERICA



Suppliers

- ✓ *Purchased materials account for about half of manufacturing costs*
- ✓ *Materials, parts, and service must be delivered on time, of high quality, and low cost*
- ✓ *Suppliers should be integrated into their customers' supply chains*
- ✓ *Partnerships should be established*
- ✓ *On-demand delivery (JIT) is a frequent requirement*

Supplier Related Issues

- *Sourcing (choosing suppliers)*
  - *Vendor analysis (evaluating sources of supply)*
  - *Supplier audits*
  - *Supplier certification*
- *Supplier relationship management*
- *Supplier partnerships*
  - *CPFR*
  - *Strategic partnering*

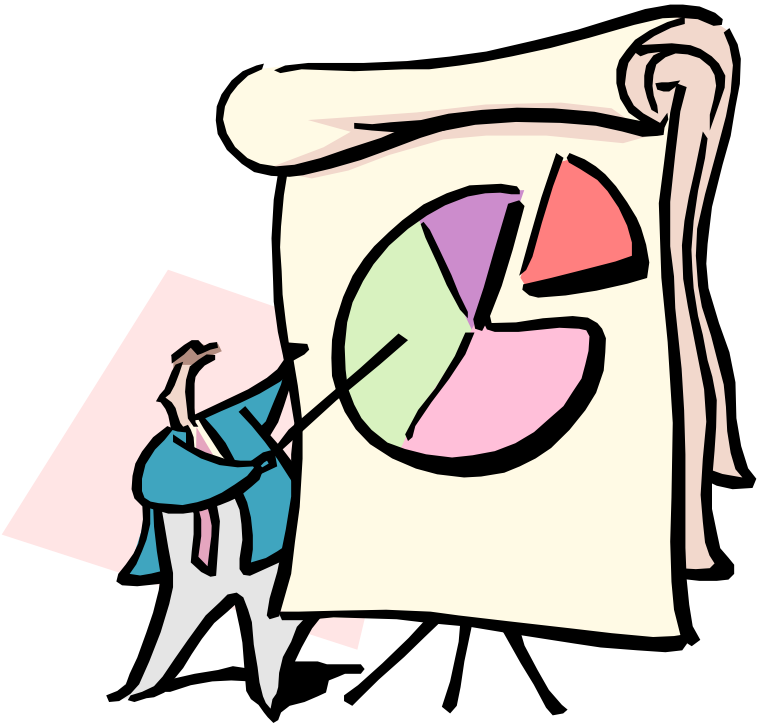
Sourcing

- ✓ *Sourcing is the selection of suppliers*
- ✓ *Relationship between customers and suppliers focuses on collaboration and cooperation*
- ✓ *Outsourcing has become a long-term strategic decision*
- ✓ *Organizations focus on core competencies*
- ✓ *Single-sourcing is increasingly a part of supplier relations*

Vendor Analysis

Evaluating the sources of supply in terms of:

- *Price*
- *Quality and quality pratices*
- *Flexibility*
- *Location*
- *Past experience*
- *Product or service changes*
- *Reputation and financial stability*
- *Lead times and on-time delivery*
- *Inventory policy*
- *Services (such as technical support and training) provided*



The above criteria can be classified as 1) those related to the organization, 2) those related to the product, and 3) those related to the service provided

Supplier Audits and Certification

- ***Supplier audit***
  - *A means of keeping current on suppliers' production (or service) capabilities, quality and delivery problems and resolutions, and performance on other criteria*
- ***Supplier certification***
  - *Involves a detailed examination of a supplier's policies and capabilities*
  - *The process verifies the supplier meets or exceeds the requirements of a buyer*

SUPPLIER RELATIONSHIP MANAGEMENT

Type of relationship is often governed by the duration of the trading relationship

- Short-term
  - Oftentimes involves competitive bidding
  - Minimal interaction
- Medium-term
  - Often involves an ongoing relationship
- Long-term
  - Often involves greater cooperation that evolves into a partnership

Contrasting Supplier Relationships

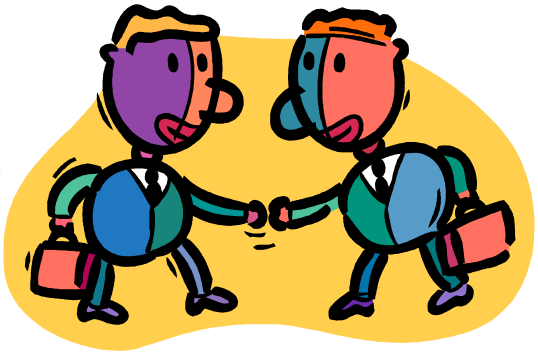
Aspect	Adversary	Partner
Number of suppliers	Many	One or a few
Length of relationship	May be brief	Long-term
Low price	Major consideration	Moderately important
Reliability	May not be high	High
Openness	Low	High
Quality	May be unreliable; buyer inspects	At the source; vendor certified
Volume of business	May be low	High
Flexibility	Relatively low	Relatively high
Location	Widely dispersed	Nearness is important

Supplier Partnerships

Ideas from suppliers could lead to improved competitiveness

1. *Reduce cost of making the purchase*
2. *Reduce transportation costs*
3. *Reduce production costs*
4. *Improve product quality*
5. *Improve product design*
6. *Reduce time to market*
7. *Improve customer satisfaction*
8. *Reduce inventory costs*
9. *Introduce new products or services*

Collaborative Planning, Forecasting, and Replenishment



- *A system based on the notion that there should be*
  - *information sharing among supply chain trading partners in planning, forecasting and inventory replenishment*
  - *cooperation among supply chain trading partners in planning*
  - *coordination of activities*
- *Requires partners to agree on common goals (goal sharing)*

CPFR Process

- *Internet-based exchange of data and information*
- *Significant decrease in inventory levels and more efficient logistics*
- *Companies focus on core competencies*
- *Eliminates typical order processig*

CPFR Results

- ***Nabisco and Wegmans***
  - *50% increase in category sales*
- ***Wal-mart and Sara Lee***
  - *14% reduction in store-level inventory*
  - *32% increase in sales*
- ***Kimberly-Clark and Kmart***
  - *Increased category sales that exceeded market growth*

Strategic Partnering

Two or more business organizations that have complementary products or services join so that each may realize a strategic benefit

EXAMPLE: AUSTIN AUTO AUCTION

Question:

Suppose a four-year old car with 60,000 miles on the odometer is up for auction. If its original price was $12,500, what starting bid should the auctioneer require?

Answer:

$B = .7(12{,}500) - 560(4) - .0175(60{,}000) = \$5460.$

EXAMPLE: AUSTIN AUTO AUCTION

Question:

The model is based on what assumptions?

Answer:

The model assumes that the only factors influencing the value of a used car are the original price, age, and mileage (not condition, rarity, or other factors).

Also, it is assumed that age and mileage devalue a car in a linear manner and without limit. (Note, the starting bid for a very old car might be negative!)

EXAMPLE: IRON WORKS, INC.

Iron Works, Inc. (IWI) manufactures two products made from steel and just received this month's allocation of b pounds of steel. It takes a_1 pounds of steel to make a unit of product 1 and it takes a_2 pounds of steel to make a unit of product 2.

Let x_1 and x_2 denote this month's production level of product 1 and product 2, respectively. Denote by p_1 and p_2 the unit profits for products 1 and 2, respectively.

The manufacturer has a contract calling for at least m units of product 1 this month. The firm's facilities are such that at most u units of product 2 may be produced monthly.

EXAMPLE: IRON WORKS, INC.

Mathematical Model

- The total monthly profit =

(profit per unit of product 1)
x (monthly production of product 1)
+ (profit per unit of product 2)
x (monthly production of product 2)

$= p_1x_1 + p_2x_2$

We want to maximize total monthly profit:

$\text{Max} \quad p_1x_1 + p_2x_2$

EXAMPLE: IRON WORKS, INC.

Mathematical Model (continued)

- The total amount of steel used during monthly production =

  (steel required per unit of product 1)

  x (monthly production of product 1)

  + (steel required per unit of product 2)

  x (monthly production of product 2)

  $= a_1x_1 + a_2x_2$

This quantity must be less than or equal to the allocated b pounds of steel:

$$a_1x_1 + a_2x_2 \leq b$$

EXAMPLE: IRON WORKS, INC.

Mathematical Model (continued)

- The monthly production level of product 1 must be greater than or equal to m:

$$x_1 \geq m$$

- The monthly production level of product 2 must be less than or equal to u:

$$x_2 \leq u$$

- However, the production level for product 2 cannot be negative:

$$x_2 \geq 0$$

EXAMPLE: IRON WORKS, INC.

Mathematical Model Summary

$$
\begin{aligned}
\text{Max} \quad & p_1 x_1 + p_2 x_2 \\
\text{s.t.} \quad & a_1 x_1 + a_2 x_2 \leq b \\
& x_1 \geq m \\
& x_2 \leq u \\
& x_2 \geq 0
\end{aligned}
$$

EXAMPLE: IRON WORKS, INC.

Question:

Suppose $b = 2000$, $a_1 = 2$, $a_2 = 3$, $m = 60$, $u = 720$, $p_1 = 100$, $p_2 = 200$. Rewrite the model with these specific values for the uncontrollable inputs.

Answer:

Substituting, the model is:

$$\begin{aligned} \text{Max} \quad & 100x_1 + 200x_2 \\ \text{s.t.} \quad & 2x_1 + 3x_2 \leq 2000 \\ & x_1 \geq 60 \\ & x_2 \leq 720 \\ & x_2 \geq 0 \end{aligned}$$

EXAMPLE: IRON WORKS, INC.

Question:

The optimal solution to the current model is $x_1 = 60$ and $x_2 = 626\ 2/3$. If the product were engines, explain why this is not a true optimal solution for the "real-life" problem.

Answer:

One cannot produce and sell 2/3 of an engine. Thus the problem is further restricted by the fact that both x_1 and x_2 must be integers. They could remain fractions if it is assumed these fractions are work in progress to be completed the next month.

EXAMPLE: IRON WORKS, INC.

Uncontrollable Inputs

$100 profit per unit Prod. 1
$200 profit per unit Prod. 2
2 lbs. steel per unit Prod. 1
3 lbs. Steel per unit Prod. 2
2000 lbs. steel allocated
60 units minimum Prod. 1
720 units maximum Prod. 2
0 units minimum Prod. 2

Controllable Inputs

60 units Prod. 1
626.67 units Prod. 2

Mathematical Model

$$\text{Max } 100(60) + 200(626.67)$$
$$\text{s.t. } 2(60) + 3(626.67) < 2000$$
$$60 > 60$$
$$626.67 < 720$$
$$626.67 > 0$$

Output

Profit = $131,333.33
Steel Used = 2000

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