

# Supply Chain Analytics

## Lecture 11: Neural network in supply chain

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# SUPPLY CHAIN PERFORMANCE DRIVERS

1. Quality
2. Cost
3. Flexibility
4. Velocity (inventory velocity, information velocity)
5. Customer service

# SUPPLY CHAIN PERFORMANCE MEASURES

## 1. Financial

- Return on assets
- Cost
- Cash flow
- Profits

## 2. Suppliers

- Quality
- On-time delivery
- Cooperation
- flexibility

## 3. Operations

- Productivity
- Quality

# ***Supply Chain Performance Measures***

## ***4. Inventory***

- *Avarage value*
- *Turnover*
- *Weeks of supply*

## ***5. Order fulfillment***

- *Order accuracy*
- *Time to fill orders*
- *Percentage of incompete orders shipped*
- *Percentage of orders delivered on time*

## ***6. Customers.***

- *Costomer satisfaction*
- *Percentage of customer complaints*

# ***Measuring SC Performance: Inventory Turnover***

- ***One of the most commonly used measures is “Inventory Turnover”***

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Average aggregate inventory value}}$$

# Measuring SC Performance: SCOR Metrics

<i>Perspective</i>	<i>Metrics</i>
<i>Reliability</i>	<i>On-time delivery Order fulfillment lead time Fill rate (fraction of demand met from stock) Perfect order fulfillment</i>
<i>Flexibility</i>	<i>Supply chain response time Upside production flexibility</i>
<i>Expenses</i>	<i>Supply chain management costs Warranty cost as a percent of revenue Value added per employee</i>
<i>Assets/utilization</i>	<i>Total inventory days of supply Cash-to-cash cycle time Net asset turns</i>

# ***Supply Chain Uncertainty***

- ✓ *Forecasting, lead times, batch ordering, price fluctuations, and inflated orders contribute to variability*
- ✓ *Inventory is a form of insurance*
- ✓ *Distorted information is one of the main causes of uncertainty*

# ***Inventory Management within A SC***

## ***Inventory issues in SCM***

### ***– Inventory location***

- ***Centralized inventories***
- ***Decentralized inventories***

### ***– Inventory velocity***

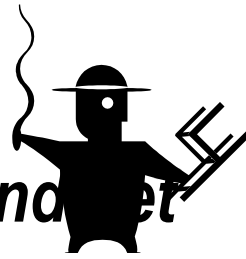
- ***The speed at which goods move through a supply chain***

### ***– The effect of demand variability on inventories***

#### ***The bullwhip effect***

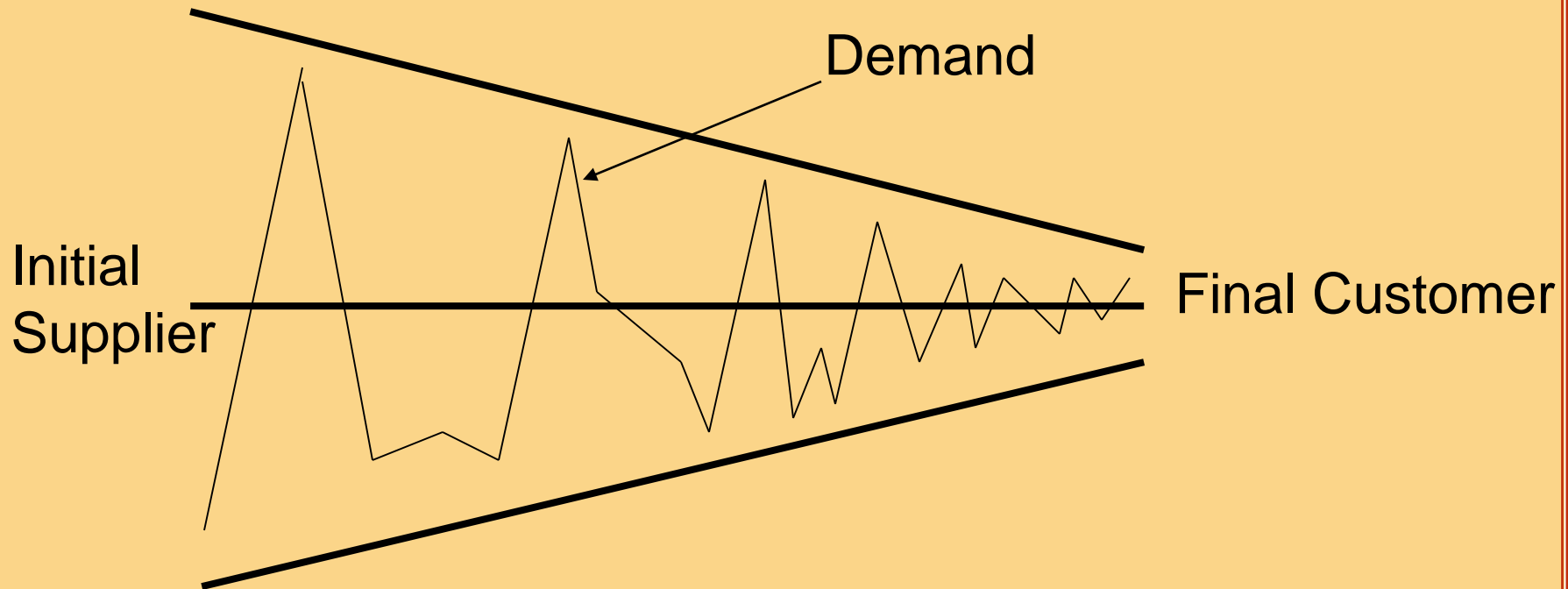
- ***Inventory oscillations that become increasingly larger looking backward through the supply chain***

# ***The Bullwhip Effect***



- ***Variations in demand cause inventories to fluctuate and get out of control***
- ***Results in higher costs and lower customer satisfaction***
  - ***Inventory fluctuation can be magnified by***
    - ***Periodic ordering***
    - ***Overreactions to stockouts***
    - ***Quality problems***
    - ***Labor problems***
    - ***Unusual weather conditions***
    - ***Delays in shipments of goods***
    - ***Communication delays***
    - ***Incomplete communications***
    - ***Lack of coordination of activities among organizations***
    - ***Forecast inaccuracies***
    - ***Order batching***
    - ***Product mix changes***
    - ***Sales incentives and promotions***
    - ***Liberal product return policies***

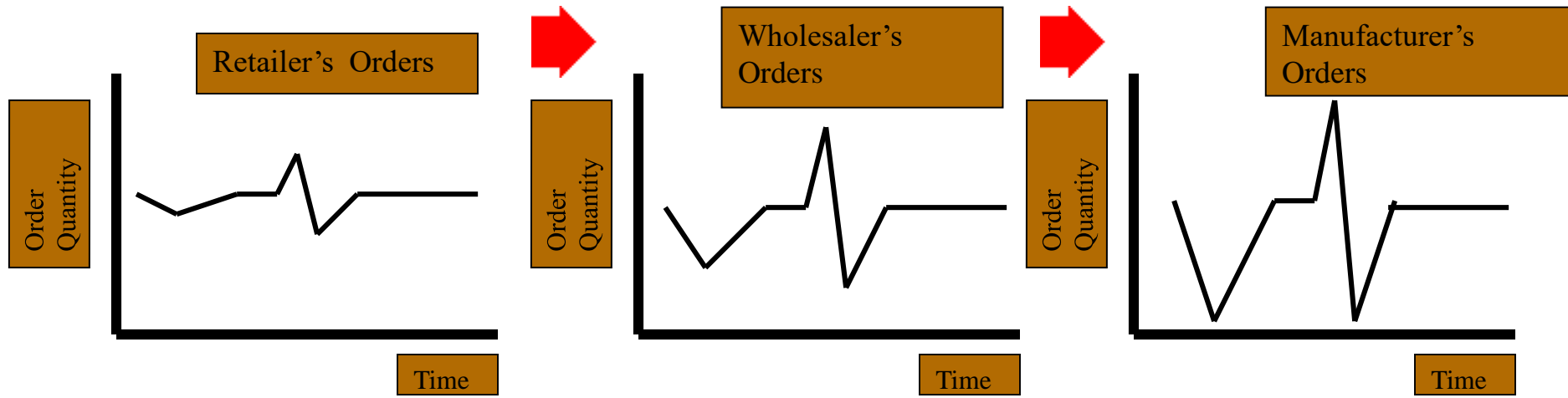
# ***Bullwhip Effect***



Demand variations begin at the customer end of the chain and become increasingly large as they radiate backwards through the chain (inventory oscillations become progressively larger moving backward through the supply chain)

# *Inventories in a SC: Bullwhip Effect*

The magnification of variability in orders in the supply-chain

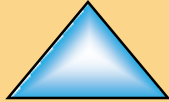


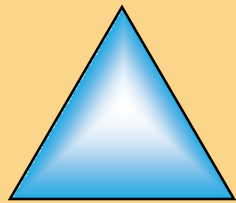
A lot of retailers each with little variability in their orders....

...can lead to greater variability for a fewer number of wholesalers, and...

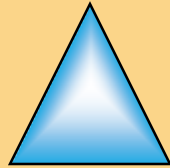
...can lead to even greater variability for a single manufacturer.

# *Inventories in a SC: Bullwhip Effect*

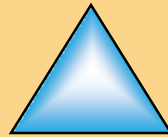
 = Amount of inventory



**Tier 2  
Suppliers**



**Tier 1  
Suppliers**



**Producer**



**Distributor**



**Retailer**

**Final  
Customer**

# ***Mitigating the Bullwhip Effect***

- ***Good supply chain management can overcome the bullwhip effect***
  - ***Strategic buffering***
    - ***Holding inventory at a distribution center rather than at retail outlets***
  - ***Replenishment based on need***
- ***Vendor-managed inventory***
  - ***Vendors monitor goods and replenish retail inventories when supplies are low***

# VENDOR-MANAGED INVENTORIES

*The use of a local supplier to maintain inventory for the manufacturer*

- ✓ *Stocking information is accessed using EDI*
- ✓ *A first step towards supply chain collaboration*
- ✓ *Increased speed, reduced errors, and improved service*

# ***Role of Information in the Supply Chain (1 of 2)***

- ✓ *Centralized coordination of information flows*
- ✓ *Integration of transportation, distribution, ordering, and production*
- ✓ *Direct access to domestic and global transportation and distribution channels*
- ✓ *Locating and tracking the movement of every item in the supply chain*

# ***Role of Information in the Supply Chain (2 of 2)***

- ✓ *Data interchange*
- ✓ *Data acquisition at the point of origin and point of sale*
- ✓ *Intercompany and intracompany information access*
- ✓ *Instantaneous updating of inventory levels*
- ✓ *Increasing the rate at which information is communicated in a SC.*

# SOME IT APPLICATIONS FOR SCM (1 OF 3)

- **Electronic Business** (*replacement of physical processes with electronic ones*)
- **Electronic Data Interchange** (*a computer-to-computer exchange of business documents including purchase orders, shipping notices, and debit or credit memos) in a standard format*)
- **Bar Coding** (*computer readable codes attached to items flowing through the SC). Generates point-of-sale data which is useful for determining sales trends, ordering, production scheduling, and delivery plans*)



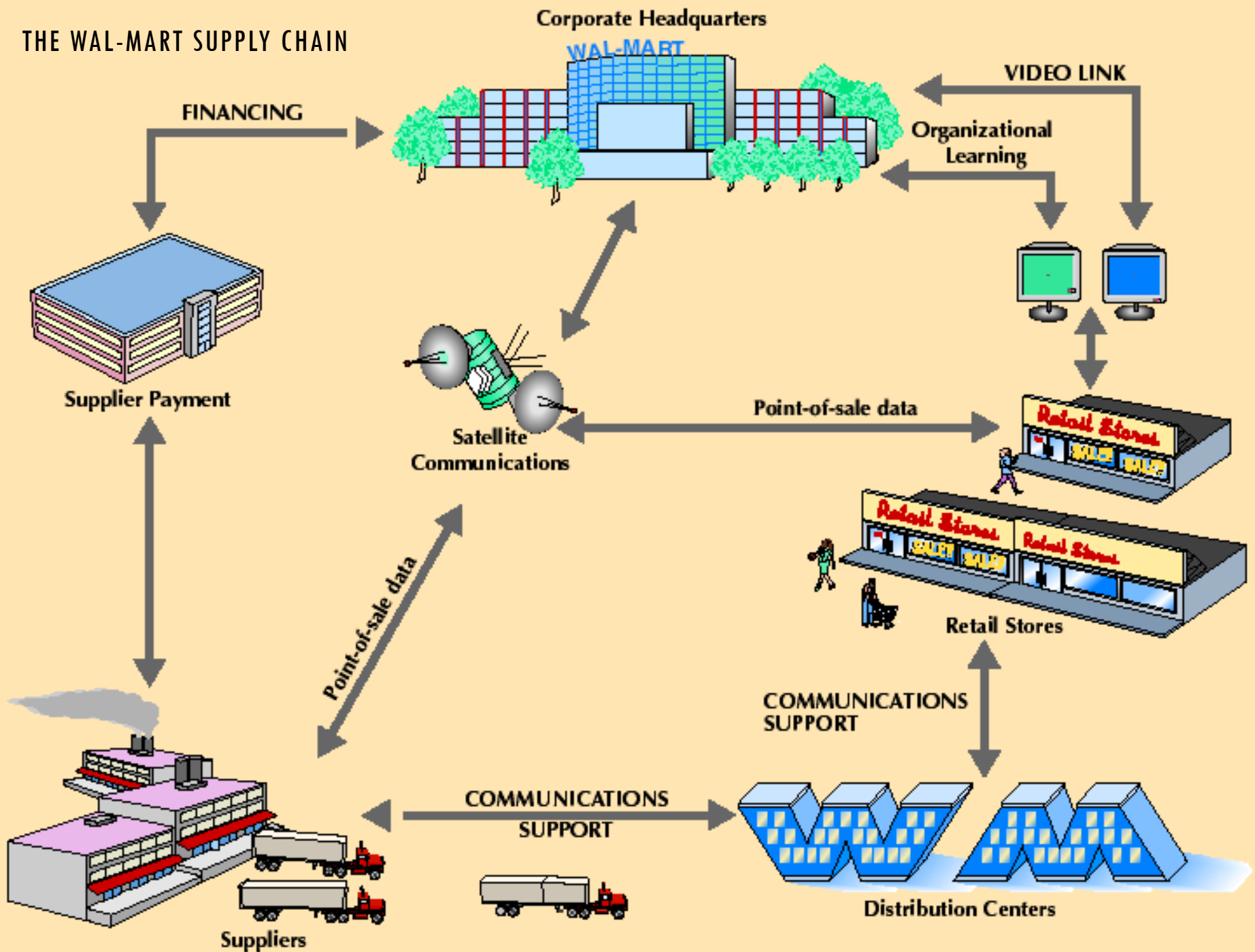
# ***Some IT Applications for SCM (2 of 3)***

- ***RFID (Radio Frequency Identification) Technology***
  - ***A technology that uses radio waves to identify objects, such as goods in supply chains)***
  - ***Similar to bar codes but***
    - ***uses radio frequency to transmit product information to receiver***
    - ***Are able to convey much more information***
    - ***Do not require line-of-sight for reading***
    - ***Do not need to be read one at a time***
  - ***Used to track goods in supply chain***
  - ***RFID tags attached to objects***
  - ***RFID eliminates need for manual counting and bar code scanning***

## **Some IT Applications for SCM (3 of 3)**

- **Internet** (*provides instant access to organizations, individuals and information sources; fundamentally changes the way organizations do business; add speed and accessibility to the SC*)
- **Intranets** (*internet-like networks that operate within a single organization*)
- **Extranets** (*intranets that can be connected to the global internet & that include a company's suppliers and customers; they allow limited access*)

# THE WAL-MART SUPPLY CHAIN



# *Wal-Mart Case*

- *Wal-Mart has a satellite network for electronic data interchange that allows vendors to directly access point-of-sale data in real time, enabling them to improve their forecasting and inventory management.*
- *Wal-Mart also uses the system for issuing purchase orders and receiving invoices from its vendors.*

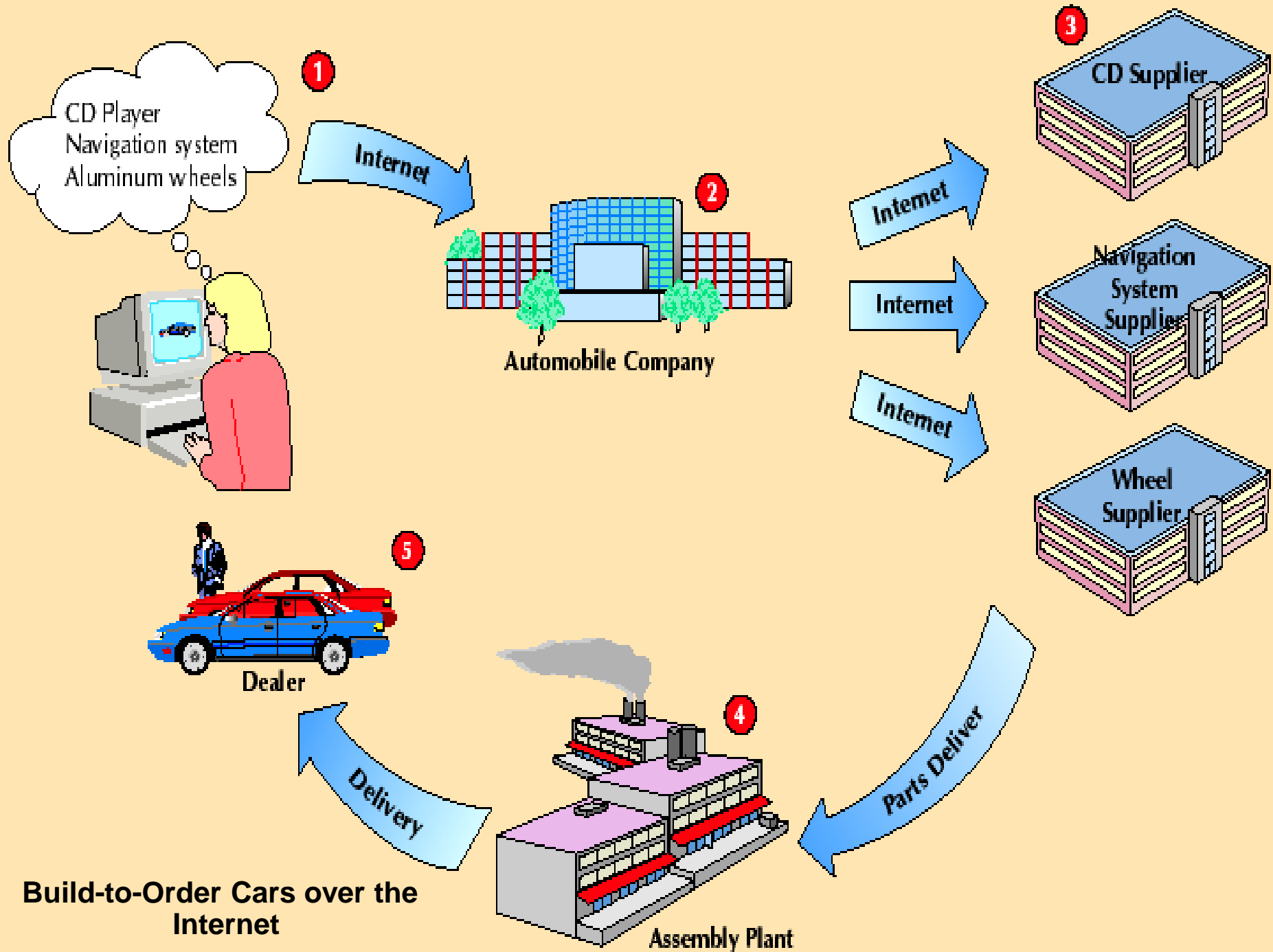
# ***Benefits of Electronic Data Interchange***

- *Increased productivity*
- *Reduction of paperwork*
- *Lead time and inventory reduction*
- *Facilitation of just-in-time systems*
- *Electronic transfer of funds*
- *Improved control of operations*
- *Reduction in clerical labor*
- *Increased accuracy*

# ***The Internet***

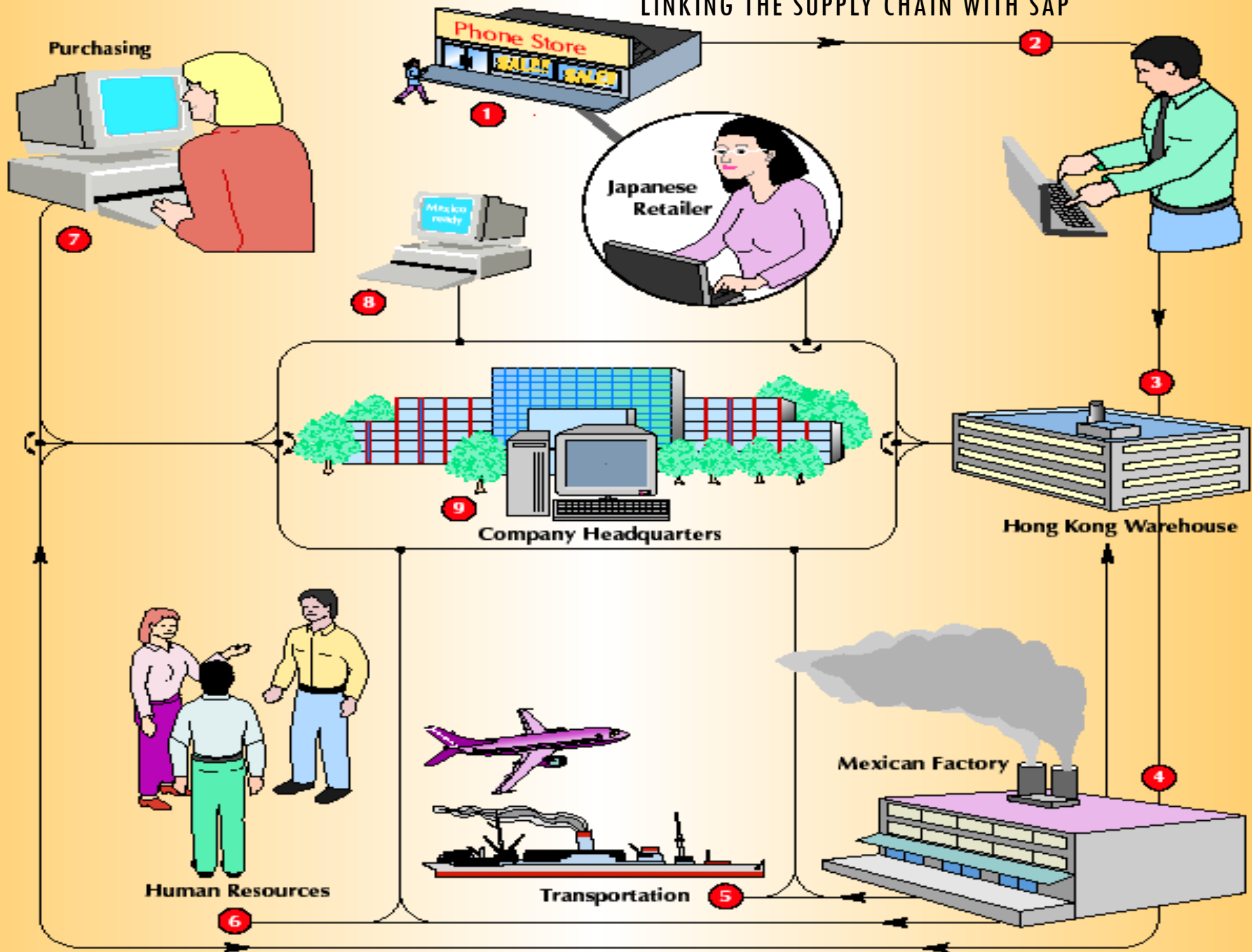
- ✓ *Instant global access to organizations, individuals, and information sources*
- ✓ *Fundamentally changes the way organizations do business*
- ✓ *Removed geographic barriers*
- ✓ *Adds speed and accessibility to the supply chain*





**Build-to-Order Cars over the Internet**

# LINKING THE SUPPLY CHAIN WITH SAP



# ***Electronic Business***

- ***E-Business***: *the use of electronic technology to facilitate business transactions Involves the interaction of different business organizations as well as the interaction of individuals with business organizations.*  
*Replacement of physical processes with electronic ones*
- *Applications include:*
  - *Internet buying and selling*
  - *E-mail*
  - *Order and shipment tracking*
  - *Electronic data interchange*

# ***Essential Features of E-Business***

- *The Web site (front-end design)*
- *Order fulfillment (back end)*
  - *Order processsing*
  - *Billing*
  - *Inventory management*
  - *Warehousing*
  - *Packing*
  - *Shiping*
  - *Delivery*

# ***Advantages of E-Business (1 of 2)***

- *Global presence and increased visibility*
- *Global access to markets and customers*
- *Improved competitiveness, quality and service*
- *Greater choices and more and easy access to information for customers*
- *Collection and analysis of detailed customer data, interests and preferences*
- *Shortened supply chain response times*

# ***Advantages of E-Business (2 of 2)***

- *Shortened transaction times for ordering and delivery*
- *Cost savings and price reductions*
- *Virtual companies with lower prices*
- *Leveling the playing field for small companies*
- *Reducing or eliminating intermediaries (disintermediation)*
- *Improved service*

# ***E-Business Order Fulfillment Problems***

- ***Efficient web sites do not necessarily mean the rest of the supply chain will be as efficient***
  - ***Customer expectations***
    - ***Order quickly → Quick delivery***
- ***Demand variability creates order fulfillment problems***
- ***Sometimes Internet demand exceeds an organization's ability to fulfill orders***
- ***Inventory***
  - ***Outsourcing order fulfillment***
    - ***Loss of control***
  - ***Build large warehouses***
    - ***Internal holding costs***



# IT ISSUES

- ✓ *Increased benefits and sophistication come with increased costs*
- ✓ *Efficient web sites do not necessarily mean the rest of the supply chain will be as efficient*
- ✓ *Security problems are very real*
- ✓ *Partnership and trust are important elements that may be new to business relationships*

# REFERENCES

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