





## The Role of Distribution in the Supply Chain

- ◆ **Distribution**: the steps taken to move and store a product from the supplier stage to the customer stage in a supply chain
- ◆ Distribution directly affects cost and the customer experience and therefore drives profitability
- ◆ Choice of distribution network can achieve supply chain objectives from low cost to high responsiveness
- ◆ Examples: Wal-Mart, Dell, Proctor & Gamble, Grainger

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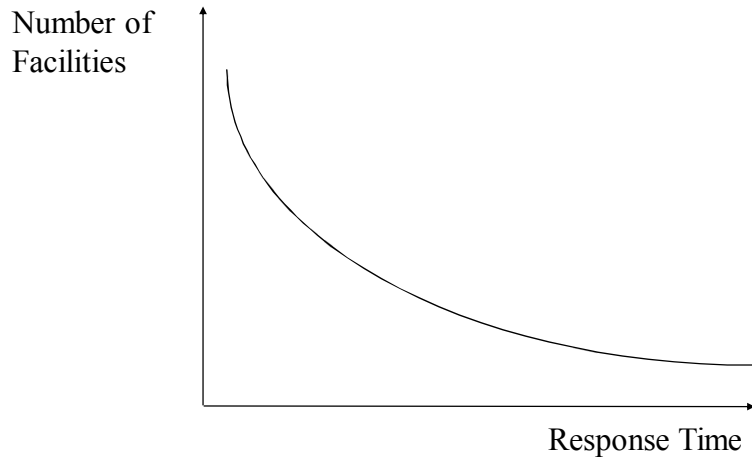
## Factors Influencing Distribution Network Design

- ◆ Elements of customer service influenced by network structure:
  - Response time
  - Product variety
  - Product availability
  - Customer experience
  - Order visibility
  - Returnability
- ◆ Supply chain costs affected by network structure:
  - Inventories
  - Transportation
  - Facilities and handling
  - Information

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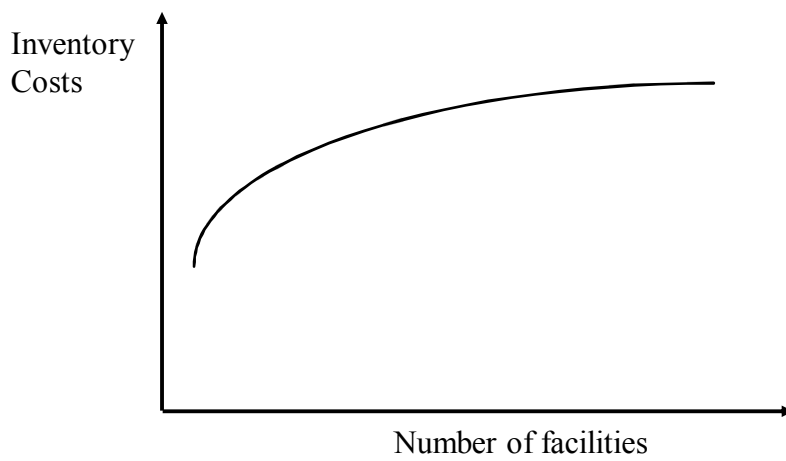
## Service and Number of Facilities (Fig. 4.1)



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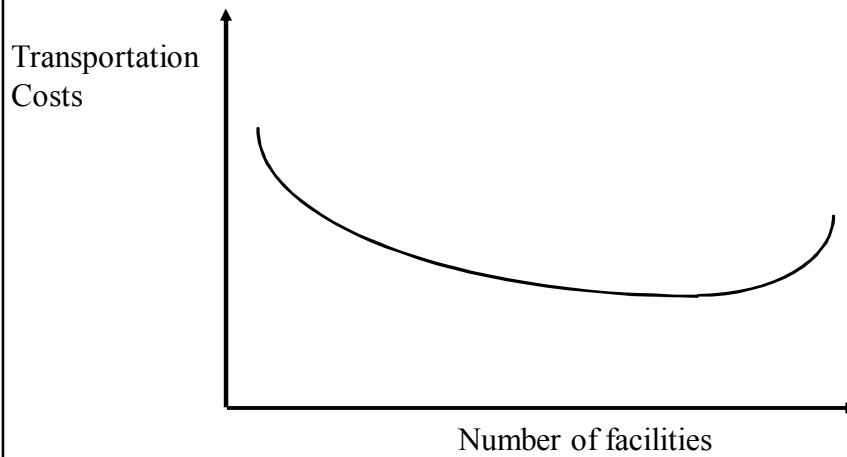
## Inventory Costs and Number of Facilities (Fig. 4.2)



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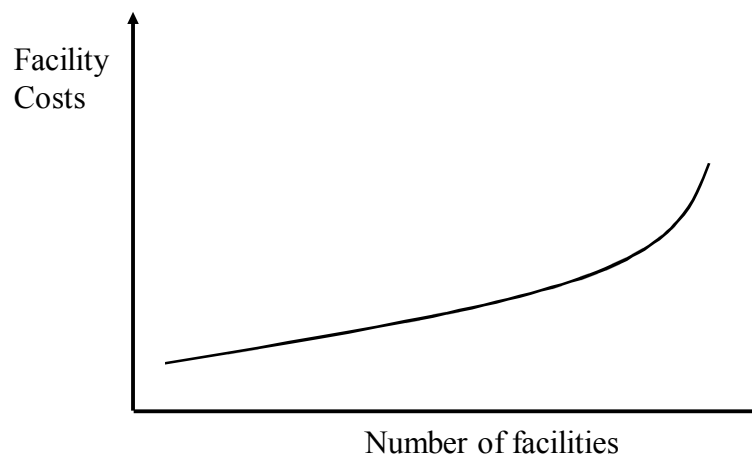
## Transportation Costs and Number of Facilities (Fig. 4.3)



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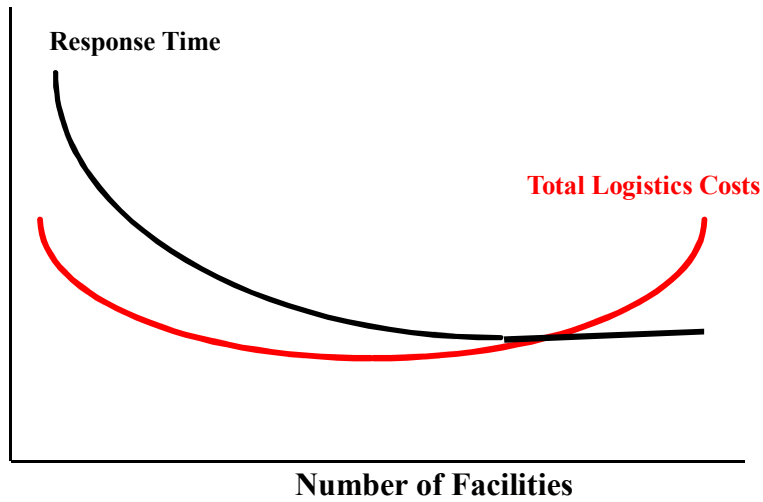
## Facility Costs and Number of Facilities (Fig. 4.4)



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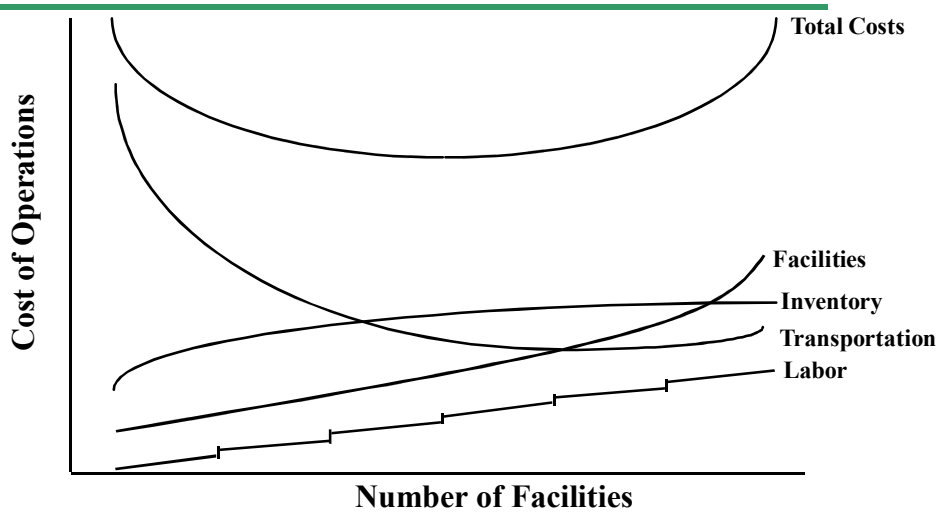
## Variation in Logistics Costs and Response Time with Number of Facilities (Fig. 4.5)



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## Cost Buildup as a Function of Facilities



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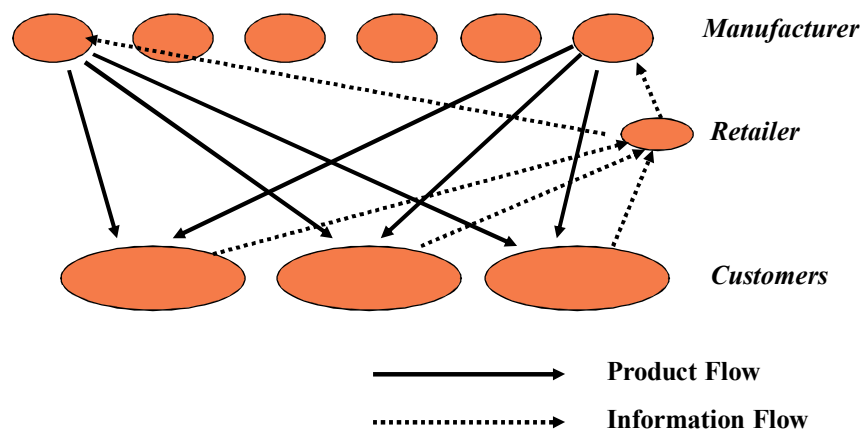
## Design Options for a Distribution Network

- ◆ Manufacturer Storage with Direct Shipping
- ◆ Manufacturer Storage with Direct Shipping and In-Transit Merge
- ◆ Distributor Storage with Carrier Delivery
- ◆ Distributor Storage with Last Mile Delivery
- ◆ Manufacturer or Distributor Storage with Customer Pickup
- ◆ Retail Storage with Customer Pickup
- ◆ Selecting a Distribution Network Design

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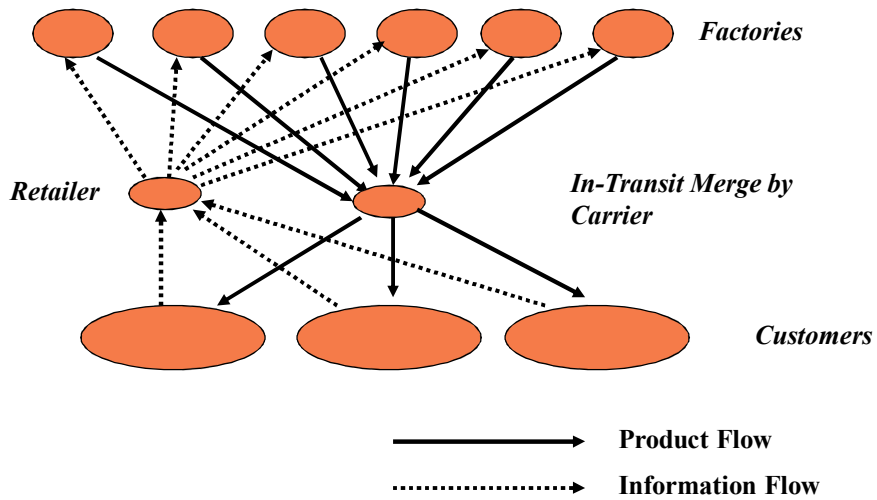
## Manufacturer Storage with Direct Shipping (Fig. 4.6)



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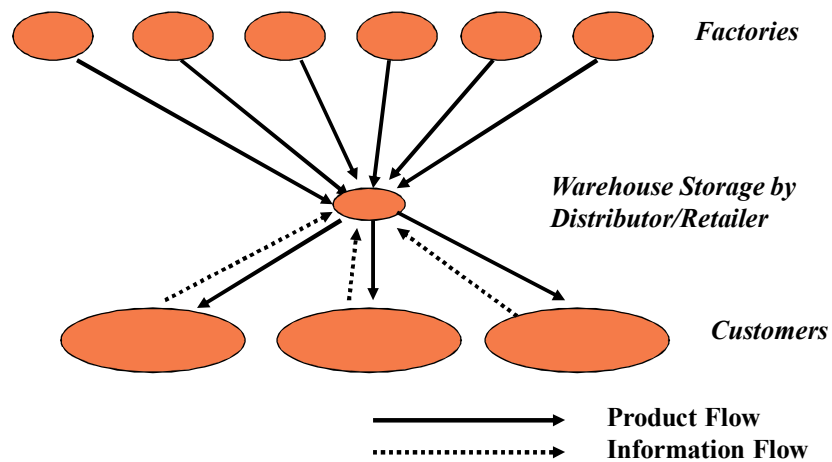
## In-Transit Merge Network (Fig. 4.7)



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## Distributor Storage with Carrier Delivery (Fig. 4.8)

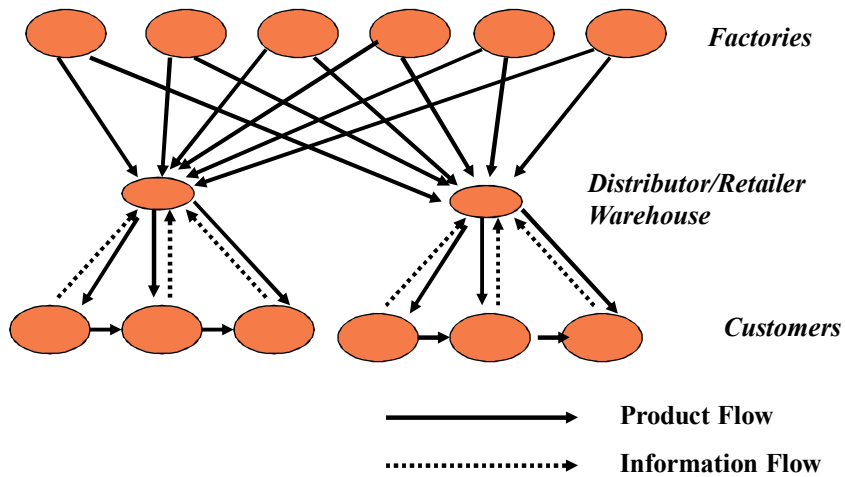


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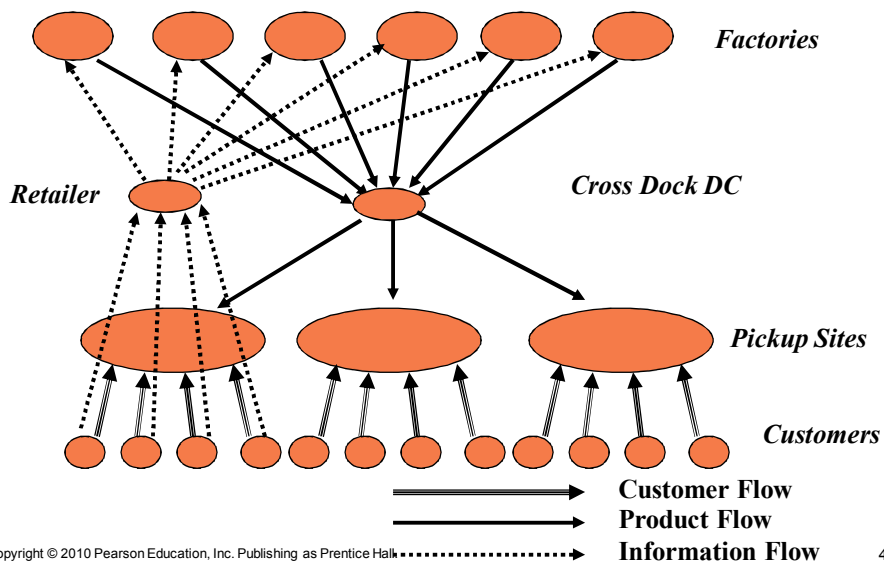
## Distributor Storage with Last Mile Delivery (Fig. 4.9)



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## Manufacturer or Distributor Storage with Customer Pickup (Fig. 4.10)



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## RETAIL STORAGE WITH CUSTOMER PICKUP

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- ◆ In this option, often viewed as the most traditional type of supply chain, inventory is stored locally at retail stores.
- ◆ Customers walk into the retail store or place an order online or by phone and pick it up at the retail store.
- ◆ Examples of companies that offer multiple options of order placement include Albertsons, which uses part of the facility as a grocery store and part of the facility as an online fulfillment center.
- ◆ Customers can walk into the store or order online.
- ◆ A B2B example is W.W. Grainger: Customers can order online, by phone, or in person and pick up their order at one of W.W. Grainger's retail outlets.

## SELECTING A DISTRIBUTION NETWORK DESIGN

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- ◆ A network designer needs to consider product characteristics as well as network requirements when deciding on the appropriate delivery network.
- ◆ The various networks considered earlier have different strengths and weaknesses.

## Comparative Performance of Delivery Network Designs (Table 4.7)

	Retail Storage with Customer Pickup	Manufacturer Storage with Direct Shipping	Manufacturer Storage with In-Transit Merge	Distributor Storage with Package Carrier Delivery	Distributor storage with last mile delivery	Manufacturer storage with pickup
Response Time	1	4	4	3	2	4
Product Variety	4	1	1	2	3	1
Product Availability	4	1	1	2	3	1
Customer Experience	5*	4	3	2	1	5
Order Visibility	1	5	4	3	2	6
Returnability	1	5	5	4	3	2
Inventory	4	1	1	2	3	1
Transportation	1	4	3	2	5	1
Facility & Handling	6	1	2	3	4	5
Information	1	4	4	3	2	5

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## SELECTING A DISTRIBUTION NETWORK DESIGN

- ◆ An excellent example of a hybrid network is that of W.W. Grainger, which combines all the fore-mentioned options in its distribution network.
  - The network, however, is tailored to match the characteristics of the product and the needs of the customer.
  - Fast-moving and emergency items are stocked locally, and customers can either pick them up or have them shipped, depending on the urgency.
  - Slower-moving items are stocked at a national DC and shipped to the customer within a day or two.
  - Very-slow-moving items are typically drop-shipped from the manufacturer and carry a longer lead time.
- ◆ Another hybrid network is used by Amazon, which stocks some items at its warehouses.
  - Other slow-moving items may be drop-shipped from distributors or publishers.

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## Performance of Delivery Networks for Different Product/Customer Characteristics (Table 4-8)

	Retail Storage with Customer Pickup	Manufacturer Storage with Direct Shipping	Manufacturer Storage with In-Transit Merge	Distributor Storage with Package Carrier Delivery	Distributor storage with last mile delivery	Manufacturer storage with pickup
High demand product	+2	-2	-1	0	+1	-1
Medium demand product	+1	-1	0	+1	0	0
Low demand product	-1	+1	0	+1	-1	+1
Very low demand product	-2	+2	+1	0	-2	+1
Many product sources	+1	-1	-1	+2	+1	0
High product value	-1	+2	+1	+1	0	-2
Quick desired response	+2	-2	-2	-1	+1	-2
High product variety	-1	+2	0	+1	0	+2
Low customer effort	-2	+1	+2	+2	+2	-1

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## E-Business and the Distribution Network

- ◆ Impact of E-Business on Customer Service
- ◆ Impact of E-Business on Cost
- ◆ Using E-Business: Dell, Amazon, Peapod, Grainger

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## Impact of E-Business on Customer Service

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- ◆ Product Availability
- ◆ Customer experience
- ◆ Time to market
- ◆ Order Visibility
- ◆ Returnability
- ◆ Direct Sales to Customers
- ◆ Flexible Pricing, Product Portfolio, and Promotions
- ◆ Efficient Funds Transfer

## Impact of E-Business on Cost

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- ◆ Inventory
- ◆ Facilities
- ◆ Transportation
- ◆ Information

**TABLE 4-9** The e-Business Scorecard

<i>Area</i>	<i>Impact</i>
Response time	
Product variety	
Product availability	
Customer experience	
Time to market	
Order visibility	
Direct sales	
Flexible pricing, portfolio, promotions	
Efficient funds transfer	
Inventory	
Facilities	
Transportation	
Information	

Key: +2 = very positive; +1 = positive; 0 = neutral;  
-1 = negative; -2 = very negative.

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**TABLE 4-10** Impact of e-Business on Performance at Dell

<i>Area</i>	<i>Impact</i>
Response time	-1
Product variety	+2
Product availability	+1
Customer experience	+2
Time to market	+2
Order visibility	+1
Direct sales	+2
Flexible pricing, portfolio, promotions	+2
Efficient funds transfer	+2
Inventory	+2
Facilities	+2
Transportation	-1
Information	0

Key: +2 = very positive; +1 = positive; 0 = neutral; -1 = negative;  
-2 = very negative

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**TABLE 4-11** Impact of e-Business on Performance at Amazon.com

<i>Area</i>	<i>Impact</i>
Response time	-1
Product variety	+2
Product availability	+1
Customer experience	+1
Time to market	+1
Order visibility	0
Direct sales	0
Flexible pricing, portfolio, promotions	+1
Efficient funds transfer	0
Inventory	+1
Facilities	+1
Transportation	-2
Information	-1

Key: +2 = very positive; +1 = positive; 0 = neutral; -1 = negative; -2 = very negative.

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**TABLE 4-12** Impact of e-Business on Performance at Peapod

<i>Area</i>	<i>Impact</i>
Response time	-1
Product variety	0
Product availability	0
Customer experience	+1
Time to market	0
Order visibility	-1
Direct sales	0
Flexible pricing, portfolio, promotions	+1
Efficient funds transfer	0
Inventory	0
Facilities	-1
Transportation	-2
Information	-1

Key: +2 = very positive; +1 = positive; 0 = neutral; -1 = negative; -2 = very negative.

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**TABLE 4-13** Impact of e-Business on W.W. Grainger Performance

<i>Area</i>	<i>Impact</i>
Response time	0
Product variety	+2
Product availability	0
Customer experience	+1
Time to market	+1
Order visibility	+1
Direct sales	0
Flexible pricing, portfolio, promotions	+1
Efficient funds transfer	0
Inventory	0
Facilities	+1
Transportation	0
Information	-1

Key: +2 = very positive; +1 = positive; 0 = neutral; -1 = negative; -2 = very negative.

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## Summary of Learning Objectives

- ◆ What are the key factors to be considered when designing the distribution network?
- ◆ What are the strengths and weaknesses of various distribution options?
- ◆ How has E-Business affected the design of distribution networks in different industries?
- ◆ What roles do distributors play in the supply chain?

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## Network Design Decisions

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- ◆ Supply chain *network design decisions include*
  - *the assignment of facility role,*
  - *location* of manufacturing, storage, or transportation-related facilities,
  - and the allocation of capacity and markets to each facility.
- ◆ Supply chain network design decisions are classified as follows.
  - Facility role
  - Facility location
  - Capacity allocation
  - Market and supply allocation

## Example - Toyota

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- ◆ Toyota has plants located worldwide in each market that it serves.
- ◆ Before 1997, each plant was capable of serving only its local market.
- ◆ This hurt Toyota when the Asian economy went into a recession in the late 1990s.
- ◆ The local plants in Asia had idle capacity that could not be used to serve other markets that were experiencing excess demand.
- ◆ Toyota has added flexibility to each plant to be able to serve markets other than the local one.
- ◆ This additional flexibility helps Toyota deal more effectively with changing global market conditions.

## Factors Influencing Network Design Decisions

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- ◆ Strategic
- ◆ Technological
- ◆ Macroeconomic
- ◆ Political
- ◆ Infrastructure
- ◆ Competitive
- ◆ Logistics and facility costs

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## Models for Facility Location and Capacity Allocation – Information required

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- ◆ The following information ideally is available in making the design decision:
  - Location of supply sources and markets
  - Location of potential facility sites
  - Demand forecast by market
  - Facility, labor, and material costs by site
  - Transportation costs between each pair of sites
  - Inventory costs by site and as a function of quantity
  - Sale price of product in different regions
  - Taxes and tariffs
  - Desired response time and other service factors

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## Summary of Learning Objectives

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- ◆ What is the role of network design decisions in the supply chain?
- ◆ What are the factors influencing supply chain network design decisions?
- ◆ Describe a strategic framework for facility location.
- ◆ How are the following optimization methods used for facility location and capacity allocation decisions?
  - Gravity methods for location
  - Network optimization models