

# Chapter 4

## Designing Distribution Networks and Applications to Online Sales

# Learning Objectives

- Identify the key factors to be considered when designing a distribution network
- Discuss the strengths and weaknesses of various distribution options
- Understand how online sales have affected the design of distribution networks in different industries

# 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
- Drives profitability by directly affecting supply chain cost and the customer experience
- Choice of distribution network can achieve supply chain objectives from low cost to high responsiveness

# Factors Influencing Distribution Network Design

- Distribution network performance is evaluated along two dimensions
  - ↷ Customer needs that are met
  - ↷ Cost of meeting customer needs
- Evaluate the impact on customer service and cost for different distribution network options
- Profitability of the delivery network determined by revenue from met customer needs and network costs

# Factors Influencing Distribution Network Design

- Elements of customer service influenced by network structure:
  - ~ Response time
  - ~ Product variety
  - ~ Product availability
  - ~ Customer experience
  - ~ Order visibility
  - ~ Returnability

# Factors Influencing Distribution Network Design

- Supply chain costs affected by network structure:
  - ↪ Inventories
  - ↪ Transportation
  - ↪ Facilities and handling
  - ↪ Information

# Desired Response Time and Number of Facilities

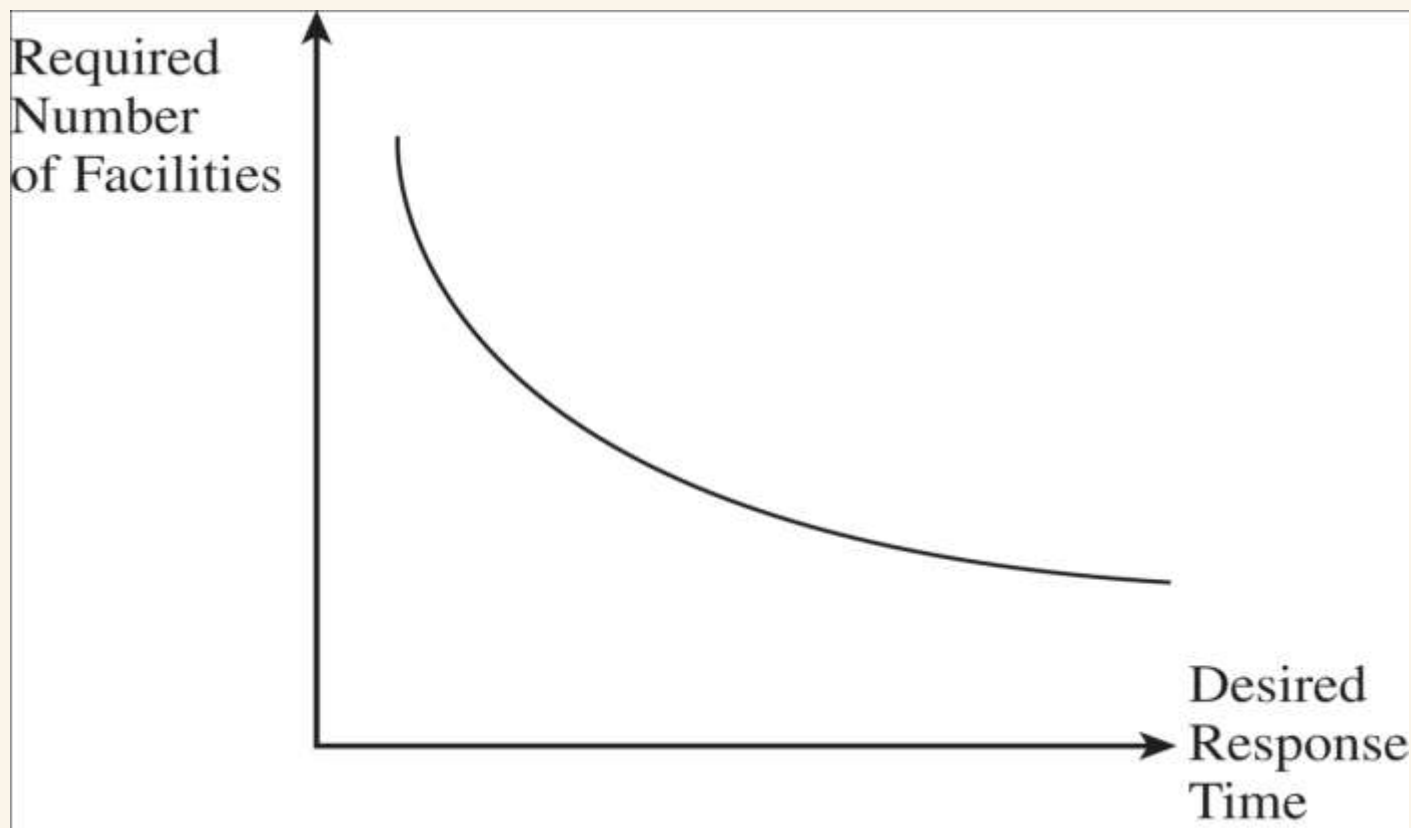
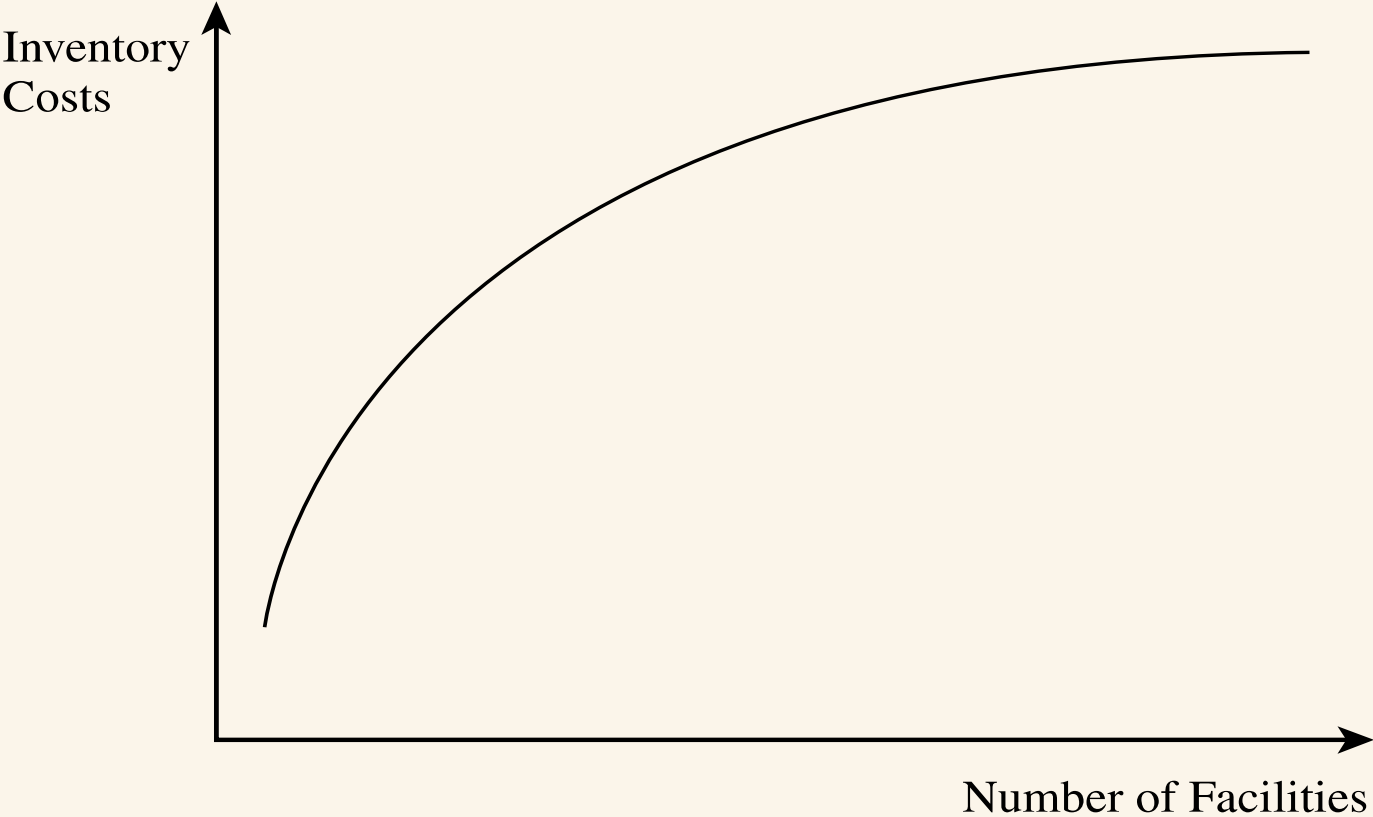


Figure 4-1

# Inventory Costs and Number of Facilities



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Figure 4-2



# Transportation Costs and Number of Facilities

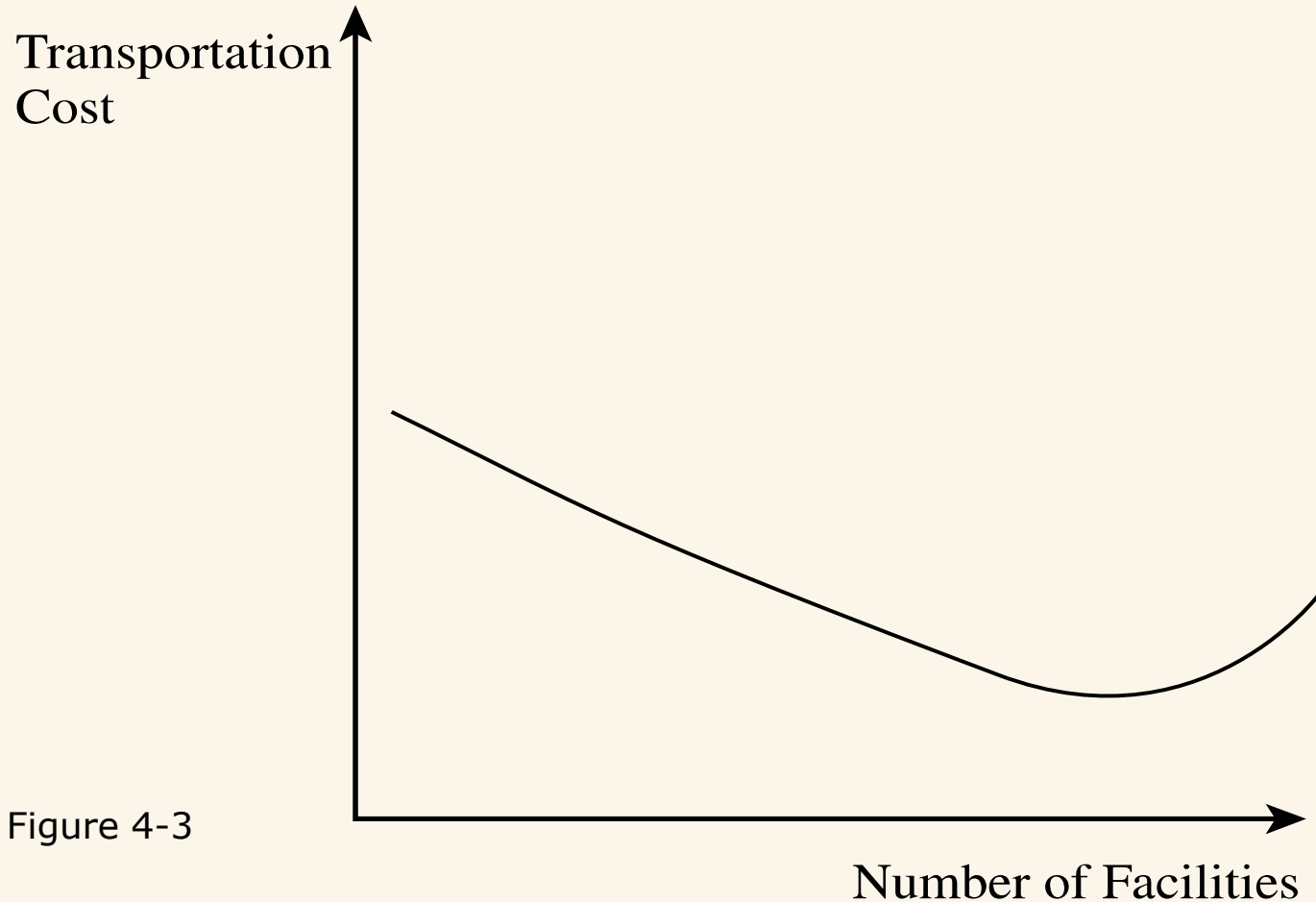


Figure 4-3

# Facility Costs and Number of Facilities

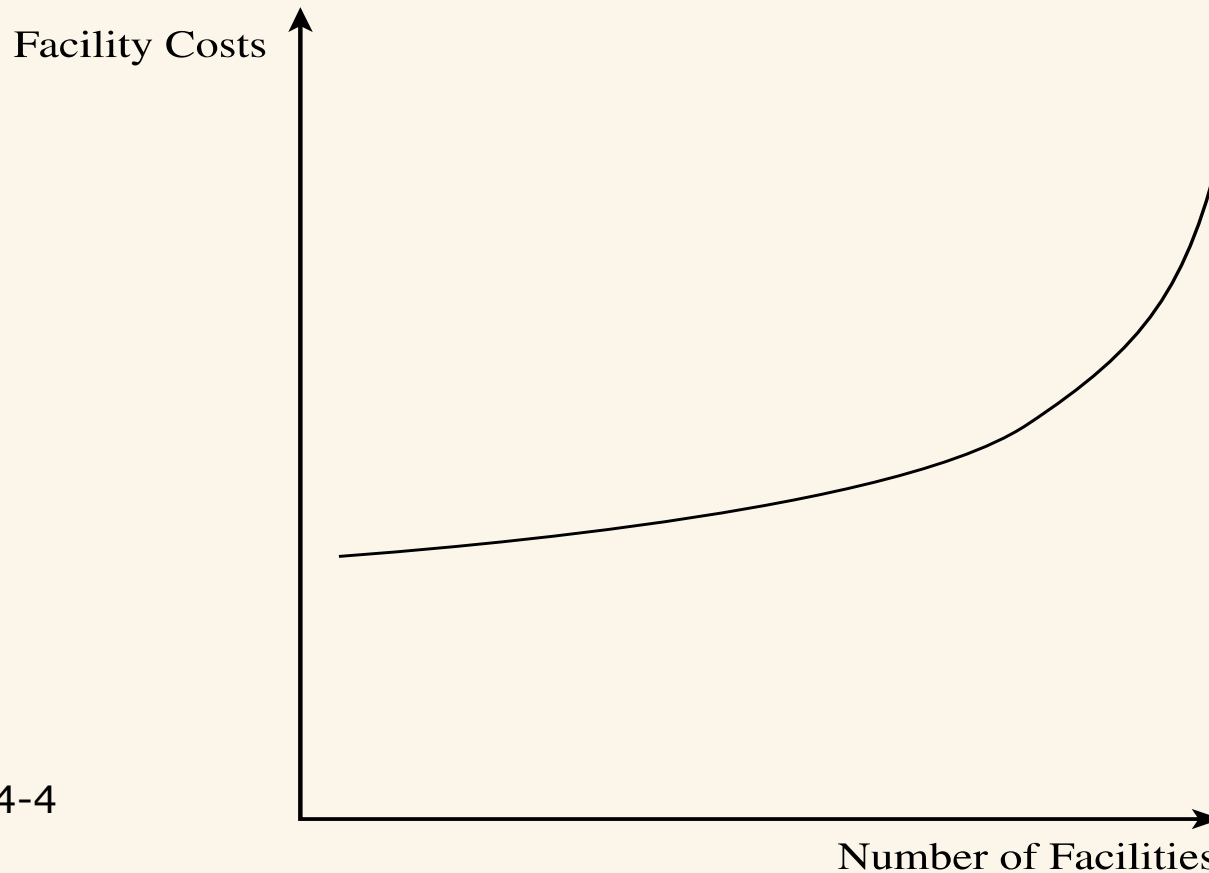


Figure 4-4

# Logistics Cost, Response Time, and Number of Facilities

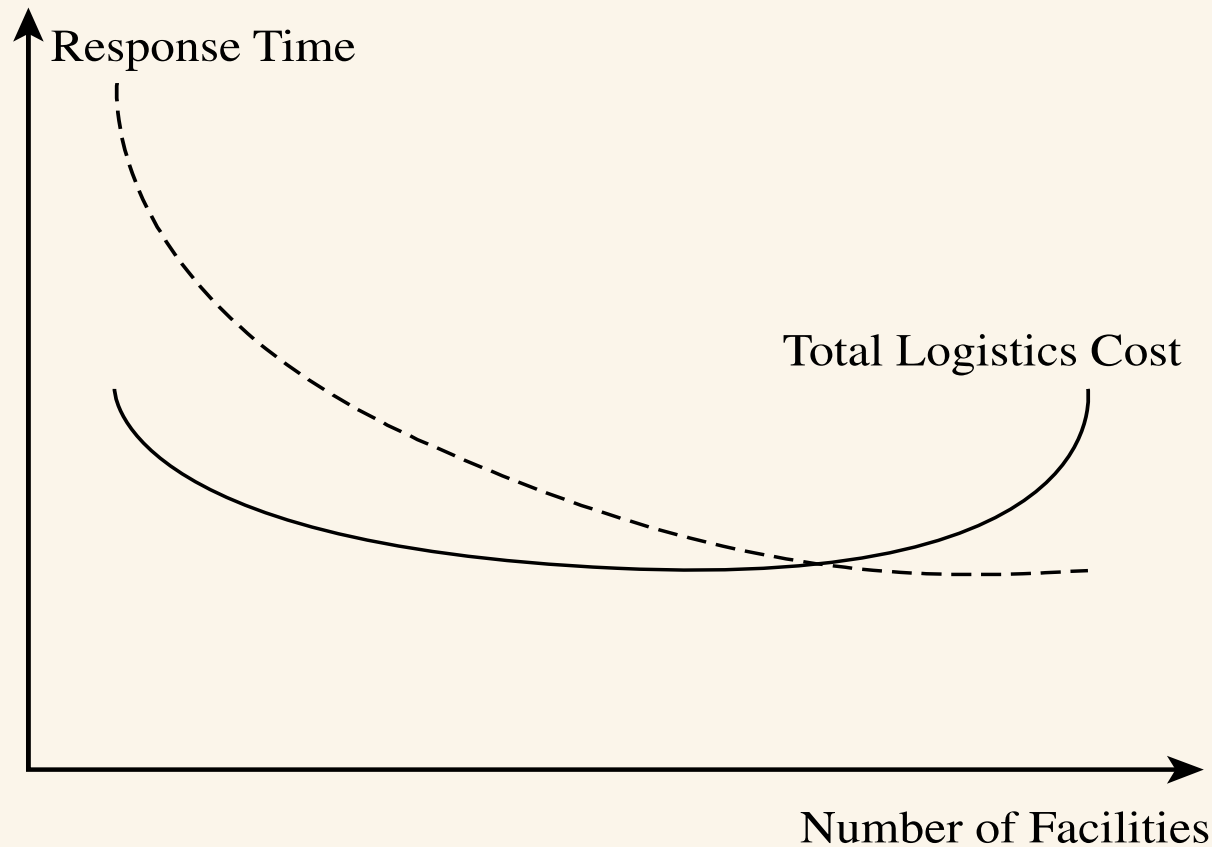


Figure 4-5

# Design Options for a Distribution Network

- Distribution network choices from the manufacturer to the end consumer
- Two key decisions
  - Will product be delivered to the customer location or picked up from a prearranged site?
  - Will product flow through an intermediary (or intermediate location)?

# Design Options for a Distribution Network

- One of six designs may be used
  - 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/distributor storage with customer pickup
  - Retail storage with customer pickup

# Manufacturer Storage with Direct Shipping

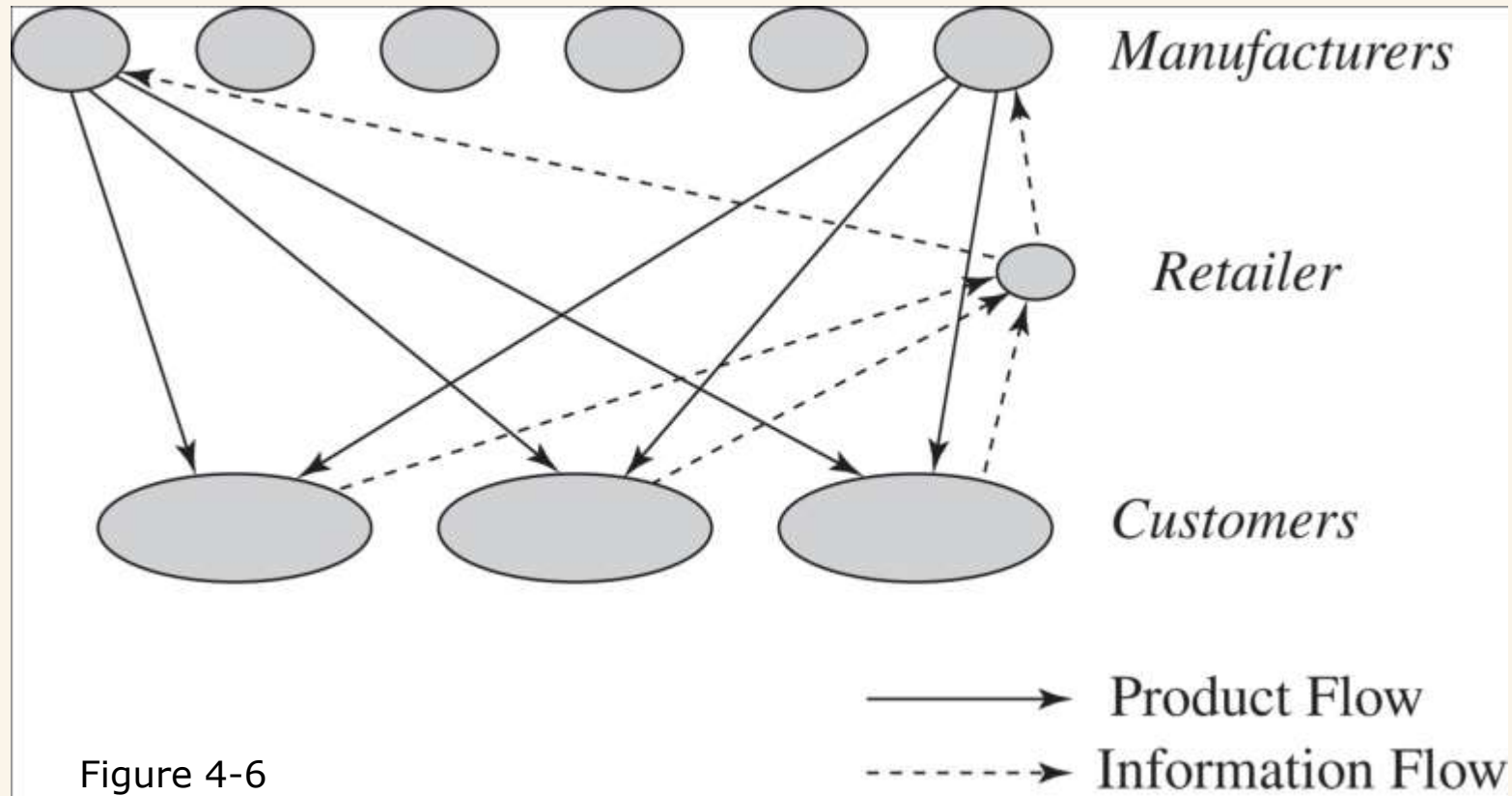


Figure 4-6

# Manufacturer Storage with Direct Shipping Network

Cost Factor	Performance
Inventory	Lower costs because of aggregation. Benefits of aggregation are highest for low-demand, high-value items. Benefits are large if product customization can be postponed at the manufacturer.
Transportation	Higher transportation costs because of increased distance and disaggregate shipping.
Facilities and handling	Lower facility costs because of aggregation. Some saving on handling costs if manufacturer can manage small shipments or ship from production line.
Information	Significant investment in information infrastructure to integrate manufacturer and retailer.

Table 4-1

# Manufacturer Storage with Direct Shipping Network

Service Factor	Performance
Response time	Long response time of one to two weeks because of increased distance and two stages for order processing. Response time may vary by product, thus complicating receiving.
Product variety	Easy to provide a high level of variety.
Product availability	Easy to provide a high level of product availability because of aggregation at manufacturer.
Customer experience	Good in terms of home delivery but can suffer if order from several manufacturers is sent as partial shipments.
Time to market	Fast, with the product available as soon as the first unit is produced.
Order visibility	More difficult but also more important from a customer service perspective.
Returnability	Expensive and difficult to implement.

Table 4-1



# In-Transit Merge Network

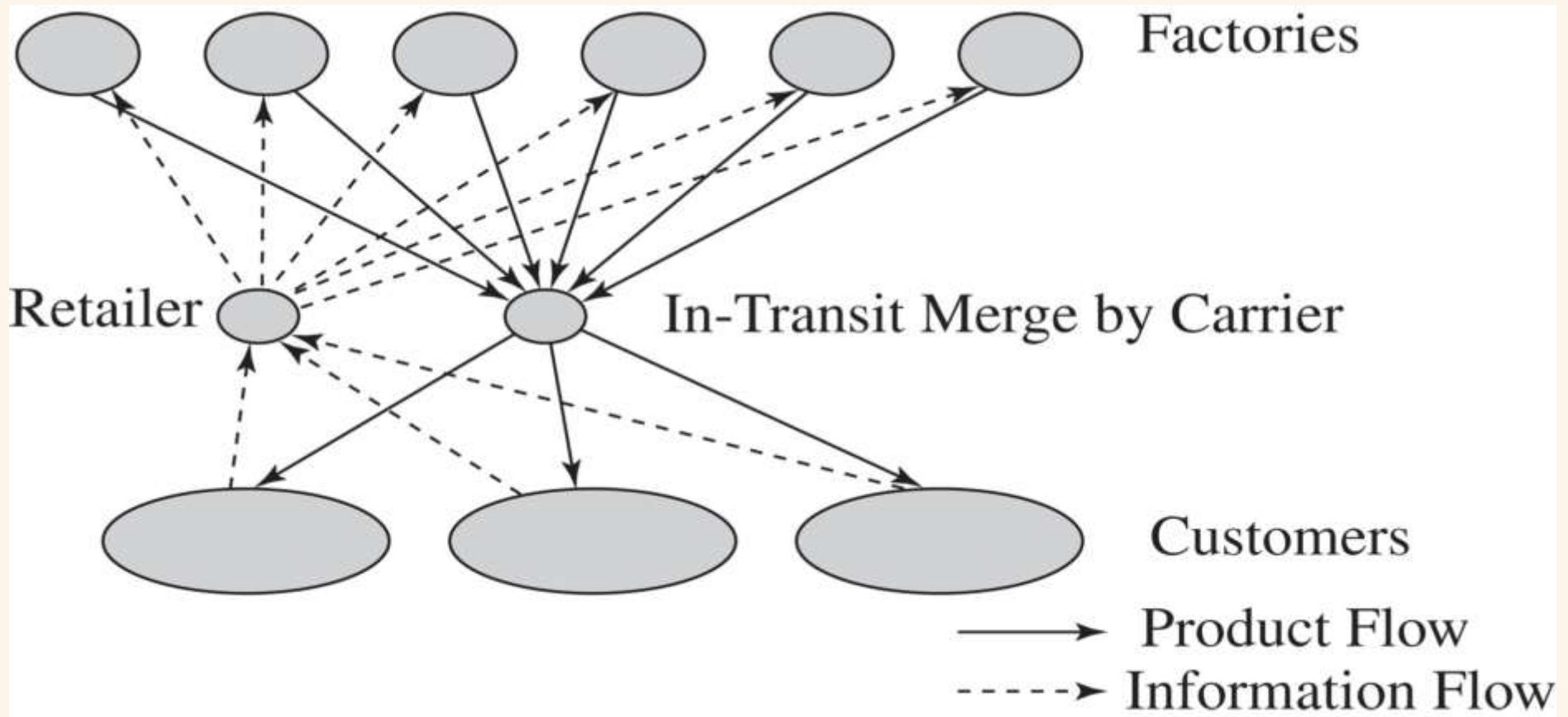


Figure 4-7

# In-Transit Merge

Cost Factor	Performance
Inventory	Similar to drop-shipping.
Transportation	Somewhat lower transportation costs than drop-shipping.
Facilities and handling	Handling costs higher than drop-shipping at carrier; receiving costs lower at customer.
Information	Investment is somewhat higher than for drop-shipping.

Table 4-2

# In-Transit Merge

Service Factor	Performance
Response time	Similar to drop-shipping; may be marginally higher.
Product variety	Similar to drop-shipping.
Product availability	Similar to drop-shipping.
Customer experience	Better than drop-shipping because only a single delivery has to be received.
Time to market	Similar to drop-shipping.
Order visibility	Similar to drop-shipping.
Returnability	Similar to drop-shipping.

Table 4-2

# Distributor Storage with Carrier Delivery

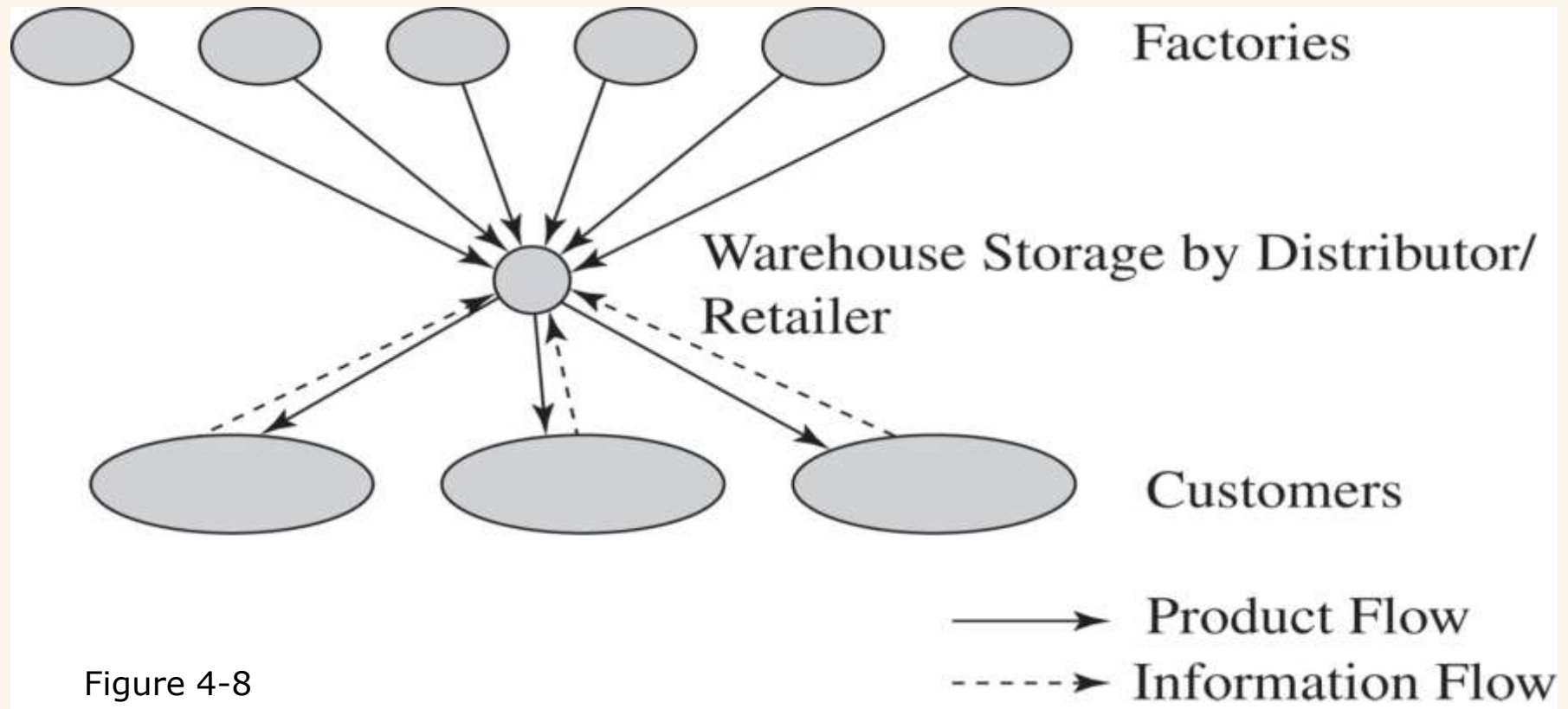


Figure 4-8

# Distributor Storage with Carrier Delivery

Cost Factor	Performance
Inventory	Higher than manufacturer storage. Difference is not large for faster moving items but can be large for very slow-moving items.
Transportation	Lower than manufacturer storage. Reduction is highest for faster moving items.
Facilities and handling	Somewhat higher than manufacturer storage. The difference can be large for very slow-moving items.
Information	Simpler infrastructure compared to manufacturer storage.

Table 4-3

# Distributor Storage with Carrier Delivery

Service Factor	Performance
Response time	Faster than manufacturer storage.
Product variety	Lower than manufacturer storage.
Product availability	Higher cost to provide the same level of availability as manufacturer storage.
Customer experience	Better than manufacturer storage with drop-shipping.
Time to market	Higher than manufacturer storage.
Order visibility	Easier than manufacturer storage.
Returnability	Easier than manufacturer storage.

Table 4-3

# Distributor Storage with Last Mile Delivery

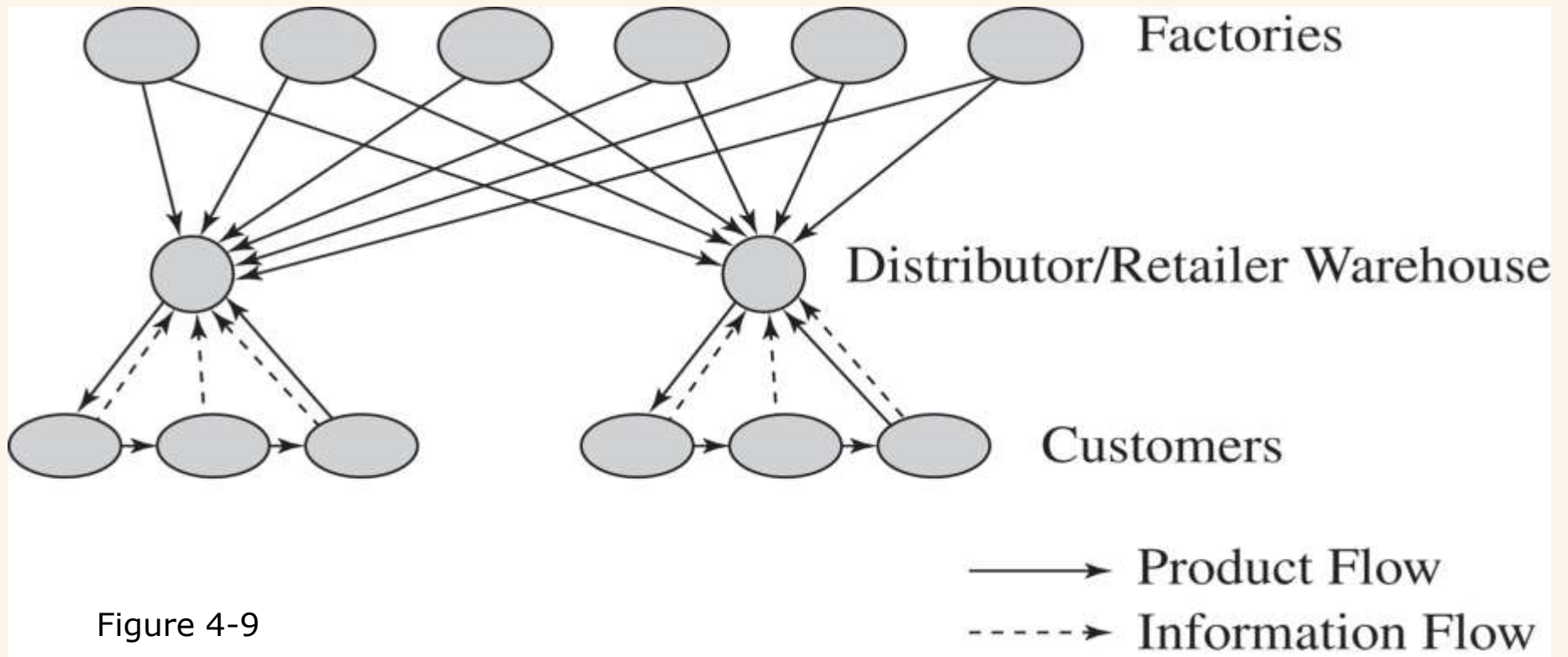


Figure 4-9

# Distributor Storage with Last Mile Delivery

Cost Factor	Performance
Inventory	Higher than distributor storage with package carrier delivery.
Transportation	Very high cost given minimal scale economies. Higher than any other distribution option.
Facilities and handling	Facility costs higher than manufacturer storage or distributor storage with package carrier delivery, but lower than a chain of retail stores.
Information	Similar to distributor storage with package carrier delivery.

Table 4-4

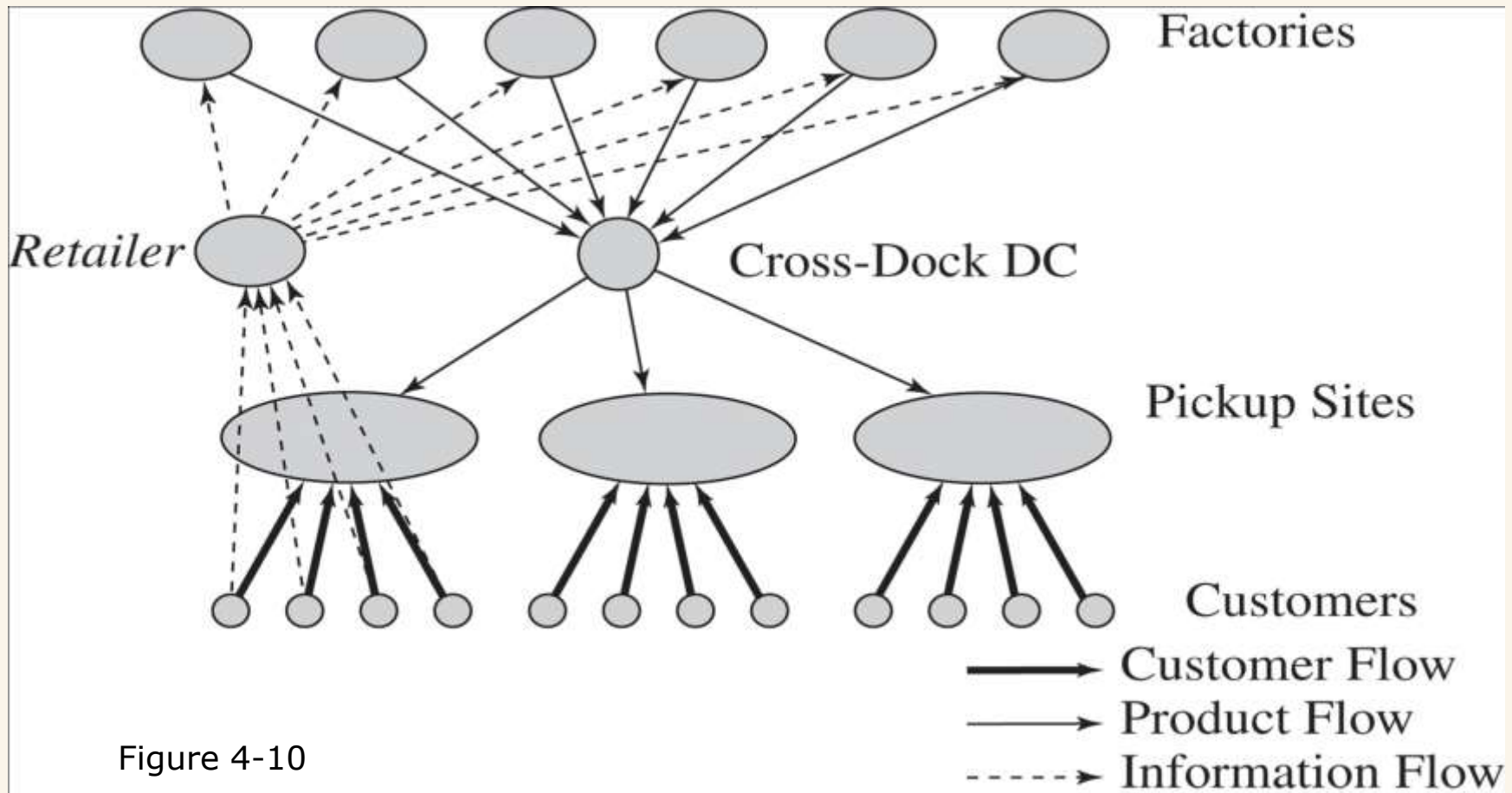


# Distributor Storage with Last Mile Delivery

Service Factor	Performance
Response time	Very quick. Same day to next-day delivery.
Product variety	Somewhat less than distributor storage with package carrier delivery but larger than retail stores.
Product availability	More expensive to provide availability than any other option except retail stores.
Customer experience	Very good, particularly for bulky items. Slightly higher than distributor storage with package carrier delivery.
Time to market	Less of an issue and easier to implement than manufacturer storage or distributor storage with package carrier delivery.
Order visibility	Easier to implement than other previous options.
Returnability	Harder and more expensive than a retail network.

Table 4-4

# Manufacturer or Distributor Storage with Customer Pickup



# Manufacturer or Distributor Storage with Customer Pickup

Cost Factor	Performance
Inventory	Can match any other option, depending on the location of inventory.
Transportation	Lower than the use of package carriers, especially if using an existing delivery network.
Facilities and handling	Facility costs can be high if new facilities have to be built. Costs are lower if existing facilities are used. The increase in handling cost at the pickup site can be significant.
Information	Significant investment in infrastructure required.

Table 4-5

# Manufacturer or Distributor Storage with Customer Pickup

Service Factor	Performance
Response time	Similar to package carrier delivery with manufacturer or distributor storage. Same-day delivery possible for items stored locally at pickup site.
Product variety	Similar to other manufacturer or distributor storage options.
Product availability	Similar to other manufacturer or distributor storage options.
Customer experience	Lower than other options because of the lack of home delivery. Experience is sensitive to capability of pickup location.
Time to market	Similar to manufacturer storage options.
Order visibility	Difficult but essential.
Returnability	Somewhat easier given that pickup location can handle returns.

Table 4-5

# Retail Storage with Customer Pickup

Cost Factor	Performance
Inventory	Higher than all other options.
Transportation	Lower than all other options.
Facilities and handling	Higher than other options. The increase in handling cost at the pickup site can be significant for online and phone orders.
Information	Some investment in infrastructure required for online and phone orders.

Table 4-6

# Retail Storage with Customer Pickup

Service Factor	Performance
Response time	Same-day (immediate) pickup possible for items stored locally at pickup site.
Product variety	Lower than all other options.
Product availability	More expensive to provide than all other options.
Customer experience	Related to whether shopping is viewed as a positive or negative experience by customer.
Time to market	Highest among distribution options.
Order visibility	Trivial for in-store orders. Difficult, but essential, for online and phone orders.
Returnability	Easier than other options because retail store can provide a substitute.

Table 4-6

# Comparative Performance of Delivery Network Designs

	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	Varies from 1 to 5	4	3	2	1	5
Time to market	4	1	1	2	3	1
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 and handling	6	1	2	3	4	5
Information	1	4	4	3	2	5

Key: 1 corresponds to the strongest performance and 6 the weakest performance.

Table 4-7

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# Delivery Networks for Different Product/ Customer Characteristics

	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

Key: +2 = very suitable; +1 = somewhat suitable; 0 = neutral; -1 = somewhat unsuitable; -2 = very unsuitable.

Table 4-8



# Impact of Online Sales on Customer Service

- Response time to customers
  - ↷ Physical products take longer to fulfill than retail store
  - ↷ No delay for information goods
- Product variety
  - ↷ Easier to offer larger selection
- Product availability
  - ↷ Aggregating inventory and better information on customer preferences improves product availability

# Impact of Online Sales on Customer Service

- Customer experience
  - ↻ Improved access, customization, and convenience
- Faster time to market
- Order visibility
- Returnability
  - ↻ Harder with online orders
  - ↻ Proportion of returns likely to be much higher

# Impact of Online Sales on Customer Service

- Direct sales to customers
  - ↪ Social networking channels allow firms to directly pitch products and promotion
- Flexible pricing, product portfolio, and promotions
  - ↪ Manage revenues from product portfolio more effectively than traditional channels
  - ↪ Promotion information can be conveyed to customers quickly and inexpensively
- Efficient funds transfer

# Impact of Online Sales on Cost

- Inventory
  - ↷ Lower inventory levels if customers will wait
  - ↷ Postpone variety until after the customer order is received
- Facilities
  - ↷ Costs related to the number and location of facilities in a network
  - ↷ Costs associated with the operations in these facilities

# Impact of Online Sales on Cost

- Transportation
  - ↪ Lower cost of “transporting” information goods in digital form
  - ↪ For non digital, aggregating inventories increases outbound transportation
- Information
  - ↪ Share demand, planning, and forecasting information throughout its supply chain
  - ↪ Additional costs to build and maintain the information infrastructure

# Online Sales Scorecard

Area	Impact
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.

Table 4-9

# Using Online Sales to Sell Computer Hardware: Dell

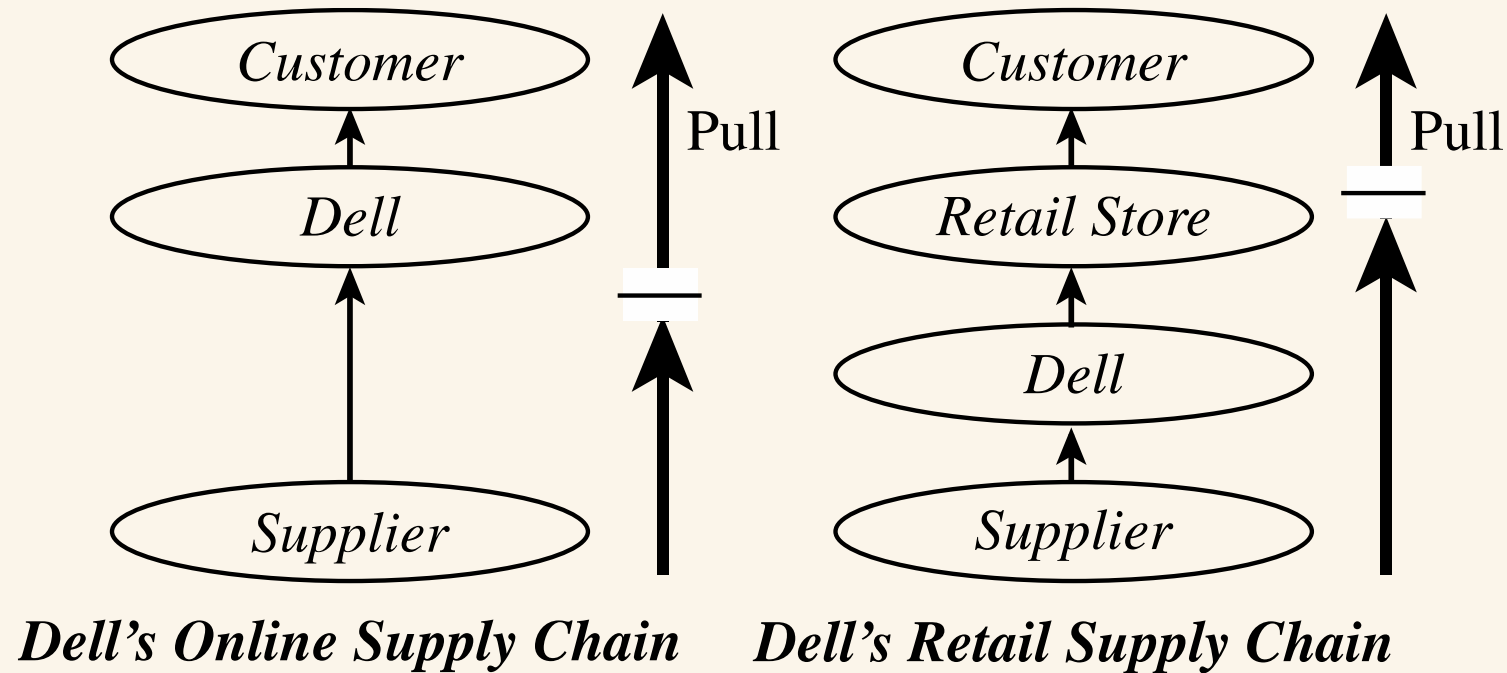


Figure 4-11

# Using Online Sales to Sell Computer Hardware: Dell

- Impact of online sales on customer service
  - ~ Delay in fulfilling customer request
- Impact of online sales on cost
  - ~ Reduced inventory costs
  - ~ Lower facility costs
  - ~ Higher total transportation costs
  - ~ Incremental increase in information costs



# Impact of Online Sales on Performance

Area	Impact for Customized Hardware	Impact for Standard Low-Cost Hardware
Response time	-1	-2
Product variety	+2	0
Product availability	+1	+1
Customer experience	+2	+1
Time to market	+2	+1
Order visibility	+1	0
Direct sales	+2	+1
Flexible pricing, portfolio, promotions	+2	+1
Efficient funds transfer	+2	+2
Inventory	+2	+1
Facilities	+2	+1
Transportation	-1	-2
Information	0	0

Table 4-10

# Using Online Sales to Sell Computer Hardware: Dell

- A tailored supply chain network
  - ↪ A hybrid model can be very effective
  - ↪ More significant as hardware becomes more of a commodity
  - ↪ Take advantage of the strengths of both online sales and traditional retail and distribution channels

# Using Online Sales to Sell Books: Amazon

- Impact of online sales on customer service
  - ↪ Internet has not shortened supply chains
  - ↪ Increased selection, convenience
- Impact of online sales on cost
  - ↪ Reduced inventory costs
  - ↪ Lower facility costs
  - ↪ Higher total transportation costs
  - ↪ Increase in information costs

# Impact of Online Sales on Performance

Area	Physical Books	E-books
Response time	-1	+1
Product variety	+2	+2
Product availability	+1	+2
Customer experience	+1	+1
Time to market	+1	+2
Order visibility	0	0
Direct sales	0	+1
Flexible pricing, portfolio, promotions	+1	+1
Efficient funds transfer	0	0
Inventory	+1	+2
Facilities	+1	+1
Transportation	-2	+1
Information	-1	-1

Table 4-11

# Using Online Sales to Sell Books: Amazon

- A supply chain network for books
  - ↪ Traditional bookstores pressured from both ends
  - ↪ Amazon more efficient

# Using the Internet to Sell Groceries: Peapod

- Impact of online sales on customer service
  - ↪ Sell convenience and the time savings
  - ↪ Offers less variety
  - ↪ Creating a personalized shopping experience and customized advertising and promotions

# Using the Internet to Sell Groceries: Peapod

- Impact of online sales on cost
  - ↷ Reduced inventory costs
  - ↷ Higher facility costs due to picking operation
  - ↷ Significantly higher total transportation costs
  - ↷ Increase in information costs

# Impact of Online Sales on Performance

Area	Impact
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

Table 4-12



# Using Internet to Sell Groceries: Peapod

- Value of online sales to a traditional grocery chain
  - ↪ Complement the strengths of their existing network
  - ↪ Offer an entire array of services at differing prices based on the amount of work the customer does

# Using the Internet to Rent Movies: Netflix

- Impact of online sales on customer service
  - ↪ Staggering selection and an excellent recommendation engine
  - ↪ Video streaming through a variety of devices
  - ↪ Customers received their DVDs within 24 hours of being shipped

# Using the Internet to Rent Movies: Netflix

- Impact of online sales on cost
  - ↪ Reduced inventory costs
  - ↪ Lower facility costs
  - ↪ Considerably higher total transportation costs, increased streaming will reduce transportation costs
  - ↪ Increase in information costs

# Impact of Online Sales on Performance

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

Table 4-12

# Distribution Networks in Practice

- The ownership structure of the distribution network can have as big an impact as the type of distribution network
- It is important to have adaptable distribution networks
- Product price, commoditization, and criticality affect the type of distribution system preferred by customers
- Integrate the Internet with the existing physical network

# Traditional Indian Distribution Channels

- What characteristics of the traditional Indian agricultural produce distribution channels militate against delivering simultaneous benefits to the farmer and the consumer?
- What supply chain best practices do you see as being relevant to the Indian agricultural produce distribution system?
- Organized retailing underway in India is likely to impact the traditional distribution channels and transform the same radically. What major changes do you visualize taking place in the agricultural produce distribution system in India and how do you see the existing channels responding to the same?

# Distribution Networks in Practice

- Consider whether an exclusive distribution strategy is advantageous
- Product, price, commoditization, and criticality have an impact on the type of distribution system preferred by customers

# Summary of Learning Objectives

- Identify the key factors to be considered when designing a distribution network
- Discuss the strengths and weaknesses of various distribution options
- Understand how online sales have affected the design of distribution networks in different industries