

Supply Chain Management, 6e (Chopra/Meindl)
Chapter 5 Network Design in the Supply Chain

5.1 True/False Questions

1) Supply chain *network design decisions* include the location of manufacturing, storage, or transportation-related facilities and the allocation of capacity and roles to each facility.

Answer: TRUE

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

2) Decisions concerning the role of each facility are significant because they determine the amount of rigidity the supply chain has in changing the way it meets demand.

Answer: FALSE

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

3) Facility location decisions have a long-term impact on a supply chain's performance because it is cost effective to shut down a facility or move it to a different location.

Answer: FALSE

Diff: 1

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

4) Capacity allocation decisions have a significant impact on supply chain performance because they tend to stay in place for several years.

Answer: TRUE

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

5) The allocation of supply sources and markets to facilities has a significant impact on performance because it affects total production, inventory, and transportation costs incurred by the supply chain to satisfy customer demand.

Answer: TRUE

Diff: 1

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

6) Network design decisions have a significant impact on performance because they determine the supply chain configuration and set constraints within which inventory, transportation, and information can be used to either decrease supply chain cost or increase responsiveness.

Answer: TRUE

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

7) Decisions concerning the role of each facility are significant because they determine the amount of flexibility the supply chain has in changing the way it meets demand.

Answer: TRUE

Diff: 1

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

8) Network design decisions have a significant impact on performance because they determine the supply chain configuration and set constraints within which the other supply chain drivers can be used either to decrease supply chain cost or to increase responsiveness.

Answer: TRUE

Diff: 1

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

9) If facilities have higher fixed costs, many local facilities are preferred because this helps lower transportation costs.

Answer: FALSE

Diff: 1

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Analytical thinking

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

10) Firms focusing on cost leadership tend to find the lowest cost location for their manufacturing facilities, but only if that means locating very far from the markets they serve.

Answer: FALSE

Diff: 1

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

11) If production technology displays significant economies of scale, many local locations are the most effective.

Answer: FALSE

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

12) If facilities have lower fixed costs, many local facilities are preferred because this helps lower transportation costs.

Answer: TRUE

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

13) If the technology is flexible, it becomes more difficult to consolidate manufacturing in a few large facilities.

Answer: FALSE

Diff: 3

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

14) High tariffs lead to more production locations within a supply chain network, with each location having a lower allocated capacity.

Answer: TRUE

Diff: 3

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

15) When designing supply chain networks, companies must build appropriate flexibility to help counter fluctuations in exchange rates and demand across different countries.

Answer: TRUE

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

16) Inventory and facility costs increase as the number of facilities in a supply chain increase.

Answer: TRUE

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

17) Transportation costs increase as the number of facilities is increased.

Answer: FALSE

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

18) A firm may increase the number of facilities beyond the point that minimizes total logistics cost to improve the response time to its customers.

Answer: TRUE

Diff: 1

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

19) When faced with a network design decision, the goal of a manager is to design a network that minimizes the firm's costs while satisfying customer needs in terms of demand and responsiveness.

Answer: FALSE

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

20) The supply chain network is designed to maximize total profits, taking into account the expected margin and demand in each market, various logistics and facility costs, and the taxes and tariffs at each location.

Answer: TRUE

Diff: 1

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

5.2 Multiple Choice Questions

1) Supply chain *network design decisions* include

A) only the location of manufacturing, storage, or transportation-related facilities.

B) only the allocation of capacity and roles to each facility.

C) both the location of manufacturing, storage, or transportation-related facilities and the allocation of capacity and roles to each facility.

D) neither the location of manufacturing, storage, or transportation-related facilities nor the allocation of capacity and roles to each facility.

Answer: C

Diff: 1

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 2) Supply chain network design decisions classified as *facility role* are concerned with
- A) what processes are performed at each facility.
 - B) where facilities should be located.
 - C) how much capacity should be allocated to each facility.
 - D) what markets each facility should serve and which supply sources should feed each facility.

Answer: A

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 3) Supply chain network design decisions classified as *facility location* are concerned with
- A) what processes are performed at each facility.
 - B) where facilities should be located.
 - C) how much capacity should be allocated to each facility.
 - D) what markets each facility should serve and which supply sources should feed each facility.

Answer: B

Diff: 1

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 4) Supply chain network design decisions classified as *capacity allocation* are concerned with
- A) what processes are performed at each facility.
 - B) where facilities should be located.
 - C) how much capacity should be allocated to each facility.
 - D) what markets each facility should serve and which supply sources should feed each facility.

Answer: C

Diff: 1

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 5) Supply chain network design decisions classified as *market and supply allocation* are concerned with
- A) what processes are performed at each facility.
 - B) where facilities should be located.
 - C) how much capacity should be allocated to each facility.
 - D) what markets each facility should serve and which supply sources should feed each facility.

Answer: D

Diff: 1

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 6) Decisions concerning the role of each facility are significant because
- A) they determine the amount of flexibility the supply chain has in demanding change.
 - B) they determine the amount of flexibility the supply chain has in changing the way it meets demand.
 - C) they determine the amount of capacity the supply chain has in changing the way it meets demand.
 - D) they determine the amount of inventory the supply chain has in demanding change.

Answer: B

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 7) Facility location decisions have a long-term impact on a supply chain's performance because
- A) it is very expensive to shut down a facility or move it to a different location.
 - B) it is not expensive to shut down a facility or move it to a different location.
 - C) it is advisable to shut down a facility or move it to a different location.
 - D) it is cost effective to shut down a facility or move it to a different location.

Answer: A

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 8) Capacity allocation decisions have a significant impact on supply chain performance because
- A) capacity decisions tend to be permanent.
 - B) capacity decisions tend to be changed frequently.
 - C) capacity decisions do not tend to stay in place for several years.
 - D) capacity decisions tend to stay in place for several years.

Answer: D

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 9) Allocating too much capacity to a location results in
- A) poor utilization, and as a result, higher costs.
 - B) high utilization, and as a result, higher costs.
 - C) poor utilization, and as a result, lower costs.
 - D) high utilization, and as a result, lower costs.

Answer: A

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

10) Allocating too little capacity results in

A) good responsiveness if demand is not satisfied or low cost if demand is filled from a distant facility.

B) good responsiveness if demand is not satisfied or high cost if demand is filled from a distant facility.

C) poor responsiveness if demand is not satisfied or low cost if demand is filled from a distant facility.

D) poor responsiveness if demand is not satisfied or high cost if demand is filled from a distant facility.

Answer: D

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

11) The allocation of supply sources and markets to facilities has a significant impact on performance because

A) it cannot affect total production, inventory, and transportation costs incurred by the supply chain to satisfy customer demand.

B) it cannot affect customer demand.

C) it affects total production, inventory, and transportation costs incurred by the supply chain to satisfy customer demand.

D) it cannot satisfy customer demand.

Answer: C

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

12) The allocation of supply sources and markets to facilities should be reconsidered on a regular basis so that

A) the allocation can be held constant as market conditions or plant capacities expand.

B) the allocation can be changed as market conditions or plant capacities stagnate.

C) the allocation can be held constant as market conditions or plant capacities change.

D) the allocation can be changed as market conditions or plant capacities change.

Answer: D

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 13) Network design decisions have a significant impact on performance because they
- A) determine the customer demand.
 - B) determine the supply chain conflagration.
 - C) set constraints within which inventory, transportation, and information can be used to either decrease supply chain cost or increase responsiveness.
 - D) set constraints within which inventory, transportation, and information can be used to either increase supply chain cost or decrease responsiveness.

Answer: C

Diff: 3

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 14) Customer order entry is
- A) the point in time when the customer has access to choices and makes a decision regarding a purchase.
 - B) the customer informing the retailer of what they want to purchase and the retailer allocating product to the customer.
 - C) the process where product is prepared and sent to the customer.
 - D) the process where the customer receives the product and takes ownership.

Answer: B

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

- 15) Firms focusing on cost leadership tend to
- A) locate facilities close to the market they serve.
 - B) locate facilities very far from the market they serve.
 - C) find the lowest cost location for their manufacturing facilities.
 - D) select a high-cost location to be able to react quickly.

Answer: C

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

- 16) Firms focusing on responsiveness tend to
- A) locate facilities close to the market they serve.
 - B) locate facilities very far from the market they serve.
 - C) find the lowest cost location for their manufacturing facilities.
 - D) select a high-cost location to be able to react slowly.

Answer: A

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

17) A facility that serves the role of being a low-cost supply source for markets located outside the country where the facility is located is

- A) an offshore facility.
- B) a source facility.
- C) a contributor facility.
- D) an outpost facility.

Answer: A

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

18) A facility that also has low cost as its primary objective, but its strategic role is broader than that of an offshore facility is

- A) an offshore facility.
- B) a source facility.
- C) a contributor facility.
- D) an outpost facility.

Answer: B

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

19) A facility built because of tax incentives, local content requirement, tariff barriers, or high logistics cost to supply the region from elsewhere with the objective to supply the market where it is located is

- A) an offshore facility.
- B) a source facility.
- C) a server facility.
- D) a contributor facility.

Answer: C

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

20) A facility located primarily to obtain access to knowledge or skills that may exist within a certain region is

- A) an offshore facility.
- B) a source facility.
- C) a server facility.
- D) an outpost facility.

Answer: D

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

21) A facility that serves the market where it is located but also assumes responsibility for product customization, process improvements, product modifications, or product development is

- A) an offshore facility.
- B) a source facility.
- C) a server facility.
- D) a contributor facility.

Answer: D

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

22) A facility that creates new products, processes, and technologies for the entire network is

- A) a lead facility.
- B) a source facility.
- C) a server facility.
- D) an outpost facility.

Answer: A

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

23) If facilities have lower fixed costs

- A) a few high-capacity facilities are preferred because this helps lower transportation costs.
- B) a few local facilities are preferred because this helps lower transportation costs.
- C) many high-capacity facilities are preferred because this helps lower transportation costs.
- D) many local facilities are preferred because this helps lower transportation costs.

Answer: D

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Analytical thinking

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

24) If the production technology is very inflexible and product requirements vary from one country to another, a firm has to set up

- A) local facilities to serve the market in each country.
- B) a few high-capacity facilities to serve the market in each country.
- C) many local facilities because this helps lower transportation costs.
- D) a few high-capacity facilities because this helps lower transportation costs.

Answer: A

Diff: 3

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

25) If the technology is flexible

- A) it becomes more difficult to consolidate manufacturing in a few large facilities.
- B) it becomes more difficult to distribute manufacturing in many local facilities.
- C) it becomes easier to consolidate manufacturing in a few large facilities.
- D) it becomes easier to consolidate manufacturing in many local facilities.

Answer: C

Diff: 3

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

26) Duties that must be paid when products and/or equipment are moved across international, state, or city boundaries are referred to as

- A) taxes.
- B) tax incentives.
- C) tariffs.
- D) incentives.

Answer: C

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

27) If a country has very high tariffs

- A) companies either do not serve the local market or set up manufacturing plants within the country to save on duties.
- B) companies do not serve the local market.
- C) companies set up manufacturing plants within the country to save on duties.
- D) companies will not serve the local market or set up manufacturing plants within the country to save on duties.

Answer: A

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

- 28) Developing countries often create *free trade zones* where
- A) duties and tariffs are imposed as long as production is used primarily for export.
 - B) duties and tariffs are imposed as long as production is used primarily for import.
 - C) duties and tariffs are relaxed as long as production is used primarily for export.
 - D) duties and tariffs are relaxed as long as production is used primarily for import.

Answer: C

Diff: 1

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

- 29) Building some over-capacity in the supply chain network and making the capacity flexible allows a firm to alter production flows within the supply chain to

- A) produce less in facilities that have a lower cost based on current exchange rates.
- B) produce more in facilities that have a lower cost based on current exchange rates.
- C) produce more in facilities that have a higher cost based on current exchange rates.
- D) produce less in facilities that have the same cost based on current exchange rates.

Answer: B

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

- 30) Total logistics costs are a sum of the

- A) inventory and facility costs.
- B) transportation and facility costs.
- C) inventory and transportation costs.
- D) inventory, transportation, and facility costs.

Answer: D

Diff: 2

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Analytical thinking

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

- 31) The facilities in a supply chain network must

- A) at least maximize total logistics cost.
- B) at least equal the number that maximizes total logistics cost.
- C) at least equal the number that minimizes total logistics cost.
- D) at least minimize total logistics cost.

Answer: C

Diff: 1

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Analytical thinking

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

32) Firms that focus on cost leadership tend to find the lowest-cost location might

- A) locate far from their customers.
- B) locate in a higher cost area to provide faster response.
- C) have many facilities to take advantage of economies of scale.
- D) increase inventory levels to reduce stockouts.

Answer: A

Diff: 1

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

33) _____ costs increase as the number of facilities in a supply chain increases.

- A) Inventory
- B) Transportation
- C) Retail operation
- D) Information

Answer: A

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Analytical thinking

Objective: LO 5.3: Develop a framework for making network design decisions.

34) Capital, growth strategy, existing networks and global competition mostly affect which of the four Global Network Design Decisions?

- A) Phase I - Supply Chain Strategy
- B) Phase II - Regional Facility Configuration
- C) Phase III - Desirable Sites
- D) Phase IV - Location Choices

Answer: A

Diff: 2

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

35) The availability of suppliers, transportation services, communication, utilities, and warehousing infrastructure mostly affect which of the four Global Network Design Decisions?

- A) Phase I - Supply Chain Strategy
- B) Phase II - Regional Facility Configuration
- C) Phase III - Desirable Sites
- D) Phase IV - Location Choices

Answer: C

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

36) Tariffs, economies of scale and aggregate factor costs mostly affect which of the four Global Network Design Decisions?

- A) Phase I - Supply Chain Strategy
- B) Phase II - Regional Facility Configuration
- C) Phase III - Desirable Sites
- D) Phase IV - Location Choices

Answer: B

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

37) Available infrastructure, skill needs and response time mostly affect which of the four Global Network Design Decisions?

- A) Phase I - Supply Chain Strategy
- B) Phase II - Regional Facility Configuration
- C) Phase III - Desirable Sites
- D) Phase IV - Location Choices

Answer: C

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

38) When faced with a network design decision, the goal of a manager is to design a network that

- A) maximizes the firm's profits.
- B) minimizes the firm's costs.
- C) satisfies customer needs in terms of demand and responsiveness.
- D) maximizes the firm's profits while satisfying customer needs in terms of demand and responsiveness.

Answer: D

Diff: 2

Topic: 5.3 Framework for Network Design Decisions

AACSB: Analytical thinking

Objective: LO 5.3: Develop a framework for making network design decisions.

39) Which of the following is the first phase in the design of a global supply chain network?

- A) Define a supply chain strategy
- B) Define the regional facility configuration
- C) Select desirable sites
- D) Location choices

Answer: A

Diff: 2

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

- 40) The objective of the first phase of network design is to
- A) maximize total profits, taking into account the expected margin and demand in each market.
 - B) select a set of desirable sites within each region where facilities are to be located.
 - C) identify regions where facilities will be located, their potential roles, and their approximate capacity.
 - D) specify what capabilities the supply chain network must have to support a firm's competitive strategy.

Answer: D

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

- 41) The objective of the second phase of network design is to
- A) select a precise location and capacity allocation for each facility.
 - B) select a set of desirable sites within each region where facilities are to be located.
 - C) identify regions where facilities will be located, their potential roles, and their approximate capacity.
 - D) specify what capabilities the supply chain network must have to support a firm's competitive strategy.

Answer: C

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

- 42) The objective of the third phase of network design is to
- A) maximize total profits, taking into account the expected margin and demand in each market.
 - B) select a precise location and capacity allocation for each facility.
 - C) select a set of desirable sites within each region where facilities are to be located.
 - D) identify regions where facilities will be located, their potential roles, and their approximate capacity.

Answer: C

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

43) It is very important that long-term consequences be thought through when making facility decisions, because

A) network designers can use this fact to influence the role of the new facility and the focus of people working there.

B) facilities last a long time and have an enduring impact on a firm's performance.

C) it is astounding how often tax incentives drive the choice of location.

D) the location of a facility has a significant impact on the extent and form of communication that develops in the supply chain network.

Answer: B

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

44) A manufacturer of cat towers wishes to locate a super assembly facility to meet their cat tower assembly needs for the next millennium. Currently, carpet, cylinders, yarn and fasteners are purchased in bulk from suppliers in North Haverbrook, Ogden, and Springfield in the quantities shown in the table. The super assembly facility would ship to distribution centers located in Seattle, Lubbock, Nashville, and Philadelphia. The locations of all of these cities on an x-y grid, transportation costs on a ton per mile basis, and total tonnage are all contained in the table.

Sources/Markets	Transportation Cost \$/ton mile (F_n)	Quantity in Tons (D_n)	X_n	Y_n
Supply				
North Haverbrook	1.1	650	700	1200
Ogden	1.2	450	250	600
Springfield	1.4	400	225	825
Market				
Seattle	2.25	300	50	1200
Lubbock	2.25	200	450	300
Nashville	2.25	500	800	250
Philadelphia	2.25	500	950	1100

What is the distance between the Ogden and Seattle locations?

A) 450 miles

B) 350 miles

C) 630 miles

D) 1050 miles

Answer: C

Diff: 3

Topic: 5.4 Models for Facility Location and Capacity Allocation

AACSB: Analytical thinking

Objective: LO 5.4: Use optimization for facility location and capacity allocation decisions.

45) A manufacturer of cat towers wishes to locate a super assembly facility to meet their cat tower assembly needs for the next millennium. Currently, carpet, cylinders, yarn and fasteners are purchased in bulk from suppliers in North Haverbrook, Ogden, and Springfield in the quantities shown in the table. The super assembly facility would ship to distribution centers located in Seattle, Lubbock, Nashville, and Philadelphia. The locations of all of these cities on an x-y grid, outbound transportation costs on a ton per mile basis, and total tonnage are all contained in the table.

Sources/Markets	Transportation Cost \$/ton mile (F_n)	Quantity in Tons (D_n)	X_n	Y_n
Supply				
North Haverbrook	1.1	650	700	1200
Ogden	1.2	450	250	600
Springfield	1.4	400	225	825
Market				
Seattle	2.25	300	50	1200
Lubbock	2.25	200	450	300
Nashville	2.25	500	800	250
Philadelphia	2.25	500	950	1100

What is the cost to transport 500 tons of material between the Springfield and Seattle locations?

- A) \$325,000
- B) \$192,500
- C) \$682,500
- D) \$437,500

Answer: D

Diff: 3

Topic: 5.4 Models for Facility Location and Capacity Allocation

AACSB: Analytical thinking

Objective: LO 5.4: Use optimization for facility location and capacity allocation decisions.

46) A manufacturer of cat towers wishes to locate a super assembly facility to meet their cat tower assembly needs for the next millennium. Currently, carpet, cylinders, yarn and fasteners are purchased in bulk from suppliers in North Haverbrook, Ogden, and Springfield in the quantities shown in the table. The super assembly facility would ship to distribution centers located in Seattle, Lubbock, Nashville, and Philadelphia. The locations of all of these cities on an x-y grid, outbound transportation costs on a ton per mile basis, and total tonnage are all contained in the table.

Sources/Markets	Transportation Cost \$/ton mile (F_n)	Quantity in Tons (D_n)	X_n	Y_n
Supply				
North Haverbrook	1.1	650	700	1200
Ogden	1.2	450	250	600
Springfield	1.4	400	225	825
Market				
Seattle	2.25	300	50	1200
Lubbock	2.25	200	450	300
Nashville	2.25	500	800	250
Philadelphia	2.25	500	950	1100

What is the optimal location for the Super Assembly Center?

- A) (550, 808)
- B) (513, 772)
- C) (526, 795)
- D) (538, 784)

Answer: A

Diff: 3

Topic: 5.4 Models for Facility Location and Capacity Allocation

AACSB: Analytical thinking

Objective: LO 5.4: Use optimization for facility location and capacity allocation decisions.

47) A manufacturer of cat towers wishes to locate a super assembly facility to meet their cat tower assembly needs for the next millennium. Currently, carpet, cylinders, yarn and fasteners are purchased in bulk from suppliers in North Haverbrook, Ogden, and Springfield in the quantities shown in the table. The super assembly facility would ship to distribution centers located in Seattle, Lubbock, Nashville, and Philadelphia. The locations of all of these cities on an x-y grid, outbound transportation costs on a ton per mile basis, and total tonnage are all contained in the table.

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Market				
Seattle	2.25	300	50	1200
Lubbock	2.25	200	450	300
Nashville	2.25	500	800	250
Philadelphia	2.25	500	950	1100

What is the minimal shipping cost that satisfies all market demand?

- A) \$2,546,632
- B) \$2,586,342
- C) \$2,451,668
- D) \$2,522,982

Answer: B

Diff: 3

Topic: 5.4 Models for Facility Location and Capacity Allocation

AACSB: Analytical thinking

Objective: LO 5.4: Use optimization for facility location and capacity allocation decisions.

48) The implications of culture should not be glossed over because

- A) tariffs and tax incentives should be carefully considered.
- B) facilities last a long time and have an enduring impact on a firm's performance.
- C) it is astounding how often tax incentives drive the choice of location.
- D) the location of a facility has a significant impact on the extent and form of communication that develops in the supply chain network.

Answer: A

Diff: 3

Topic: 5.5 Making Network Design Decisions in Practice

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

49) The quality of life at selected facility locations has a significant impact on performance because

- A) network designers can use this fact to influence the role of the new facility and the focus of people working there.
- B) facilities last a long time and have an enduring impact on a firm's performance.
- C) the location of a facility has a significant impact on the extent and form of communication that develops in the supply chain network.
- D) it influences the work force available and their morale.

Answer: D

Diff: 3

Topic: 5.5 Making Network Design Decisions in Practice

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

50) Managers making facility location decisions should carefully consider tariffs and tax incentives, because

- A) network designers can use this fact to influence the role of the new facility and the focus of people working there.
- B) facilities last a long time and have an enduring impact on a firm's performance.
- C) it is astounding how often tax incentives drive the choice of location.
- D) the location of a facility has a significant impact on the extent and form of communication that develops in the supply chain network.

Answer: C

Diff: 2

Topic: 5.5 Making Network Design Decisions in Practice

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

5.3 Essay Questions

1) Explain how supply chain network design decisions are classified.

Answer: Supply chain *network design decisions* include the location of manufacturing, storage, or transportation-related facilities and the allocation of capacity and roles to each facility. Supply chain network design decisions are classified as follows:

1. *Facility role*: What role should each facility play? What processes are performed at each facility?
2. *Facility location*: Where should facilities be located?
3. *Capacity allocation*: How much capacity should be allocated to each facility?
4. *Market and supply allocation*: What markets should each facility serve? Which supply sources should feed each facility?

Diff: 2

Topic: 5.1 The Role of Network Design in the Supply Chain

AACSB: Application of knowledge

Objective: LO 5.1: Understand the role of network design in a supply chain.

2) Describe the factors that influence supply chain network design decisions.

Answer:

Strategic Factors. Firms focusing on cost leadership tend to find the lowest cost location for their manufacturing facilities, even if that means locating very far from the markets they serve. Firms focusing on responsiveness tend to locate facilities closer to the market and may select a high-cost location if this choice allows the firm to quickly react to changing market needs.

Technological Factors. If production technology displays significant economies of scale, a few high-capacity locations are the most effective. In contrast, if facilities have lower fixed costs, many local facilities are preferred because this helps lower transportation costs. If the production technology is very inflexible and product requirements vary from one country to another, a firm has to set up local facilities to serve the market in each country. Conversely, if the technology is flexible, it becomes easier to consolidate manufacturing in a few large facilities.

Macroeconomic Factors. *Macroeconomic factors* include taxes, tariffs, exchange rates, and other economic factors that are not internal to an individual firm. If a country has very high tariffs, companies either do not serve the local market or set up manufacturing plants within the country to save on duties. High tariffs lead to more production locations within a supply chain network, with each location having a lower allocated capacity. *Tax incentives* are a reduction in tariffs or taxes that countries, states, and cities often provide to encourage firms to locate their facilities in specific areas. Many countries vary incentives from city to city to encourage investments in areas with lower economic development. Developing countries often create *free trade zones* where duties and tariffs are relaxed as long as production is used primarily for export. This creates a strong incentive for global firms to set up a plant in these countries to be able to exploit their low labor costs. Many countries also place minimum requirements on local content and limits on imports. Such policies lead companies to set up many facilities and source from local suppliers. Exchange rate risks may be handled using financial instruments that limit, or hedge against, the loss due to fluctuations. Suitably designed supply chain networks, however, offer the opportunity to take advantage of exchange rate fluctuations and increase profits. An effective way to do this is to build some over-capacity in the network and make the capacity flexible so that it can be used to supply different markets. This flexibility allows the firm to alter production flows within the supply chain to produce more in facilities that have a lower cost based on current exchange rates. When designing supply chain networks, companies must build appropriate flexibility to help counter fluctuations in exchange rates and demand across different countries.

Political Factors. Companies prefer to locate facilities in politically stable countries where the rules of commerce are well defined. Countries with independent and clear legal systems allow firms to feel that they have recourse in the courts should they need it. This makes it easier for companies to invest in facilities in these countries. Political stability is hard to quantify, so a firm makes an essentially subjective evaluation when designing its supply chain network.

Infrastructure Factors. The availability of good infrastructure is an important prerequisite to locating a facility in a given area. Poor infrastructure adds to the cost of doing business from a given location. Key infrastructure elements to be considered during network design include availability of sites, labor availability, proximity to transportation terminals, rail service, proximity to airports and seaports, highway access, congestion, and local utilities.

Competitive Factors. Companies must consider competitors' strategy, size, and location when designing their supply chain networks. A fundamental decision firms make is whether to locate their facilities close to competitors or far from them. How the firms compete and whether external factors such as raw material or labor availability force them to locate close to each other influence this decision. Positive externalities lead to competitors locating close to each other. When there are no positive externalities, firms locate to be able to capture the largest possible share of the market.

Customer Response Time and Local Presence. Firms that target customers who value a short response time must locate close to them. If a firm is delivering its product to customers, use of a rapid means of transportation allows it to build fewer facilities and still provide a short response time. This option, however, increases transportation costs. Moreover, there are many situations where the presence of a facility close to a customer is important.

Logistics and Facility Costs. Logistics and facility costs incurred within a supply chain change as the number of facilities, their location, and capacity allocation is changed. Companies must consider inventory, transportation, and facility costs when designing their supply chain networks. Inventory and facility costs increase as the number of facilities in a supply chain increase. Transportation costs decrease as the number of facilities is increased. Increasing the number of facilities to a point where inbound economies of scale are lost increases transportation cost. The supply chain network design is also influenced by the transformation occurring at each facility. When there is a significant reduction in material weight or volume as a result of processing, it may be better to locate facilities closer to the supply source rather than the customer. Total logistics costs are a sum of the inventory, transportation, and facility costs. The facilities in a supply chain network must at least equal the number that minimizes total logistics costs. A firm may increase the number of facilities beyond this point to improve the response time to its customers. This decision is justified if the revenue increase from improved response outweighs the increased cost from additional facilities.

Diff: 3

Topic: 5.2 Factors Influencing Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.2: Identify factors influencing supply chain network design decisions.

3) Describe the four phases in the framework for network design decisions.

Answer:

Phase I: Define a Supply Chain Strategy

The objective of the first phase of network design is to define a firm's supply chain strategy. The supply chain strategy specifies what capabilities the supply chain network must have to support a firm's competitive strategy. Phase I starts with a clear definition of the firm's competitive strategy as the set of customer needs that the supply chain aims to satisfy. Next, managers must forecast the likely evolution of global competition and whether competitors in each market will be local or global players. Managers must also identify constraints on available capital and whether growth will be accomplished by acquiring existing facilities, building new facilities, or partnering. Based on the competitive strategy of the firm, an analysis of the competition, any economies of scale or scope, and any constraints, managers must determine the supply chain strategy for the firm.

Phase II: Define the Regional Facility Configuration

The objective of the second phase of network design is to identify regions where facilities will be located, their potential roles, and their approximate capacity. An analysis of Phase II is started with a forecast of the demand by country. Such a forecast must include a measure of the size of the demand as well as a determination of whether the customer requirements are homogenous or variable across different countries. The next step is for managers to identify whether economies of scale or scope can play a significant role in reducing costs given available production technologies. Next, managers must identify demand risk, exchange rate risk, and political risk associated with different regional markets. They must also identify regional tariffs, any requirements for local production, tax incentives, and any export or import restrictions for each market. The tax and tariff information is used to identify the best location to extract a major share of the profits. In general, it is best to obtain the major share of profits at the location with the lowest tax rate. Managers must identify competitors in each region and make a case for whether a facility needs to be located close to or far from a competitor's facility. The desired response time for each market must also be identified. Managers must also identify the factor and logistics costs at an aggregate level in each region. Based on all this information, managers will identify the regional facility configuration for the supply chain network using network design models discussed in the next section. The regional configuration defines the approximate number of facilities in the network, regions where facilities will be set up, and whether a facility will produce all products for a given market or a few products for all markets in the network.

Phase III: Select Desirable Sites

The objective of Phase III is to select a set of desirable sites within each region where facilities are to be located. The set of desirable sites should be larger than the desired number of facilities to be set up so that a precise selection may be made in Phase IV. Sites should be selected based on an analysis of infrastructure availability to support the desired production methodologies. *Hard infrastructure requirements* include the availability of suppliers, transportation services, communication, utilities, and warehousing infrastructure. *Soft infrastructure requirements* include the availability of skilled workforce, workforce turnover, and the community's receptivity to business and industry.

Phase IV: Location Choices

The objective of this phase is to select a precise location and capacity allocation for each facility. Attention is restricted to the desirable sites selected in Phase III. The network is designed to maximize total profits, taking into account the expected margin and demand in each market, various logistics and facility costs, and the taxes and tariffs at each location.

Diff: 3

Topic: 5.3 Framework for Network Design Decisions

AACSB: Application of knowledge

Objective: LO 5.3: Develop a framework for making network design decisions.

4) Explain the two situations in which managers use network design models.

Answer: Managers use network design models in two different situations. First, these models are used to decide on locations where facilities will be established and the capacity to be assigned to each facility. Managers must make this decision considering a time horizon over which locations and capacities will not be altered (typically in years). Second, these models are used to assign current demand to the available facilities and identify lanes along which product will be transported. Managers must consider this decision at least on an annual basis as demand, prices, and tariffs change. In both cases, the goal is to maximize the profit while satisfying customer needs.

Diff: 2

Topic: 5.4 Models for Facility Location and Capacity Allocation

AACSB: Application of knowledge

Objective: LO 5.4: Use optimization for facility location and capacity allocation decisions.

5) A manufacturer of cat towers wishes to locate a super assembly facility to meet their cat tower assembly needs for the next millennium. Currently, carpet, cylinders, yarn and fasteners are purchased in bulk from suppliers in North Haverbrook, Ogden, and Springfield in the quantities shown in the table. The super assembly facility would ship to distribution centers located in Seattle, Lubbock, Nashville, and Philadelphia. The locations of all of these cities on an x-y grid, transportation costs on a ton per mile basis, and total tonnage are all contained in the table. Formulate and solve a model that will minimize the shipping costs to the super assembly center.

Sources/Markets	Transportation Cost \$/ton mile (F_n)	Quantity in Tons (D_n)	X_n	Y_n
Supply				
North Haverbrook	1.1	650	700	1200
Ogden	1.2	450	250	600
Springfield	1.4	400	225	825
Market				
Seattle	2.25	300	50	1200
Lubbock	2.25	200	450	300
Nashville	2.25	500	800	250
Philadelphia	2.25	500	950	1100

Where should the new plant be located and what is the total system shipping cost?

Answer: The model requires that the weighted rectilinear distance between the Super Assembly Center and all sources and sinks of materials and product be minimized.

rectilinear distance is given by $d_n = \sqrt{(x - x_n)^2 + (y - y_n)^2}$

and transportation cost is given by $TC = \sum d_n D_n F_n$ from $n = 1$ to 7

Formulating this nonlinear model (and running it in the nifty table provided by the authors) results in a location for the Super Assembly Center of (550.6,808.3) and total cost of \$2,586,342.

Diff: 3

Topic: 5.4 Models for Facility Location and Capacity Allocation

AACSB: Analytical thinking

Objective: LO 5.4: Use optimization for facility location and capacity allocation decisions.