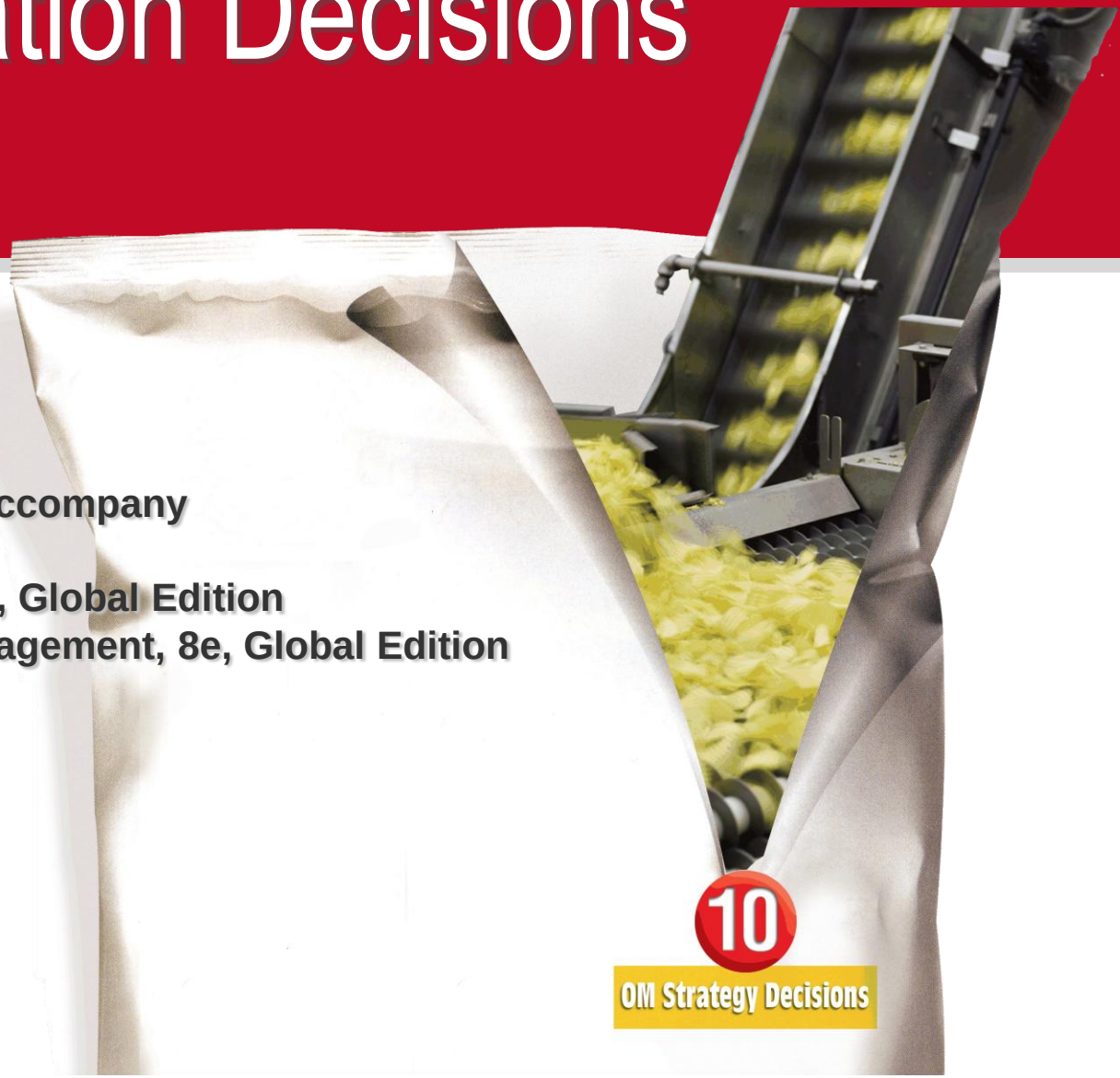
8 Location Decisions



PowerPoint presentation to accompany
Heizer and Render
Operations Management, 10e, Global Edition
Principles of Operations Management, 8e, Global Edition

PowerPoint slides by Jeff Heyl

PEARSON

Outline

- Global Company Profile: FedEx
- The Strategic Importance of Location

Outline – Continued

- **Factors That Affect Location Decisions**
  - **Labor Productivity**
  - **Exchange Rates and Currency Risks**
  - **Costs**
  - **Political Risk, Values, and Culture**
  - **Proximity to Markets**
  - **Proximity to Suppliers**
  - **Proximity to Competitors (Clustering)**

Outline – Continued

- **Methods of Evaluating Location Alternatives**
  - **The Factor-Rating Method**
  - **Locational Break-Even Analysis**
  - **Center-of-Gravity Method**
  - **Transportation Model**

Outline – Continued

- **Service Location Strategy**
  - **How Hotel Chains Select Sites**
  - **The Call Center Industry**
  - **Geographic Information Systems**

Learning Objectives

When you complete this chapter you should be able to:

1. **Identify and explain seven major factors that effect location decisions**
2. **Compute labor productivity**
3. **Apply the factor-rating method**
4. **Complete a locational break-even analysis graphically and mathematically**

Learning Objectives

When you complete this chapter you should be able to:

5. **Use the center-of-gravity method**
6. **Understand the differences between service and industrial-sector location strategies**

Federal Express

- **Central hub concept**
  - **Enables service to more locations with fewer aircraft**
  - **Enables matching of aircraft flights with package loads**
  - **Reduces mishandling and delay in transit because there is total control of packages from pickup to delivery**

Location Strategy

The objective of location strategy is to maximize the benefit of location to the firm

Location Strategy

- One of the most important decisions a firm makes
- Increasingly global in nature
- Significant impact on fixed and variable costs
- Decisions made relatively infrequently
- The objective is to maximize the benefit of location to the firm

Location and Costs

- Location decisions based on low cost require careful consideration
- Once in place, location-related costs are fixed in place and difficult to reduce
- Determining optimal facility location is a good investment

Location and Innovation

- Cost is not always the most important aspect of a strategic decision
- Four key attributes when strategy is based on innovation
  - High-quality and specialized inputs
  - An environment that encourages investment and local rivalry
  - A sophisticated local market
  - Local presence of related and supporting industries

Location Decisions: Summary

- Long-term decisions
- Decisions made infrequently
- Decision greatly affects both fixed and variable costs
- Once committed to a location, many resource and cost issues are difficult to change

Country Decisions

Country Decision

Figure 8.1

Key Success Factors

1. Political risks, government rules, attitudes, incentives
2. Cultural and economic issues
3. Location of markets
4. Labor talent, attitudes, productivity, costs
5. Availability of supplies, communications, energy
6. Exchange rates and currency risks

Region Decisions

Region/ Community Decision

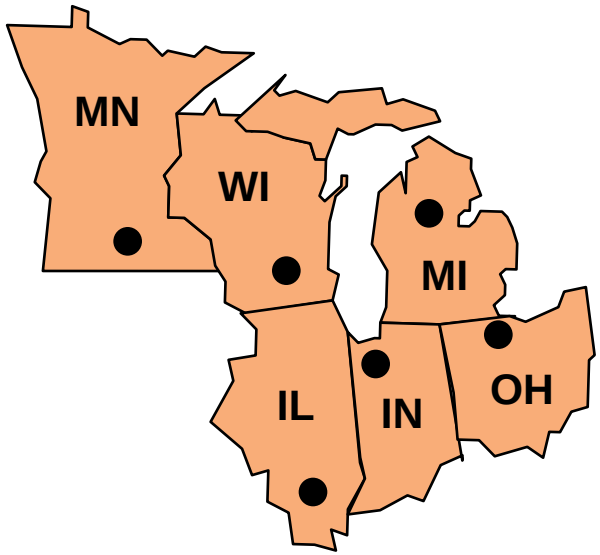


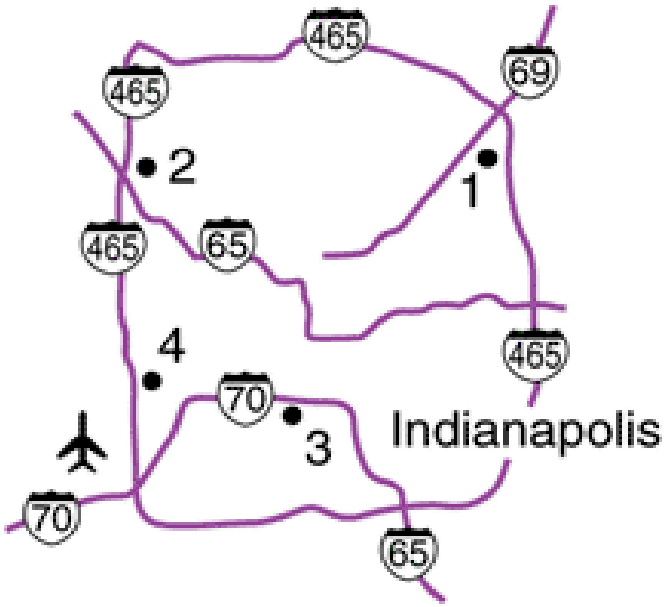
Figure 8.1

Key Success Factors

1. Corporate desires
2. Attractiveness of region
3. Labor availability and costs
4. Costs and availability of utilities
5. Environmental regulations
6. Government incentives and fiscal policies
7. Proximity to raw materials and customers
8. Land/construction costs

Site Decisions

Site Decision



Key Success Factors

1. Site size and cost
2. Air, rail, highway, and waterway systems
3. Zoning restrictions
4. Proximity of services/ supplies needed
5. Environmental impact issues

Figure 8.1

Global Competitiveness Index of Countries

Country	2009 Rank	2005 Rank
Switzerland	1	4
USA	2	1
Japan	8	10
Canada	9	13
UK	13	9
Qatar	22	46
China	29	48
India	49	22
Mexico	60	59
Russia	63	53
Lebanon	92	-

Table 8.1

Factors That Affect Location Decisions

- **Labor productivity**
  - **Wage rates are not the only cost**
  - **Lower productivity may increase total cost**

$$\frac{\text{Labor cost per day}}{\text{Productivity (units per day)}} = \text{Cost per unit}$$

Connecticut

$$\frac{\$70}{60 \text{ units}} = \$1.17 \text{ per unit}$$

Juarez

$$\frac{\$25}{20 \text{ units}} = \$1.25 \text{ per unit}$$

Factors That Affect Location Decisions

- Exchange rates and currency risks
  - Can have a significant impact on costs
  - Rates change over time
- Costs
  - Tangible - easily measured costs such as utilities, labor, materials, taxes
  - Intangible - less easy to quantify and include education, public transportation, community, quality-of-life

Factors That Affect Location Decisions

- Exchange rates and currency risks
  - Can have a s
  - Rates change
- Costs
  - Tangible - eas
    utilities, labo
  - Intangible - le
    include educa
    community, quality-of-life

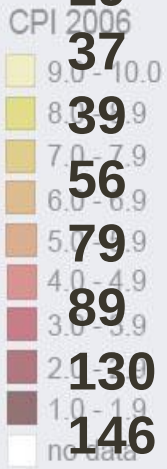
Location decisions based on costs alone can create difficult ethical situations

Factors That Affect Location Decisions

- **Political risk, values, and culture**
  - **National, state, local governments attitudes toward private and intellectual property, zoning, pollution, employment stability may be in flux**
  - **Worker attitudes towards turnover, unions, absenteeism**
  - **Globally cultures have different attitudes towards punctuality, legal, and ethical issues**

Ranking Corruption

Rank	Country	2009 CPI Score (out of 10)	
1	New Zealand	9.4	Least Corrupt
2	Demark	9.3	
3	Singapore, Sweden	9.2	
5	Switzerland	9.0	
8	Australia, Canada, Iceland	8.7	
12	Hong Kong	8.2	
14	Germany	8.0	
17	Japan, UK	7.7	
19	USA	7.5	
37	Taiwan	5.6	
39	South Korea	5.5	
56	Malaysia	4.5	
79	China	3.6	Most Corrupt
89	Mexico	3.3	
130	Lebanon	2.5	
146	Russia	2.2	



TRANSPARENCY INTERNATIONAL
the global coalition against corruption

Factors That Affect Location Decisions

- Proximity to markets
  - Very important to services
  - JIT systems or high transportation costs may make it important to manufacturers
- Proximity to suppliers
  - Perishable goods, high transportation costs, bulky products

Factors That Affect Location Decisions

- **Proximity to competitors**
  - **Called clustering**
  - **Often driven by resources such as natural, information, capital, talent**
  - **Found in both manufacturing and service industries**

Clustering of Companies

Industry	Locations	Reason for clustering
Wine making	Napa Valley (US) Bordeaux region (France)	Natural resources of land and climate
Software firms	Silicon Valley, Boston, Bangalore (India)	Talent resources of bright graduates in scientific/technical areas, venture capitalists nearby
Race car builders	Huntington/North Hampton region (England)	Critical mass of talent and information

Table 8.3

Clustering of Companies

Industry	Locations	Reason for clustering
Theme parks (Disney World, Universal Studios)	Orlando, Florida	A hot spot for entertainment, warm weather, tourists, and inexpensive labor
Electronics firms	Northern Mexico	NAFTA, duty free export to US
Computer hardware manufacturers	Singapore, Taiwan	High technological penetration rate and per capita GDP, skilled/educated workforce with large pool of engineers

Table 8.3

Clustering of Companies

Industry	Locations	Reason for clustering
Fast food chains (Wendy's, McDonald's, Burger King, and Pizza Hut)	Sites within 1 mile of each other	Stimulate food sales, high traffic flows
General aviation aircraft (Cessna, Learjet, Boeing)	Wichita, Kansas	Mass of aviation skills
Orthopedic device manufacturing	Warsaw, Indiana	Ready supply of skilled workers, strong U.S. market

Table 8.3

Factor-Rating Method

- Popular because a wide variety of factors can be included in the analysis
- Six steps in the method
  1. Develop a list of relevant factors called key success factors
  2. Assign a weight to each factor
  3. Develop a scale for each factor
  4. Score each location for each factor
  5. Multiply score by weights for each factor for each location
  6. Recommend the location with the highest point score

Factor-Rating Example

Key Success Factor	Weight	Scores (out of 100) France	Scores (out of 100) Denmark	Weighted Scores France	Weighted Scores Denmark
Labor availability and attitude	.25	70	60	(.25)(70) = 17.5	(.25)(60) = 15.0
People-to-car ratio	.05	50	60	(.05)(50) = 2.5	(.05)(60) = 3.0
Per capita income	.10	85	80	(.10)(85) = 8.5	(.10)(80) = 8.0
Tax structure	.39	75	70	(.39)(75) = 29.3	(.39)(70) = 27.3
Education and health	.21	60	70	(.21)(60) = 12.6	(.21)(70) = 14.7
Totals	1.00			70.4	68.0

Table 8.4

Locational Break-Even Analysis

- Method of cost-volume analysis used for industrial locations
- Three steps in the method
  1. Determine fixed and variable costs for each location
  2. Plot the cost for each location
  3. Select location with lowest total cost for expected production volume

Locational Break-Even Analysis Example

Three locations:

Selling price = $120
Expected volume = 2,000 units

City	Fixed Cost	Variable Cost	Total Cost
Akron	$30,000	$75	$180,000
Bowling Green	$60,000	$45	$150,000
Chicago	$110,000	$25	$160,000

Total Cost = Fixed Cost + (Variable Cost x Volume)

Locational Break-Even Analysis Example

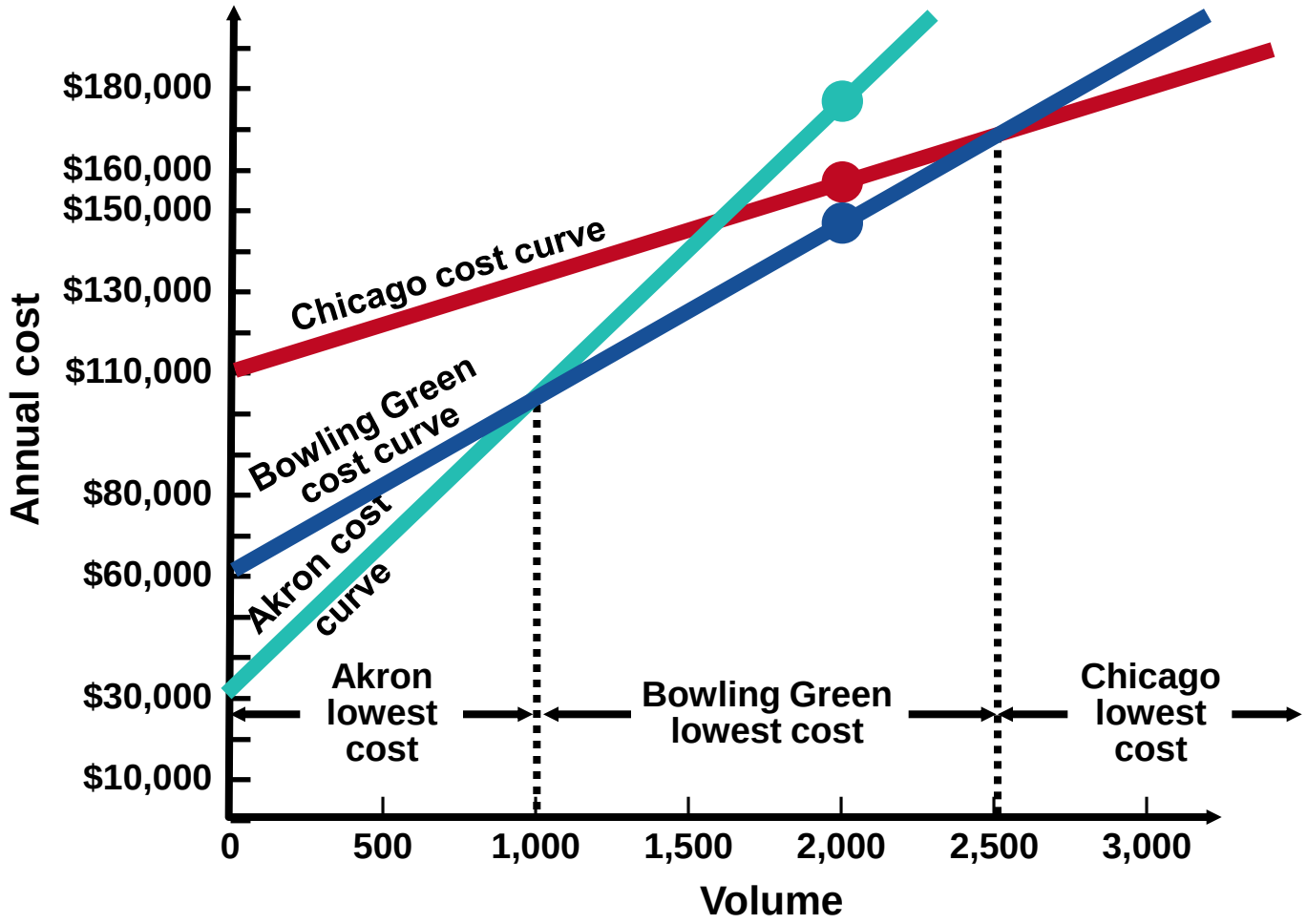


Figure 8.2

Center-of-Gravity Method

- Finds location of distribution center that minimizes distribution costs
- Considers
  - Location of markets
  - Volume of goods shipped to those markets
  - Shipping cost (or distance)

Center-of-Gravity Method

- **Place existing locations on a coordinate grid**
  - **Grid origin and scale is arbitrary**
  - **Maintain relative distances**
- **Calculate *X* and *Y* coordinates for 'center of gravity'**
  - **Assumes cost is directly proportional to distance and volume shipped**

Center-of-Gravity Method

$$x\text{ - coordinate} = \frac{\sum_i d_{ix} Q_i}{\sum_i Q_i}$$

$$y\text{ - coordinate} = \frac{\sum_i d_{iy} Q_i}{\sum_i Q_i}$$

where d_{ix} = x-coordinate of location i

d_{iy} = y-coordinate of location i

Q_i = Quantity of goods moved to or from location i

Center-of-Gravity Method

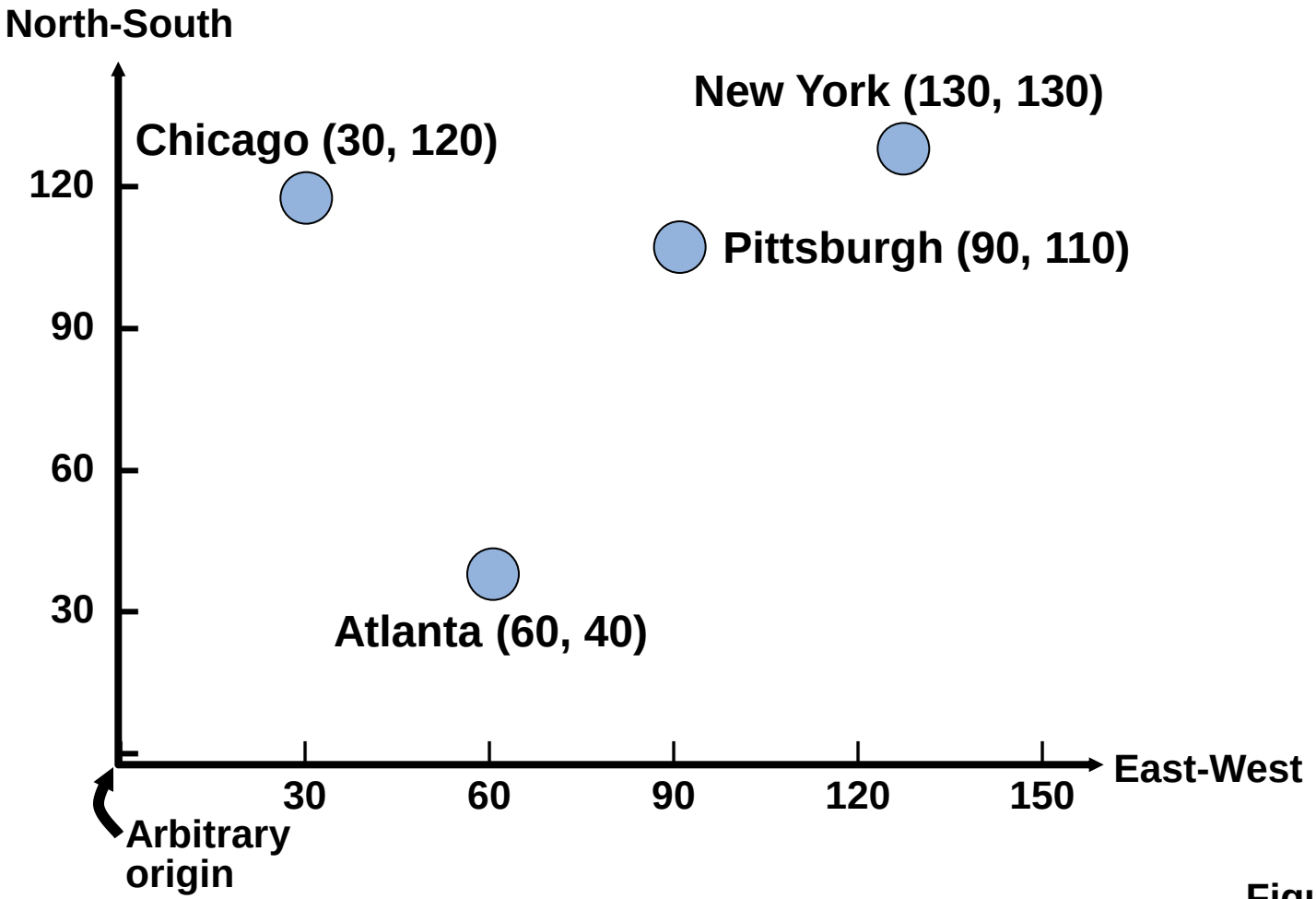


Figure 8.3

Center-of-Gravity Method

Store Location	Number of Containers Shipped per Month
Chicago (30, 120)	2,000
Pittsburgh (90, 110)	1,000
New York (130, 130)	1,000
Atlanta (60, 40)	2,000

$$x\text{-coordinate} = \frac{(30)(2000) + (90)(1000) + (130)(1000) + (60)(2000)}{2000 + 1000 + 1000 + 2000}$$

$$= 66.7$$

$$y\text{-coordinate} = \frac{(120)(2000) + (110)(1000) + (130)(1000) + (40)(2000)}{2000 + 1000 + 1000 + 2000}$$

$$= 93.3$$

Center-of-Gravity Method

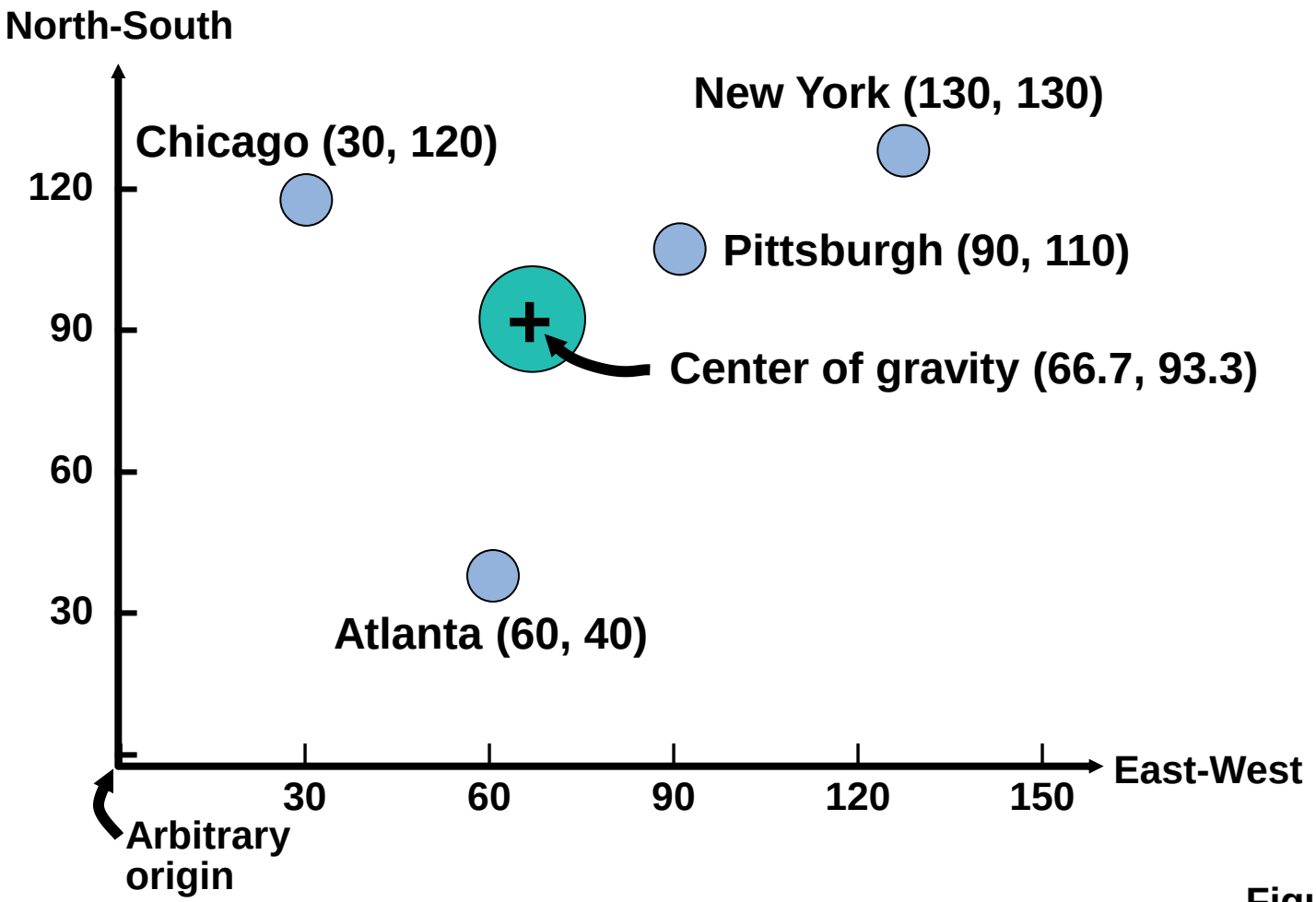


Figure 8.3

Transportation Model

- **Finds amount to be shipped from several points of supply to several points of demand**
- **Solution will minimize total production and shipping costs**
- **A special class of *linear programming problems***
  - **Will be discussed in Managerial Decision Making (DCSN 205)**

Worldwide Distribution of Volkswagens and Parts

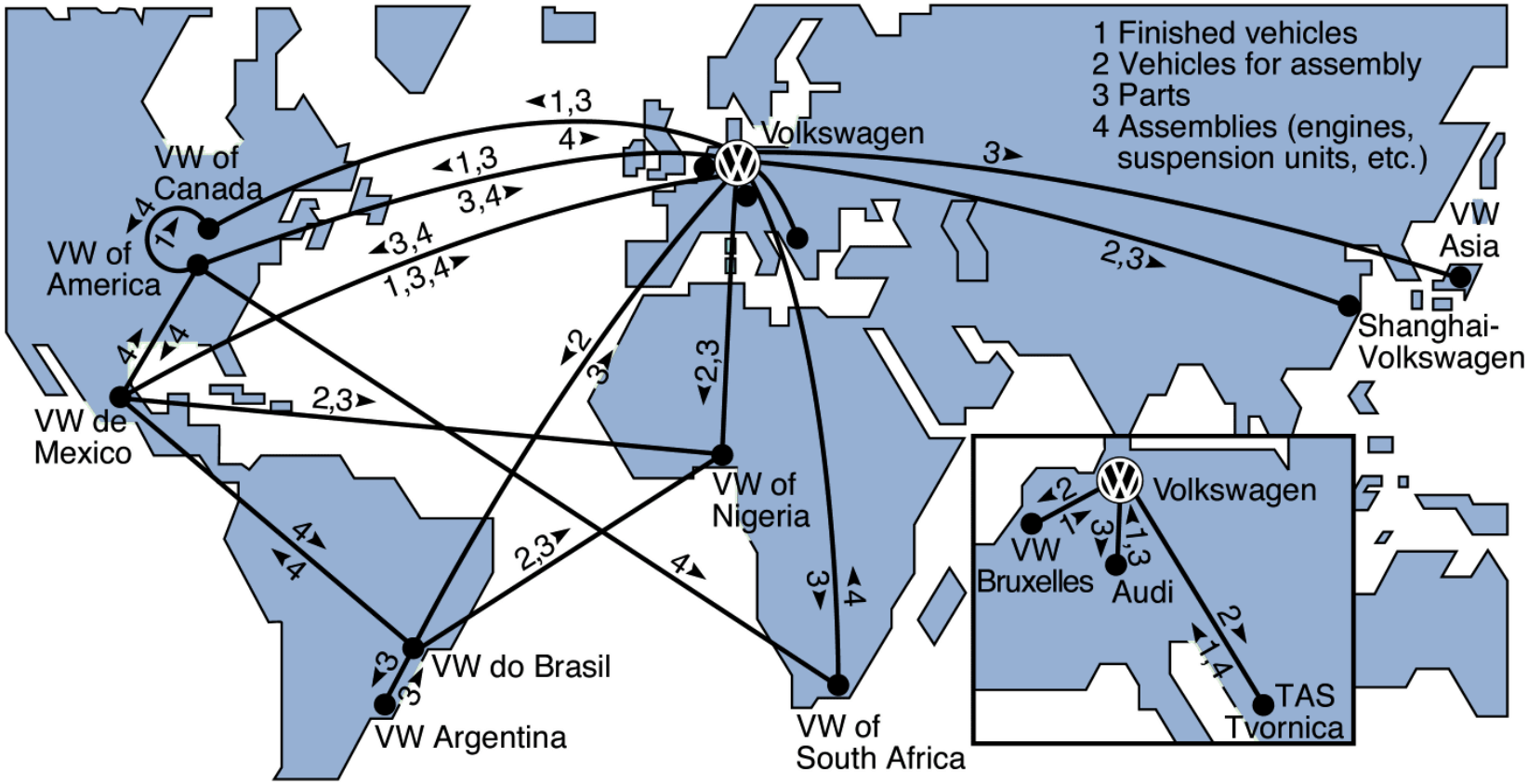


Figure 8.4

Service Location Strategy

1. Purchasing power of customer-drawing area
2. Service and image compatibility with demographics of the customer-drawing area
3. Competition in the area
4. Quality of the competition
5. Uniqueness of the firm's and competitors' locations
6. Physical qualities of facilities and neighboring businesses
7. Operating policies of the firm
8. Quality of management

Location Strategies

Service/Retail/Professional Location	Goods-Producing Location
Revenue Focus	**Cost Focus**
Volume/revenue	**Tangible costs**
Drawing area; purchasing power	Transportation cost of raw material
Competition; advertising/pricing	Shipment cost of finished goods
	Energy and utility cost; labor; raw material; taxes, and so on
Physical quality	
Parking/access; security/lighting; appearance/image	**Intangible and future costs**
	Attitude toward union
Cost determinants	Quality of life
Rent	Education expenditures by state
Management caliber	Quality of state and local government
Operations policies (hours, wage rates)	

Table 8.6

Location Strategies

Service/Retail/Professional Location	Goods-Producing Location
Techniques	Techniques
Regression models to determine importance of various factors	Transportation method
Factor-rating method	Factor-rating method
Traffic counts	Locational break-even analysis
Demographic analysis of drawing area	Crossover charts
Purchasing power analysis of area	
Center-of-gravity method	
Geographic information systems	

Table 8.6

Location Strategies

Service/Retail/Professional Location	Goods-Producing Location
Assumptions	**Assumptions**
Location is a major determinant of revenue	Location is a major determinant of cost
High customer-contact issues are critical	Most major costs can be identified explicitly for each site
Costs are relatively constant for a given area; therefore, the revenue function is critical	Low customer contact allows focus on the identifiable costs
	Intangible costs can be evaluated

Table 8.6

How Hotel Chains Select Sites

- Location is a strategically important decision in the hospitality industry
- La Quinta started with 35 independent variables and worked to refine a regression model to predict profitability
- The final model had only four variables
  - Price of the inn
  - Median income levels
  - State population per inn
  - Location of nearby colleges

$r^2 = .51$

51% of the profitability is predicted by just these four variables!

The Call Center Industry

- Requires neither face-to-face contact nor movement of materials
- Has very broad location options
- Traditional variables are no longer relevant
- Cost and availability of labor may drive location decisions

Geographic Information Systems (GIS)

- Important tool to help in location analysis
- Enables more complex demographic analysis
- Available databases include
  - Detailed census data
  - Detailed maps
  - Utilities
  - Geographic features
  - Locations of major services

Geographic Information Systems (GIS)