Location Decisions

8

PowerPoint presentation to accompany
Heizer and Render
Operations Management, Global Edition, Eleventh Edition
Principles of Operations Management, Global Edition, Ninth Edition

PowerPoint slides by Jeff Heyl

Outline

- **Global Company Profile:** FedEx
- The Strategic Importance of Location
- Factors That Affect Location Decisions
- Methods of Evaluating Location Alternatives
- Service Location Strategy
- 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 analysis

Location Provides Competitive Advantage for FedEx

- 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

The Strategic Importance of Location

- 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 Strategic Importance of Location

- Long-term decisions
- Once committed to a location, many resource and cost issues are difficult to change

The Strategic Importance of Location

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

Options include

1. Expanding existing facilities
2. Maintain existing and add sites
3. Closing existing and relocating

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

Factors That Affect Location Decisions

- Globalization adds to complexity
  - Market economics
  - Communication
  - Rapid, reliable transportation
  - Ease of capital flow
  - Differing labor costs
- Identify key success factors (KSFs)

Location 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

Location Decisions

Region/ Community Decision

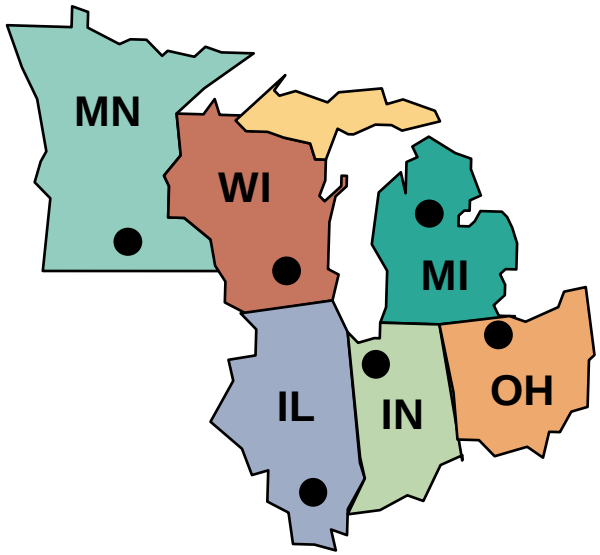

Figure 8.1

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

Location Decisions

Site Decision

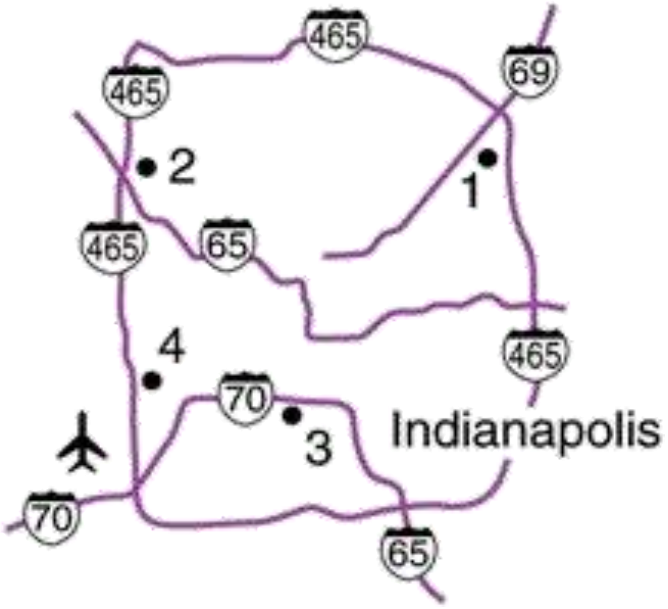

Figure 8.1

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

Global Competitiveness Index of Countries

TABLE 8.1

Competitiveness of 142 Selected Countries

COUNTRY	2011-2012 RANKING
Switzerland	1
Singapore	2
Sweden	3
Finland	4
USA	5
Japan	9
UK	10
Canada	12
Israel	22
China	26
Mexico	58
Vietnam	65
Russia	66
Haiti	141
Chad	142

Factors That Affect Location Decisions

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

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

South Carolina

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

Mexico

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

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
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    quality-of-life

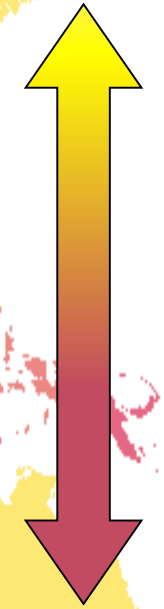
Location decisions based on costs alone can create difficult ethical situations

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	2012 CPI Score (out of 100)
1	Demark, Finland, New Zealand	90
4	Sweden	88
5	Singapore	87
6	Switzerland	86
7	Australia, Norway	85
9	Canada, Netherlands	84
13	Germany	79
14	Hong Kong	77
17	Japan, UK	74
19	USA	73
37	Taiwan	61
39	Israel	60
45	South Korea	56
80	China	39
123	Vietnam	31
133	Russia	28



TRANSPARENCY INTERNATIONAL
the 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 (clustering)
  - Often driven by resources such as natural, information, capital, talent
  - Found in both manufacturing and service industries

Clustering of Companies

TABLE 8.3	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
Clean energy	Colorado	Critical mass of talent and information, with 1,000 companies

Clustering of Companies

TABLE 8.3 Clustering of Companies

INDUSTRY	LOCATIONS	REASON FOR CLUSTERING
Theme parks (Disney World, Universal Studios, and Sea World)	Orlando, Florida	A hot spot for entertainment, warm weather, tourists, and inexpensive labor
Electronics firms	Northern Mexico	NAFTA, duty free export to U.S.
Computer hardware manufacturers	Singapore, Taiwan	High technological penetration rate and per capita GDP, skilled/educated workforce with large pool of engineers

Clustering of Companies

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, Raytheon)	Wichita, Kansas	Mass of aviation skills
Athletic footwear, outdoor wear	Portland, Oregon	300 companies, many owned by Nike, deep talent pool and outdoor culture

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. Make a recommendation based on the highest point score

Factor-Rating Example

TABLE 8.4 Weights, Scores, and Solution

KSF	WEIGHT	SCORES (OUT OF 100)		WEIGHTED SCORES	
		FRANCE	DENMARK	FRANCE	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

Locational Cost-Volume Analysis

- An economic comparison of location alternatives
- 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 Cost-Volume Analysis Example

Three locations:

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

City	Fixed Cost	Variable Cost	Total Cost
Athens	$30,000	$75	$180,000
Brussels	$60,000	$45	$150,000
Lisbon	$110,000	$25	$160,000

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

Locational Cost-Volume Analysis Example

Crossover point – Athens/Brussels

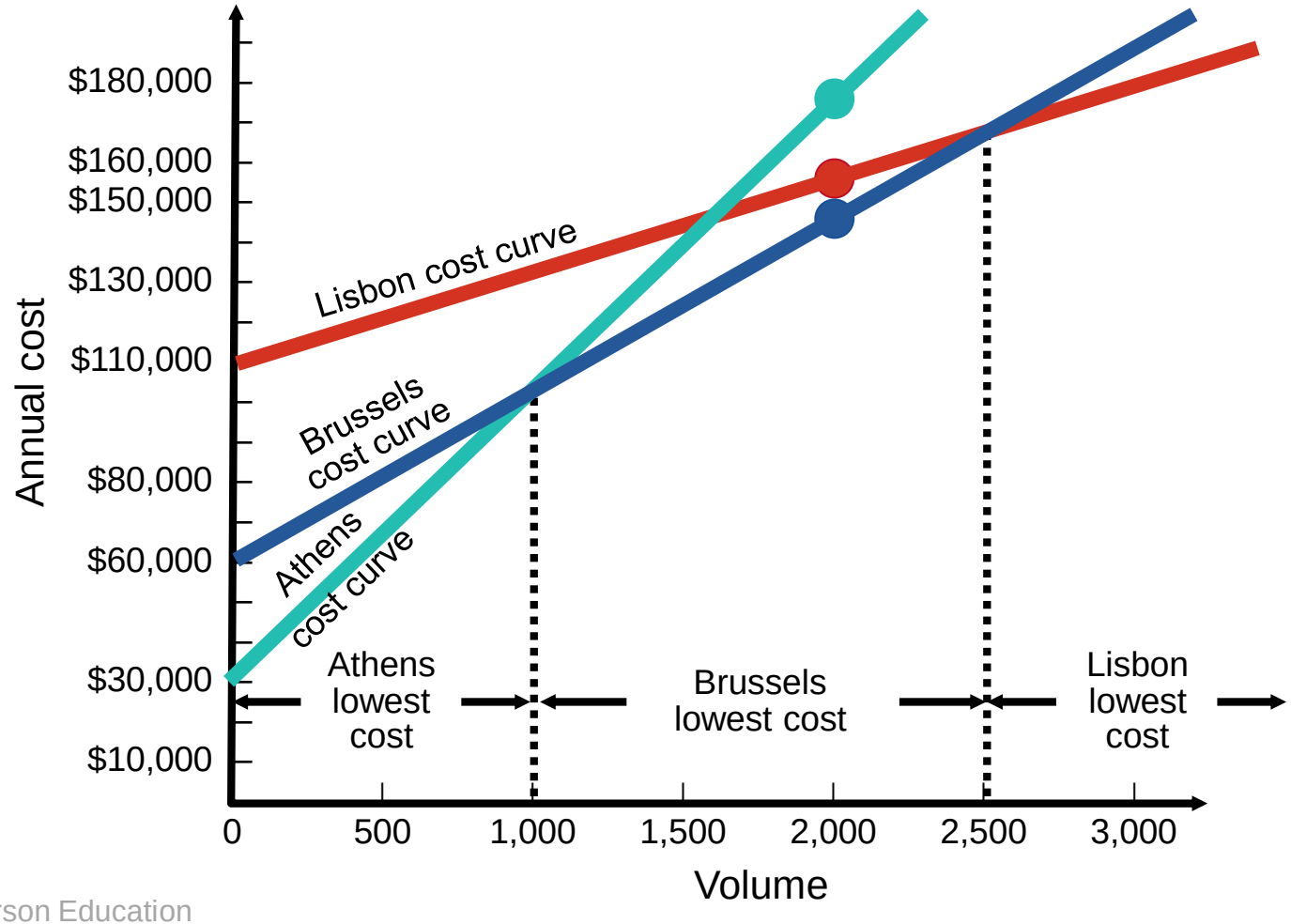
$$30{,}000 + 75(x) = 60{,}000 + 45(x)$$
$$30(x) = 30{,}000$$
$$(x) = 1{,}000$$

Crossover point – Brussels/Lisbon

$$60{,}000 + 45(x) = 110{,}000 + 25(x)$$
$$20(x) = 50{,}000$$
$$(x) = 2{,}500$$

Locational Cost-Volume 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

$$x\text{-coordinate of the center of gravity} = \frac{\sum_i d_{ix} Q_i}{\sum_i Q_i}$$

$$y\text{-coordinate of the center of gravity} = \frac{\sum_i d_{iy} Q_i}{\sum_i Q_i}$$

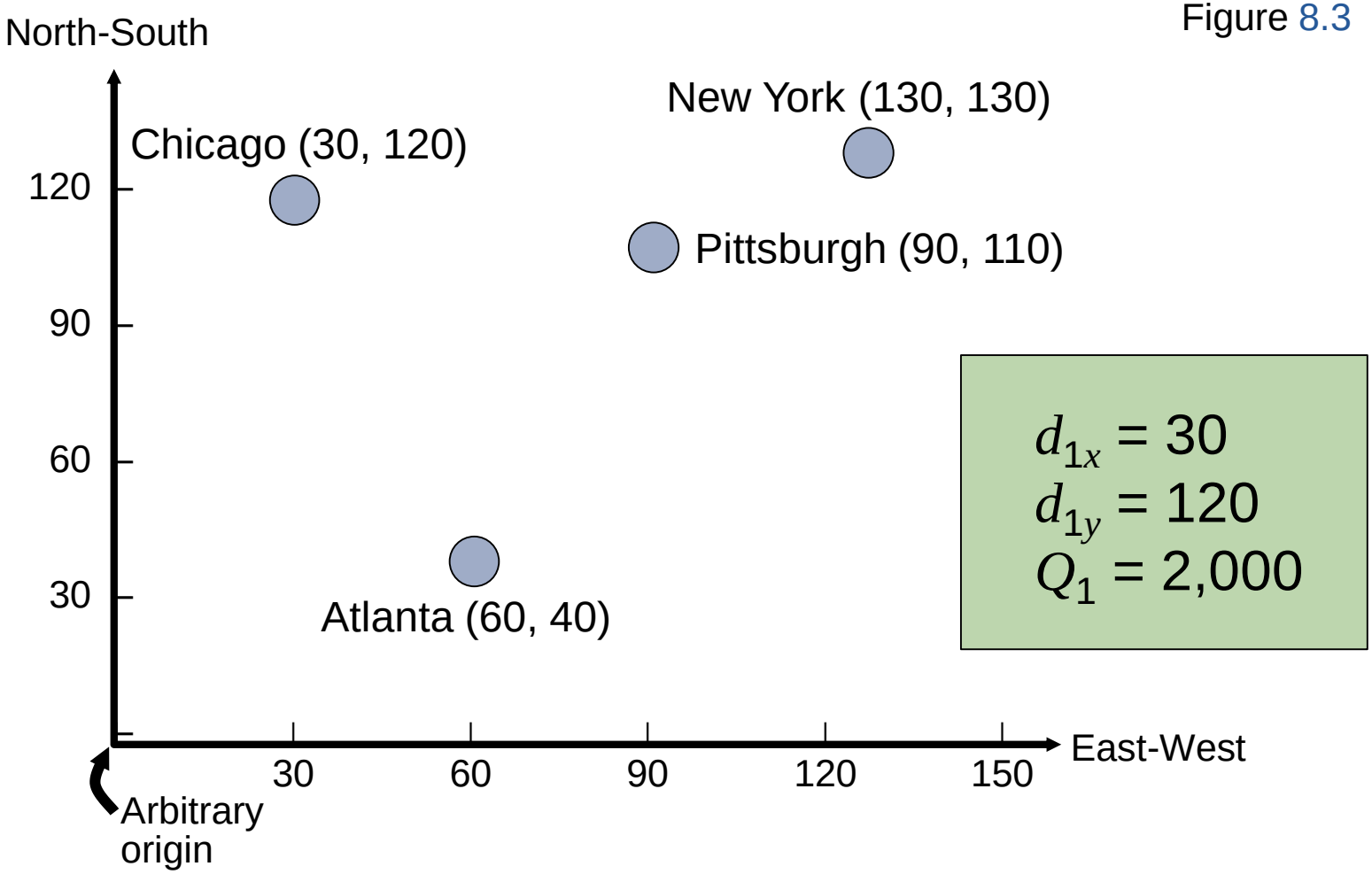
where
- d_{ix} = x-coordinate of location i
- d_{iy} = y-coordinate of location i
- Q_i = Quantity of goods moved to or from location i

Center-of-Gravity Method

TABLE 8.5	Demand for Quain's Discount Department Stores
STORE LOCATION	**NUMBER OF CONTAINERS SHIPPED PER MONTH**
Chicago	2,000
Pittsburgh	1,000
New York	1,000
Atlanta	2,000

Center-of-Gravity Method

Figure 8.3



Center-of-Gravity Method

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

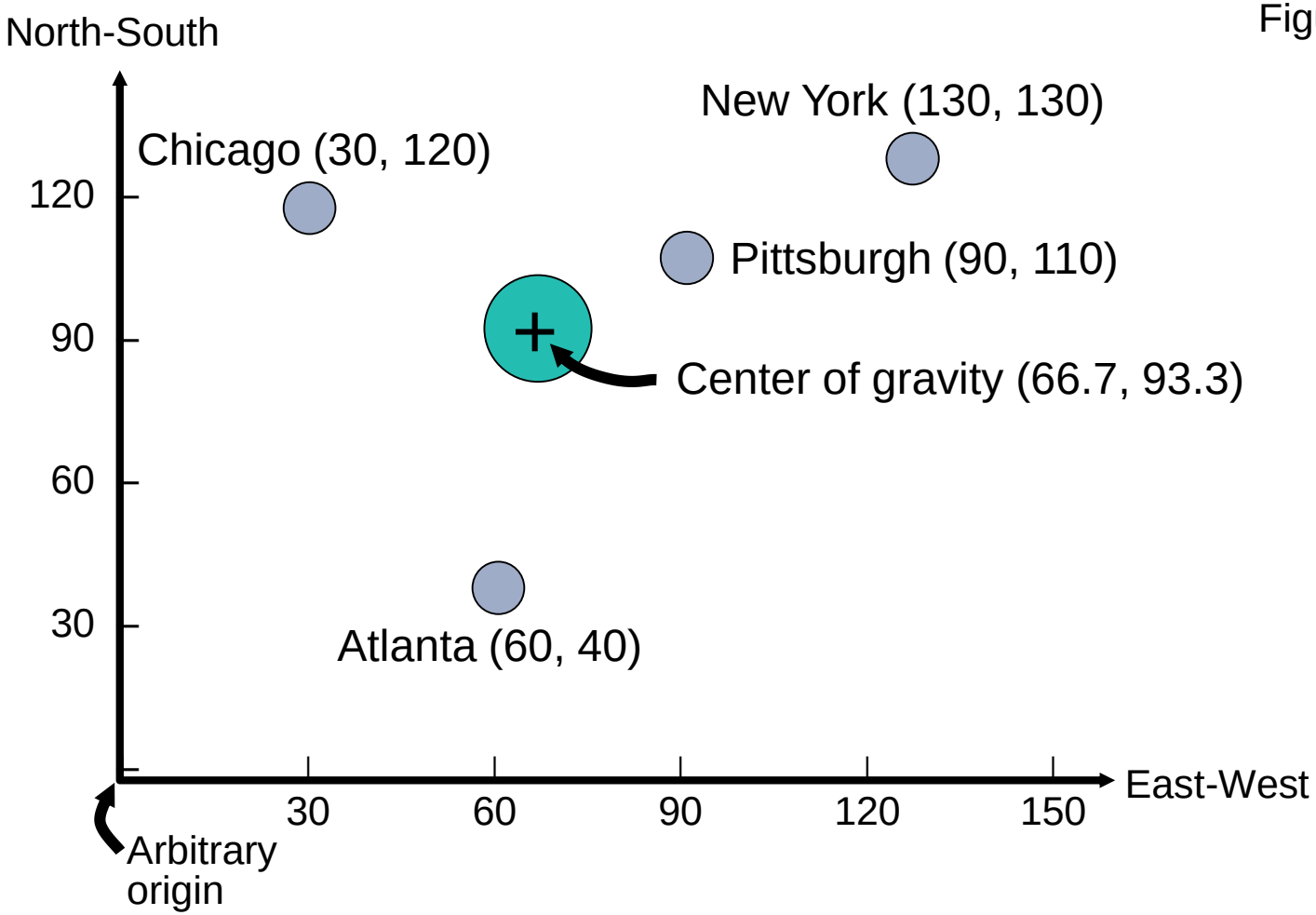
$$= 66.7$$

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

$$= 93.3$$

Center-of-Gravity Method

Figure 8.3

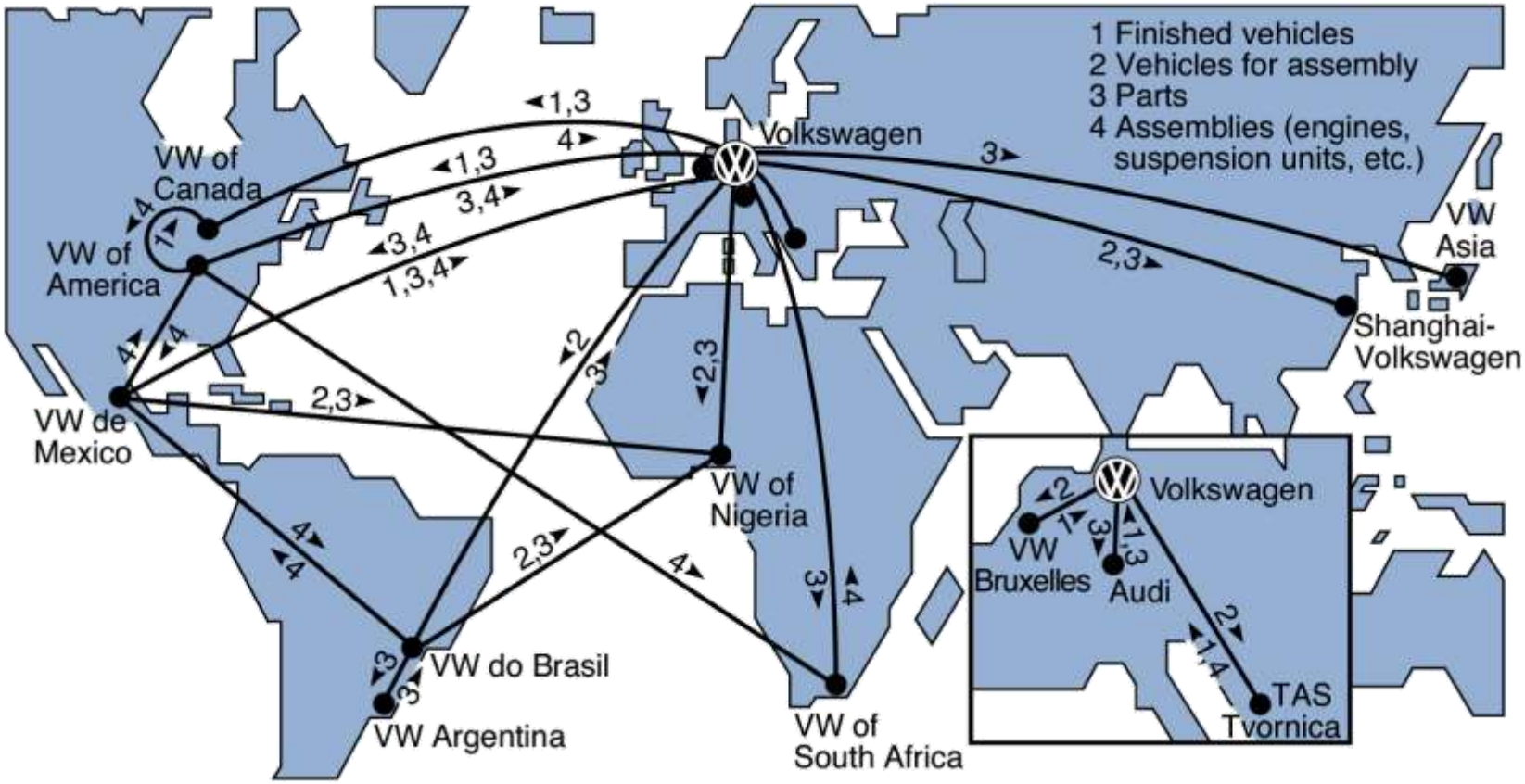


Transportation Model

- 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

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

TABLE 8.6	Location Strategies – Service vs. Goods-Producing Organizations
SERVICE/RETAIL/PROFESSIONAL	**GOODS-PRODUCING**
REVENUE FOCUS	**COST FOCUS**
Volume/revenue Drawing area; purchasing power Competition; advertising/pricing **Physical quality** Parking/access; security/lighting; appearance/ image **Cost determinants** Rent Management caliber Operation policies (hours, wage rates)	**Tangible costs** Transportation cost of raw material Shipment cost of finished goods Energy and utility cost; labor; raw material; taxes, and so on **Intangible and future costs** Attitude toward union Quality of life Education expenditures by state Quality of state and local government

Location Strategies

TABLE 8.6	Location Strategies – Service vs. Goods-Producing Organizations
SERVICE/RETAIL/PROFESSIONAL	**GOODS-PRODUCING**
TECHNIQUES	**TECHNIQUES**
Regression models to determine importance of various factors Factor-rating method Traffic counts Demographic analysis of drawing area Purchasing power analysis of area Center-of-gravity method Geographic information systems	Transportation method Factor-rating method Locational cost–volume analysis Crossover charts
ASSUMPTIONS	**ASSUMPTIONS**
Location is a major determinant of revenue High customer-contact issues are critical Costs are relatively constant for a given area; therefore, the revenue function is critical	Location is a major determinant of cost Most major costs can be identified explicitly for each site Low customer contact allows focus on the identifiable costs Intangible costs can be evaluated

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
  - 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!

Geographic Information Systems (GIS)

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

Geographic Information Systems (GIS)