Damietta University
Faculty of Commerce
English Program

Production and Operations Management

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Location Strategies
3

Methods of Evaluating Location Alternatives

1. Factor-Rating Method
2. Locational Break-even (Cost-Volume) Analysis
3. Center-of-Gravity Method
4. Transportation Model
5. Geographic Information Systems (GIS)

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

Five Flags over Florida, a U.S. chain of 10 family-oriented theme parks, intends to expand overseas by opening in Europe. France and Denmark are two potential locations.

The ratings below show a list of critical success factors that management has decided are important; the weightings and rating for two sites are also shown.

Which location appears to be better?

TABLE 8.4 **Weights and Scores**

KSF	WEIGHT	*SCORES (OUT OF 100)*	
		FRANCE	DENMARK
Labor availability and attitude	.25	70	60
People-to-car ratio	.05	50	60
Per capita income	.10	85	80
Tax structure	.39	75	70
Education and health	.21	60	70
Totals	1.00		

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 Break-Even 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 Break-Even Analysis Example

Adidas considers three locations in Athens, Brussels and Lisbon for a new plant for football shoes

Selling price = $120

Expected volume = 2,000 units

Mathematically

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)

Graphically

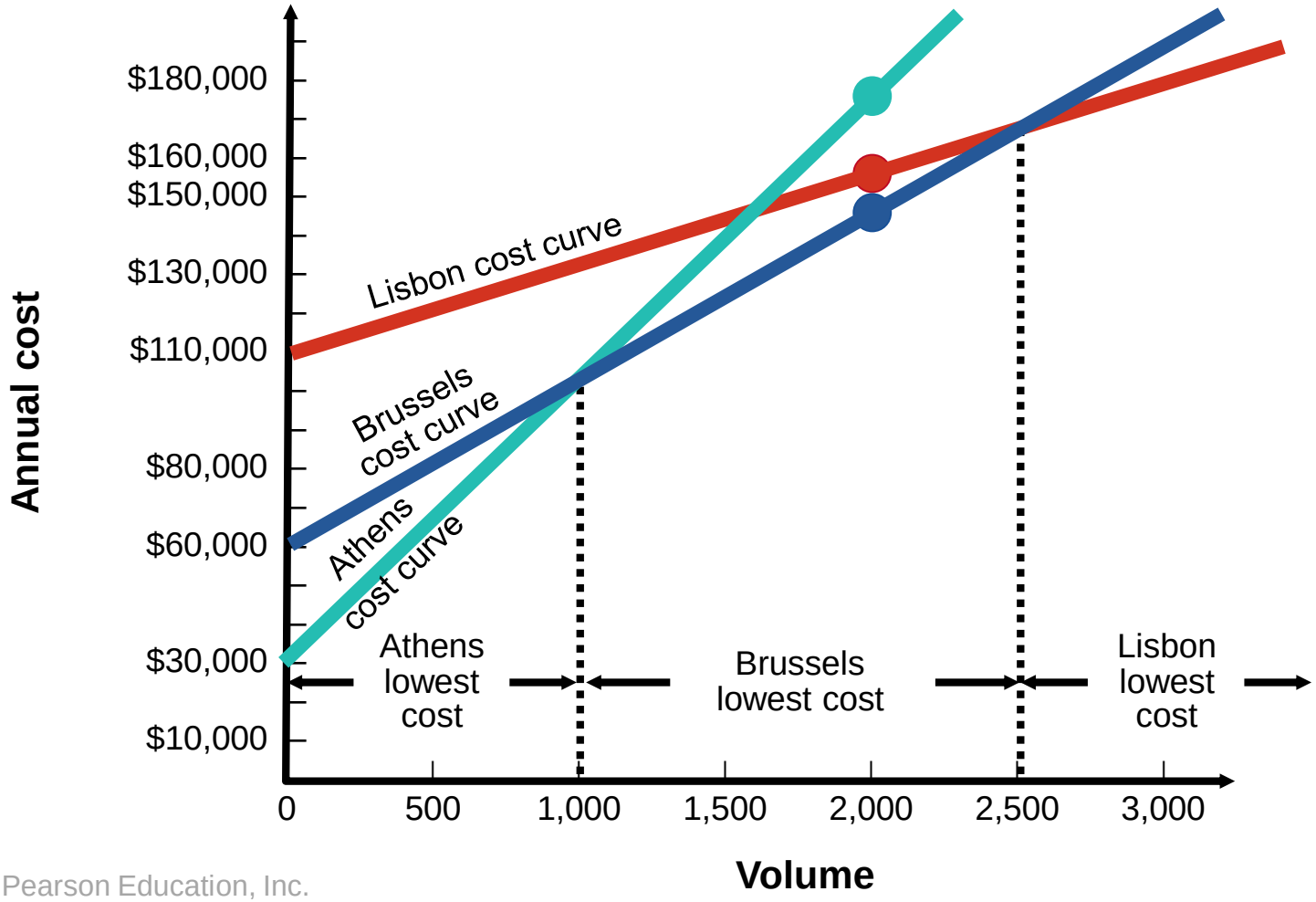
Crossover point – Athens/Brussels

$$\begin{aligned} 30{,}000 + 75(x) &= 60{,}000 + 45(x) \\ 30(x) &= 30{,}000 \\ (x) &= 1{,}000 \end{aligned}$$

Crossover point – Brussels/Lisbon

$$\begin{aligned} 60{,}000 + 45(x) &= 110{,}000 + 25(x) \\ 20(x) &= 50{,}000 \\ (x) &= 2{,}500 \end{aligned}$$

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)
- 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

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

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

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

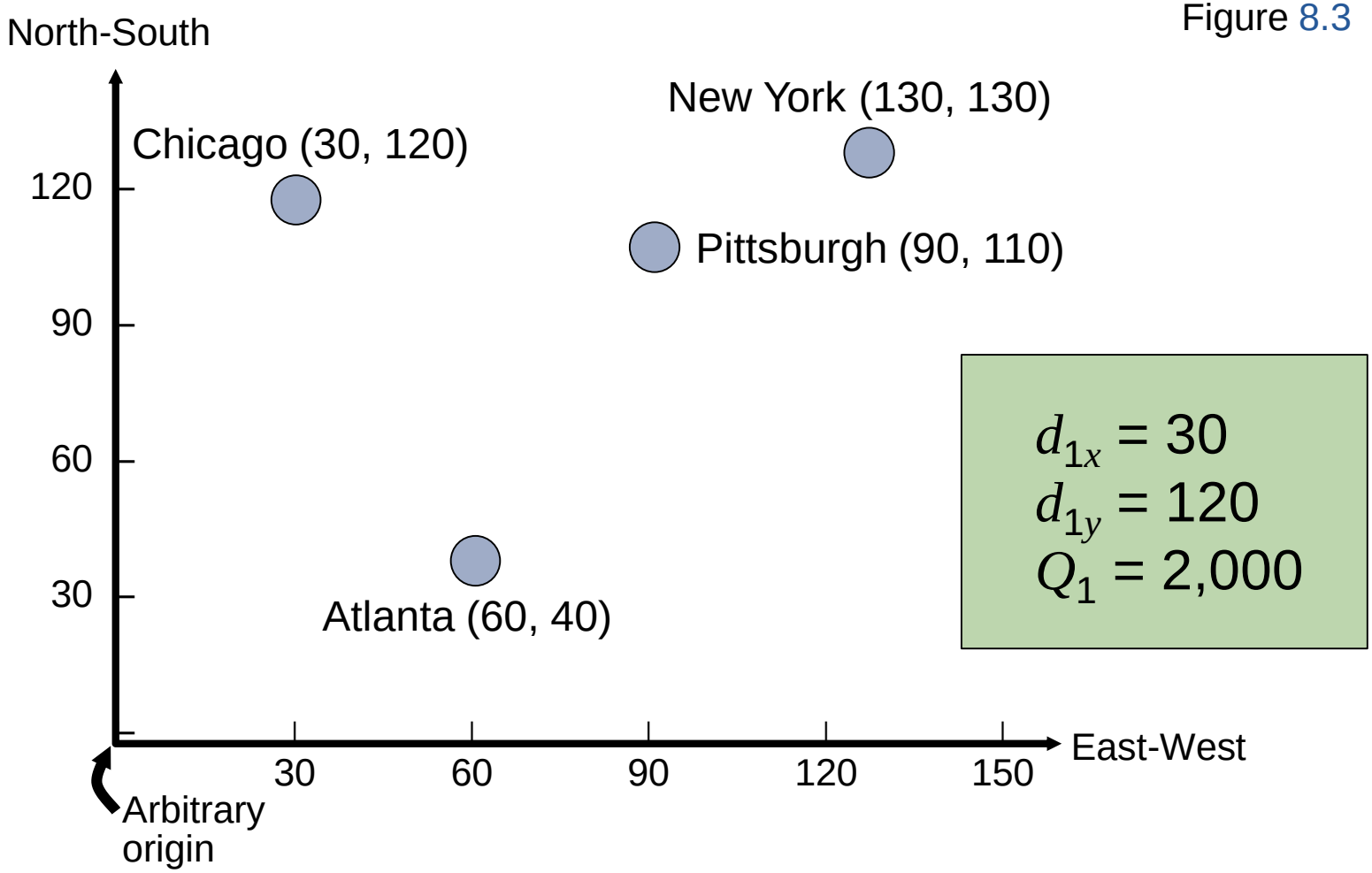
Center-of-Gravity Method Example

- Quain's stores, has store locations in four sites.
- They are currently being supplied out of an old and inadequate warehouse in Pittsburgh, the site of the chain's first store. The firm wants to find some central location in which to build a new warehouse.
- Quain will apply the centre-of-gravity method. It gathers data on demand rates at each outlet

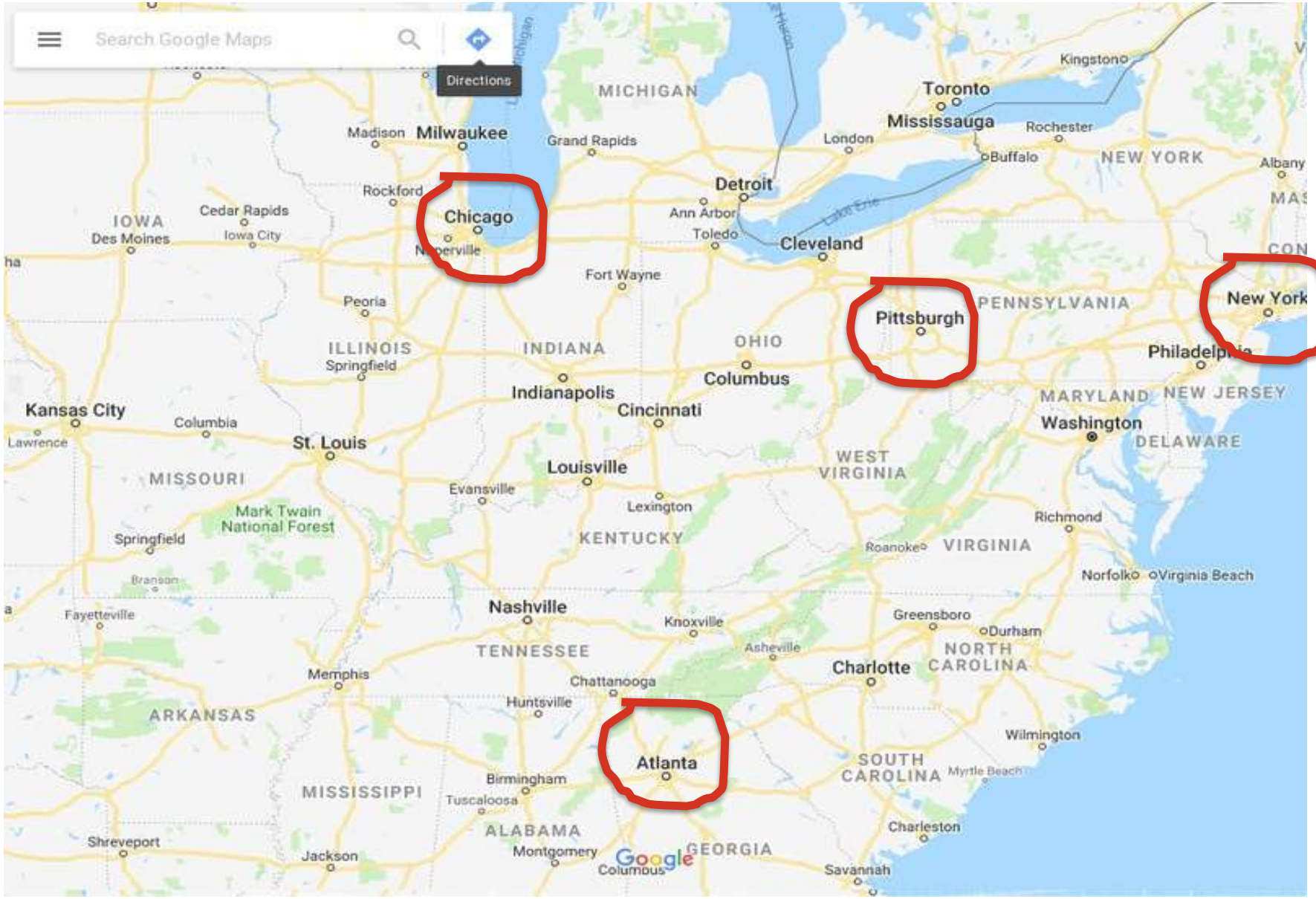
TABLE 8.5 Demand for Quain's Stores

STORE LOCATION	NUMBER OF CONTAINERS SHIPPED PER MONTH
Chicago	2,000
Pittsburgh	1,000
New York	1,000
Atlanta	2,000

Figure 8.3



Center-of-Gravity Method



Center-of-Gravity Method

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

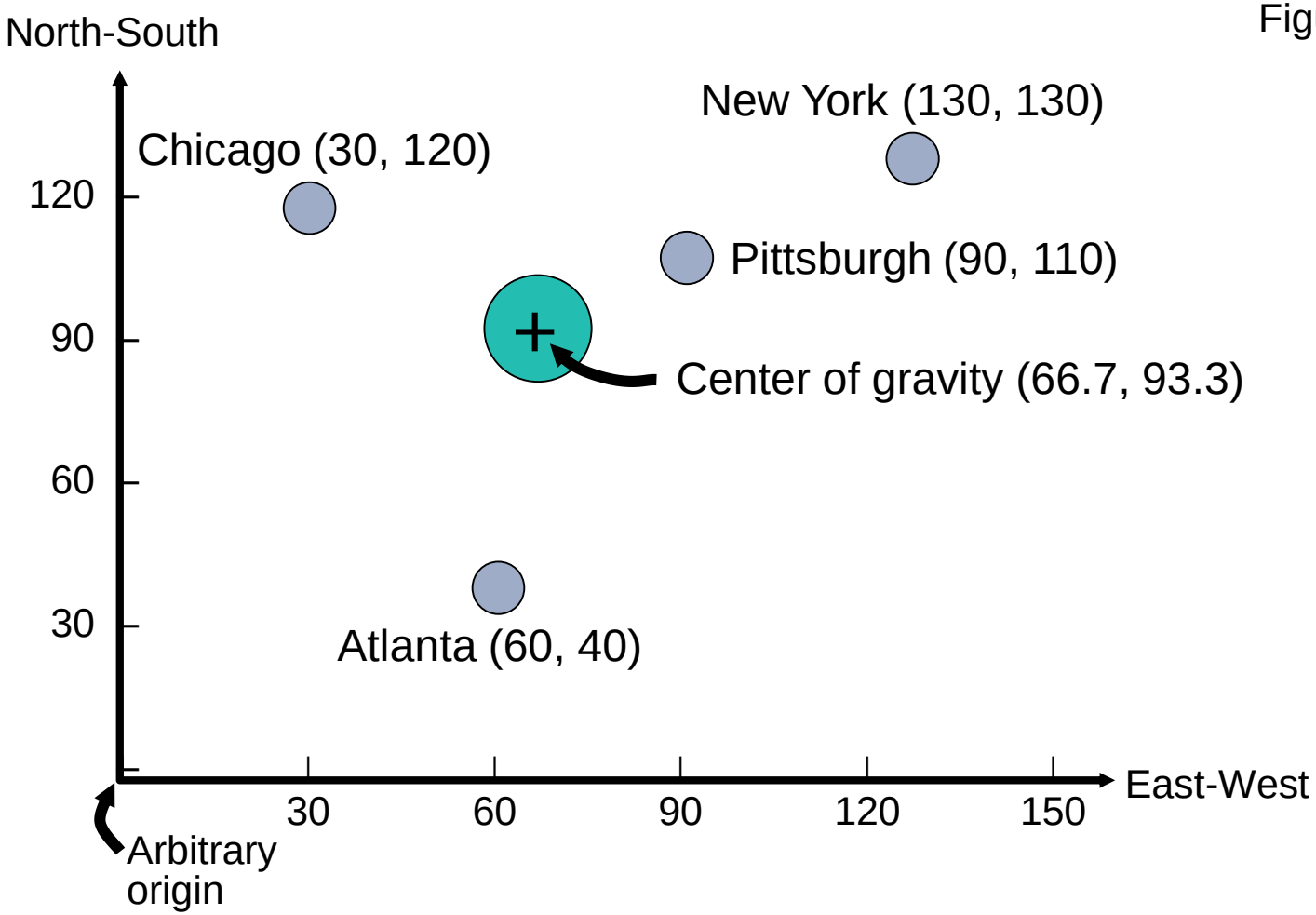
$$= 66.7$$

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

$$= 93.3$$

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

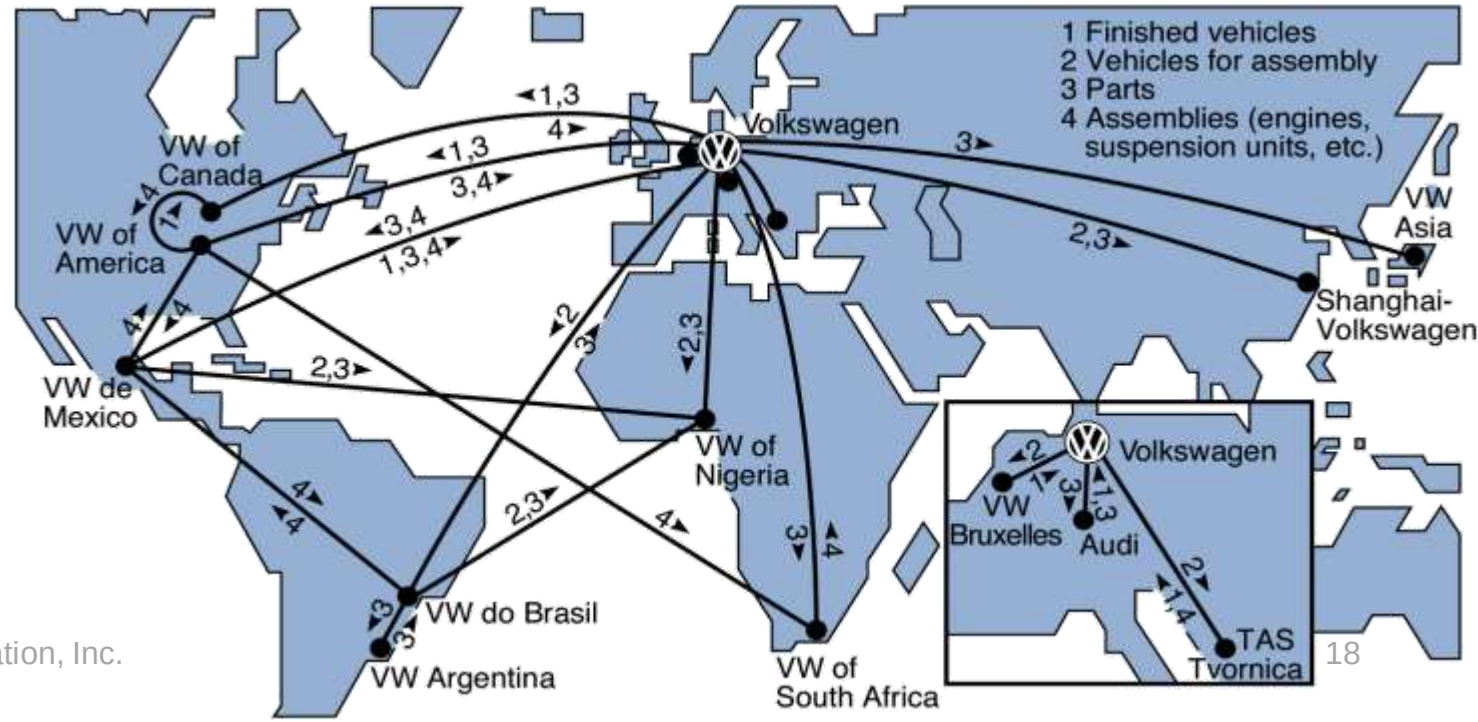


Figure 8.4

Worldwide Distribution of Volkswagens and Parts

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

Watch and Learn:
https://www.youtube.com/watch?v=-ZFmAAHBfOU

Geographic Information Systems (GIS)