

# Location Strategies

# 8

CHAPTER

## CHAPTER OUTLINE

### GLOBAL COMPANY PROFILE: FedEx

- ◆ The Strategic Importance of Location 340
- ◆ Factors That Affect Location Decisions 341
- ◆ Methods of Evaluating Location Alternatives 344
- ◆ Service Location Strategy 350
- ◆ Geographic Information Systems 351



Alaska Airlines



Alaska Airlines

## 10 OM STRATEGY DECISIONS

- Design of Goods and Services
- Managing Quality
- Process Strategy
- **Location Strategies**
- Layout Strategies
- Human Resources
- Supply-Chain Management
- Inventory Management
- Scheduling
- Maintenance

## Location Provides Competitive Advantage for FedEx

Overnight-delivery powerhouse FedEx has believed in the hub concept for its 46-year existence. Even though Fred Smith, founder and CEO, got a C on his college paper proposing a hub for small-package delivery, the idea has proven extremely successful. Starting with one central location in Memphis, Tennessee (now called its *superhub*), the \$45 billion firm has added a European hub in Paris, an Asian hub in Guangzhou, China, a Latin American hub in Miami, and a Canadian hub in Toronto. FedEx's fleet of 667 planes flies into 375 airports worldwide, then delivers to the door with more than 80,000 vans and trucks.



At the FedEx hub in Memphis, Tennessee, approximately 100 FedEx aircraft converge each night around midnight with more than 5 million documents and packages.

Oliver Berg/EPA/Newscom

At the preliminary sorting area, packages and documents are sorted and sent to a secondary sorting area. The Memphis facility covers 1.5 million square feet; it is big enough to hold 33 football fields. Packages are sorted and exchanged until 4 A.M.



Troy Glasgow/AP Images

## LEARNING OBJECTIVES

- LO 8.1** *Identify* and explain seven major factors that affect location decisions 342
- LO 8.2** *Compute* labor productivity 342
- LO 8.3** *Apply* the factor-rating method 345
- LO 8.4** *Complete* a locational cost–volume analysis graphically and mathematically 347
- LO 8.5** *Use* the center-of-gravity method 348
- LO 8.6** *Understand* the differences between service- and industrial-sector location analysis 351

## The Strategic Importance of Location

World markets continue to expand, and the global nature of business is accelerating. Indeed, one of the most important strategic decisions made by many companies, including FedEx, Mercedes-Benz, and Hard Rock, is where to locate their operations. When FedEx opened its Asian hub in Guangzhou, China, it set the stage for “round-the-world” flights linking its Paris and Memphis package hubs to Asia. When Mercedes-Benz announced its plans to build its first major overseas plant in Vance, Alabama, it completed a year of competition among 170 sites in 30 states and two countries. When Hard Rock Cafe opened in Moscow, it ended 3 years of advance preparation of a Russian food-supply chain. The strategic impact, cost, and international aspect of these decisions indicate how significant location decisions are.

Firms throughout the world are using the concepts and techniques of this chapter to address the location decision because location greatly affects both fixed and variable costs. Location has a major impact on the overall risk and profit of the company. For instance, depending on the product and type of production or service taking place, transportation costs alone can total as much as 25% of the product’s selling price. That is, one-fourth of a firm’s total revenue may be needed just to cover freight expenses of the raw materials coming in and finished products going out. Other costs that may be influenced by location include taxes, wages, raw material costs, and rents. When all costs are considered, location may alter total operating expenses as much as 50%.

The economics of transportation are so significant that companies—and even cities—have coalesced around a transportation advantage. For centuries, rivers and ports, and more recently rail hubs and then interstate highways, were a major ingredient in the location decision. Today airports are often the deciding factor, providing fast, low-cost transportation of goods and people.

Companies make location decisions relatively infrequently, usually because demand has outgrown the current plant’s capacity or because of changes in labor productivity, exchange rates, costs, or local attitudes. Companies may also relocate their manufacturing or service facilities because of shifts in demographics and customer demand.

Location options include (1) expanding an existing facility instead of moving, (2) maintaining current sites while adding another facility elsewhere, or (3) closing the existing facility and moving to another location.

The location decision often depends on the type of business. For industrial location decisions, the strategy is usually minimizing costs, although locations that foster innovation and creativity may also be critical. For retail and professional service organizations, the strategy focuses on maximizing revenue. Warehouse location strategy, however, may be driven by a combination of cost and speed of delivery. *The objective of location strategy is to maximize the benefit of location to the firm.*

**Location and Costs** Because location is such a significant cost and revenue driver, location often has the power to make (or break) a company’s business strategy. Key multinationals in every major industry, from automobiles to cellular phones, now have or are planning a presence in each of their major markets. Location decisions to support a low-cost strategy require particularly careful consideration.

### VIDEO 8.1

Hard Rock’s Location Selection

Once management is committed to a specific location, many costs are firmly in place and difficult to reduce. For instance, if a new factory location is in a region with high energy costs, even good management with an outstanding energy strategy is starting at a disadvantage. Management is in a similar bind with its human resource strategy if labor in the selected location is expensive, ill-trained, or has a poor work ethic. Consequently, hard work to determine an optimal facility location is a good investment.

## Factors That Affect Location Decisions

Selecting a facility location is becoming much more complex with globalization. As we saw in Chapter 2, globalization has taken place because of the development of (1) market economics; (2) better international communications; (3) more rapid, reliable travel and shipping; (4) ease of capital flow between countries; and (5) high differences in labor costs. Many firms now consider opening new offices, factories, retail stores, or banks outside their home country. Location decisions transcend national borders. In fact, as Figure 8.1 shows, the sequence of location decisions often begins with choosing a country in which to operate.

One approach to selecting a country is to identify what the parent organization believes are key success factors (KSFs) needed to achieve competitive advantage. Six possible country KSFs are listed at the top of Figure 8.1. Using such factors (including some negative ones, such as crime) the World Economic Forum biannually ranks the global competitiveness of 144 countries (see Table 8.1). Switzerland placed first because of its high rates of saving and investment, openness to trade, quality education, and efficient government.

Once a firm decides which country is best for its location, it focuses on a region of the chosen country and a community. The final step in the location decision process is choosing a specific site within a community. The company must pick the one location that is best suited for shipping and receiving, zoning, utilities, size, and cost. Again, Figure 8.1 summarizes this series of decisions and the factors that affect them.

**TABLE 8.1**  
**Competitiveness of 144 Selected Countries, Based on Annual Surveys of 13,000 Business Executives**

COUNTRY	2015 RANKING
Switzerland	1
Singapore	2
U.S.	3
Finland	4
Germany	5
Japan	6
⋮	
Canada	15
⋮	
Israel	27
China	28
⋮	
Russia	53
⋮	
Mexico	61
⋮	
Vietnam	68
⋮	
Haiti	137
⋮	
Chad	143
Guinea	144

Source: www.weforum.org, 2015. Used with permission of World Economic Forum.

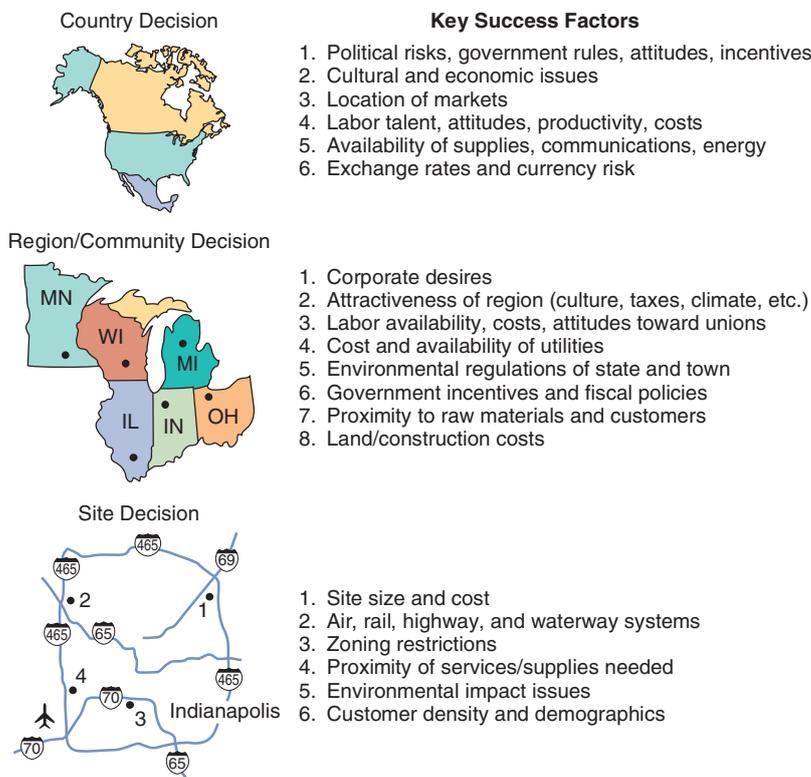


Figure 8.1

**Some Considerations and Factors That Affect Location Decisions**

In addition, with just-in-time production, suppliers want to locate near users. For a firm like Coca-Cola, whose product's primary ingredient is water, it makes sense to have bottling plants in many cities rather than shipping heavy (and sometimes fragile glass) containers cross country.

### Proximity to Suppliers

Firms locate near their raw materials and suppliers because of (1) perishability, (2) transportation costs, or (3) bulk. Bakeries, dairy plants, and frozen seafood processors deal with *perishable* raw materials, so they often locate close to suppliers. Companies dependent on inputs of heavy or bulky raw materials (such as steel producers using coal and iron ore) face expensive inbound *transportation costs*, so transportation costs become a major factor. And goods for which there is a *reduction in bulk* during production (e.g., trees to lumber) typically need facilities near the raw material.

### Proximity to Competitors (Clustering)

Both manufacturing and service organizations also like to locate, somewhat surprisingly, near competitors. This tendency, called **clustering**, often occurs when a major resource is found in that region. Such resources include natural resources, information resources, venture capital resources, and talent resources. Table 8.3 presents nine examples of industries that exhibit clustering, and the reasons why.

Italy may be the true leader when it comes to clustering, however, with northern zones of that country holding world leadership in such specialties as ceramic tile (Modena), gold jewelry (Vicenza), machine tools (Busto Arsizio), cashmere and wool (Biella), designer eyeglasses (Belluma), and pasta machines (Parma). When it comes to clusters for innovations in slaughtering, however (see the *OM in Action* box), Denmark is the leader.

#### Clustering

The location of competing companies near each other, often because of a critical mass of information, talent, venture capital, or natural resources.

## Methods of Evaluating Location Alternatives

Four major methods are used for solving location problems: the factor-rating method, locational cost–volume analysis, the center-of-gravity method, and the transportation model. This section describes these approaches.

**TABLE 8.3** Clustering of Companies

INDUSTRY	LOCATIONS	REASON FOR CLUSTERING
Wine making	Napa Valley (U.S.), Bordeaux region (France)	Natural resources of land and climate
Software firms	Silicon Valley, Boston, Bangalore, Israel	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
Theme parks (e.g., Disney World, Universal Studios, and Sea World)	Orlando, Florida	A hot spot for entertainment, warm weather, tourists, and inexpensive labor
Electronics firms (e.g., Sony, IBM, HP, Motorola, and Panasonic)	Northern Mexico	NAFTA, duty-free export to U.S. (24% of all TVs are built here)
Computer hardware manufacturing	Singapore, Taiwan	High technological penetration rates and per capita GDP, skilled/educated workforce with large pool of engineers
Fast-food chains (e.g., Wendy's, McDonald's, Burger King, Pizza Hut)	Sites within 1 mile of one another	Stimulate food sales, high traffic flows
General aviation aircraft (e.g., Cessna, Learjet, Boeing, Raytheon)	Wichita, Kansas	Mass of aviation skills (60–70% of world's small planes/jets are built here)
Athletic footwear, outdoor wear	Portland, Oregon	300 companies, many spawned by Nike, deep talent pool and outdoor culture

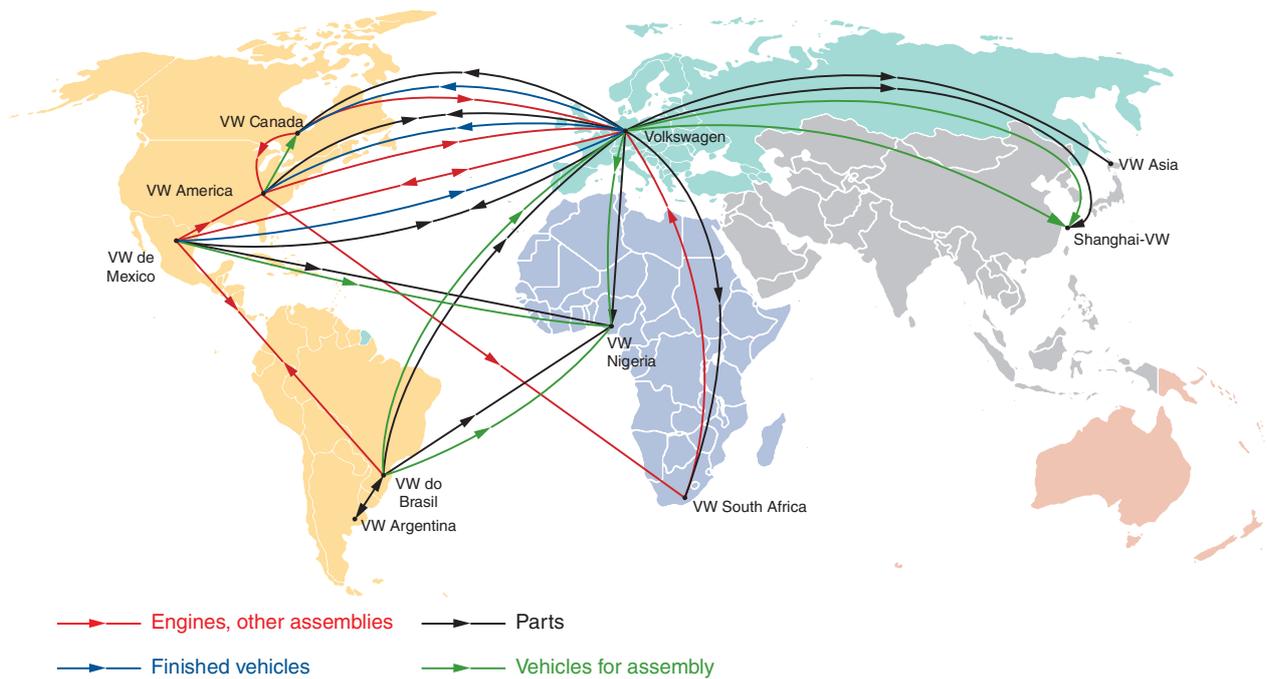


Figure 8.4

**Volkswagen, the Third Largest Automaker in the World, Finds It Advantageous to Locate Its Plants Throughout the World**

This graphic shows a portion of VW's supply network. There are 61 plants in Europe, along with nine countries in the Americas, Asia, and Africa.

Although the linear programming (LP) technique can be used to solve this type of problem, more efficient, special-purpose algorithms have been developed for the transportation application. The transportation model finds an initial feasible solution and then makes step-by-step improvement until an optimal solution is reached.

## Service Location Strategy

While the focus in industrial-sector location analysis is on *minimizing cost*, the focus in the service sector is on *maximizing revenue*. This is because manufacturing firms find that costs tend to vary substantially among locations, while service firms find that location often has more impact on revenue than cost. Therefore, the location focus for service firms should be on determining the volume of customers and revenue.

**STUDENT TIP** ◆

Retail stores often attract more shoppers when competitors are close.

There are eight major determinants of volume and revenue for the service firm:

1. Purchasing power of the 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

Realistic analysis of these factors can provide a reasonable picture of the revenue expected. The techniques used in the service sector include regression analysis (see the *OM in Action* box, "How La Quinta Selects Profitable Hotel Sites"), traffic counts, demographic analysis, purchasing power analysis, the factor-rating method, the center-of-gravity method, and geographic information systems. Table 8.6 provides a summary of location strategies for both service and goods-producing organizations.

## OM in Action

### How La Quinta Selects Profitable Hotel Sites

One of the most important decisions a lodging chain makes is location. Those that pick good sites more accurately and quickly than competitors have a distinct advantage. La Quinta Inns, headquartered in San Antonio, Texas, is a moderately priced chain of 800 inns. To model motel selection behavior and predict success of a site, La Quinta turned to regression analysis.

The hotel started by testing 35 independent variables, trying to find which of them would have the highest correlation with predicted profitability, the dependent variable. Variables included: the number of hotel rooms in the vicinity and their average room rates; local attractions such as office buildings and hospitals that drew potential customers to a 4-mile-radius trade area; local population and unemployment rate; the number of inns in a region; and physical characteristics of the site, such as ease of access or sign visibility.

In the end, the regression model chosen, with an  $R^2$  of 51%, included four predictive variables: (1) the price of the inn, (2) median income levels, (3) the state population per inn, and (4) the location of nearby colleges

(which serves as a proxy for other demand generators).

La Quinta then used the regression model to predict profitability and developed a cutoff that gave the best results for predicting success or failure of a site. A spreadsheet is now used to implement the model, which applies the decision rule

and suggests “build” or “don’t build.” The CEO likes the model so much that he no longer feels obliged to personally select new sites.



Mike Booth/Alamy

Sources: S. Kimes and J. Fitzsimmons, *Interfaces* 20, no. 2: 12–20; and G. Keller, *Statistics for Management and Economics*, 8th ed. Cincinnati-Cengage, 2008: 679.

TABLE 8.6 Location Strategies—Service vs. Goods-Producing Organizations

SERVICE/RETAIL/PROFESSIONAL	GOODS-PRODUCING
REVENUE FOCUS	COST FOCUS
<p><b>Volume/revenue</b> Drawing area; purchasing power Competition; advertising/pricing</p> <p><b>Physical quality</b> Parking/access; security/lighting; appearance/ image</p> <p><b>Cost determinants</b> Rent Management caliber Operation policies (hours, wage rates)</p>	<p><b>Tangible costs</b> Transportation cost of raw material Shipment cost of finished goods Energy and utility cost; labor; raw material; taxes, and so on</p> <p><b>Intangible and future costs</b> Attitude toward union Quality of life Education expenditures by state Quality of state and local government</p>
TECHNIQUES	TECHNIQUES
<p>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</p>	<p>Transportation method Factor-rating method Locational cost–volume analysis Crossover charts</p>
ASSUMPTIONS	ASSUMPTIONS
<p>Location is a major determinant of revenue High customer-interaction issues are critical Costs are relatively constant for a given area; therefore, the revenue function is critical</p>	<p>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</p>

#### STUDENT TIP

This table helps differentiate between service- and manufacturing-sector decisions.

**LO 8.6** Understand the differences between service- and industrial-sector location analysis

## Geographic Information Systems

Geographic information systems are an important tool to help firms make successful, analytical decisions with regard to location. A **geographic information system (GIS)** stores, accesses, displays, and links demographic information to a geographical location. For instance, retailers,

#### Geographic information system (GIS)

A system that stores and displays information that can be linked to a geographic location.

owner can measure roofs, evaluate their condition, and e-mail the client an estimate, saving hundreds of miles of driving daily. In one case, while on the phone, a potential client was told her roof was too steep for the company to tackle after the Saber employee quickly looked up the home on Google Earth.

- ◆ *Arby's*: As this fast-food chain learned, specific products can affect behavior. Using MapInfo, Arby's discovered that diners drove up to 20% farther for their roast beef sandwich (which they consider a “destination” product) than for its chicken sandwich.
- ◆ *Home Depot*: Wanting a store in New York City, even though Home Depot demographics are usually for customers who own big homes, the company opened in Queens when GIS software predicted it would do well. Although most people there live in apartments and very small homes, the store has become one of the chain's highest-volume outlets. Similarly, Home Depot thought it had saturated Atlanta two decades ago, but GIS analysis suggested expansion. There are now over 40 Home Depots in that area.
- ◆ *Jo-Ann Stores*: This fabric and craft retailer's 70 superstores were doing well a few years ago, but managers were afraid more big-box stores could not justify building expenses. So Jo-Ann used its GIS to create an ideal customer profile—female homeowners with families—and mapped it against demographics. The firm found it could build 700 superstores, which in turn increased the sales from \$105 to \$150 per square foot.

Other packages similar to MapInfo are Atlas GIS (from Strategic Mapping), ArcGIS (by Esri), SAS/GIS (by SAS Institute), Maptitude (by Caliper), and GeoMedia (by Intergraph).

These GISs can be extensive, including comprehensive sets of map and demographic data. The maps have millions of miles of streets and points of interest to allow users to locate restaurants, airports, hotels, gas stations, ATMs, museums, campgrounds, and freeway exits. Demographic data include statistics for population, age, income, education, and housing. These data can be mapped by state, county, city, zip code, or census tract.

The *Video Case Study* “Locating the Next Red Lobster Restaurant” that appears at the end of this chapter describes how that chain uses its GIS to define trade areas based on market size and population density.

**VIDEO 8.2**  
Locating the Next Red Lobster  
Restaurant

## Summary

Location may determine up to 50% of operating expense. Location is also a critical element in determining revenue for the service, retail, or professional firm. Industrial firms need to consider both tangible and intangible costs. Industrial location problems are typically addressed via a factor-rating method, locational cost–volume analysis, the center-of-gravity method, and the transportation method of linear programming.

For service, retail, and professional organizations, analysis is typically made of a variety of variables including purchasing power of a drawing area, competition, advertising and promotion, physical qualities of the location, and operating policies of the organization.

## Key Terms

Tangible costs (p. 342)  
Intangible costs (p. 342)  
Clustering (p. 344)

Factor-rating method (p. 345)  
Locational cost–volume analysis (p. 346)  
Center-of-gravity method (p. 348)

Transportation model (p. 349)  
Geographic information system (GIS) (p. 351)

## Ethical Dilemma

In this chapter, we have discussed a number of location decisions. Consider another: United Airlines announced its competition to select a town for a new billion-dollar aircraft-repair base. The bidding for the prize of 7,500 jobs paying at least \$25 per hour was fast and furious, with Orlando offering \$154 million in incentives and Denver more than twice that amount. Kentucky's governor angrily rescinded Louisville's offer of \$300 million, likening the bidding to "squeezing every drop of blood out of a turnip."

When United finally selected from among the 93 cities bidding on the base, the winner was Indianapolis and its \$320 million offer of taxpayers' money.

But a few years later, with United near bankruptcy, and having fulfilled its legal obligation, the company walked away from the massive center. This left the city and state governments out all that money, with no new tenant in sight. The city now even owns the tools, neatly arranged in each of the 12 elaborately equipped hangar bays. United outsourced its maintenance to mechanics at a southern firm (which pays one-third of what United paid in salary and benefits in Indianapolis).

What are the ethical, legal, and economic implications of such location bidding wars? Who pays for such giveaways? Are local citizens allowed to vote on offers made by their cities, counties, or states? Should there be limits on these incentives?

## Discussion Questions

- How is FedEx's location a competitive advantage? Discuss.
- Why do so many U.S. firms build facilities in other countries?
- Why do so many foreign companies build facilities in the U.S.?
- What is clustering?
- How does factor weighting incorporate personal preference in location choices?
- What are the advantages and disadvantages of a qualitative (as opposed to a quantitative) approach to location decision making?
- Provide two examples of clustering in the service sector.
- What are the major factors that firms consider when choosing a country in which to locate?
- What factors affect region/community location decisions?
- Although most organizations may make the location decision infrequently, there are some organizations that make the decision quite regularly and often. Provide one or two examples. How might their approach to the location decision differ from the norm?
- List factors, other than globalization, that affect the location decision.
- Explain the assumptions behind the center-of-gravity method. How can the model be used in a service facility location?
- What are the three steps to locational cost-volume analysis?
- "Manufacturers locate near their resources, retailers locate near their customers." Discuss this statement, with reference to the proximity-to-markets arguments covered in the text. Can you think of a counter-example in each case? Support your choices.
- Why shouldn't low wage rates alone be sufficient to select a location?
- List the techniques used by service organizations to select locations.
- Contrast the location of a food distributor and a supermarket. (The distributor sends truckloads of food, meat, produce, etc., to the supermarket.) Show the relevant considerations (factors) they share; show those where they differ.
- Elmer's Fudge Factory is planning to open 10 retail outlets in Oregon over the next 2 years. Identify (and weight) those factors relevant to the decision. Provide this list of factors and weights.

## Using Software to Solve Location Problems

This section presents three ways to solve location problems with computer software. First, you can create your own spreadsheets to compute factor ratings, the center of gravity, and locational cost-volume analysis. Second, Excel OM (free with your text and found in MyOMLab) is programmed to solve all three models. Third, POM for Windows is also found in MyOMLab and can solve all problems labeled with a **P**.

### CREATING YOUR OWN EXCEL SPREADSHEETS

Excel spreadsheets are easily developed to solve most of the problems in this chapter. Consider the Quain's Department Store center-of-gravity analysis in Example 3. You can see from Program 8.1 how the formulas are created.

#### **X** USING EXCEL OM

Excel OM may be used to solve Example 1 (with the Factor Rating module), Example 2 (with the Cost-Volume Analysis module), and Example 3 (with the Center-of-Gravity module), as well as other location problems. The factor-rating method was illustrated in Chapter 2.

#### **P** USING POM FOR WINDOWS

POM for Windows also includes three different facility location models: the factor-rating method, the center-of-gravity model, and locational cost-volume analysis. For details, refer to Appendix IV.

STORE LOCATION	NUMBER OF CONTAINERS SHIPPED PER MONTH	x-coordinate	y-coordinate
Chicago	2,000	30	120
Pittsburgh	1,000	90	110
New York	1,000	130	130
Atlanta	2,000	60	40
Sum	6,000		

Center of Gravity	=SUM(B5:B8)	66.7	93.3
-------------------	-------------	------	------

Action  
Copy D11 to C11

=SUMPRODUCT(D5:D8,\$B5:\$B8)/\$B9

Program 8.1

An Excel Spreadsheet for Creating a Center-of-Gravity Analysis for Example 3, Quain's Discount Department Stores

Solved Problems

Virtual Office Hours help is available in MyOMLab.

SOLVED PROBLEM 8.1

Just as cities and communities can be compared for location selection by the weighted approach model, as we saw earlier in this chapter, so can actual site decisions within those cities. Table 8.7 illustrates four factors of importance to Washington, DC, and the health officials charged with opening that city's first public drug treatment clinic. Of primary concern (and given a weight of 5) was location of the clinic so it would be as accessible as possible to the largest number of patients. Due to a tight budget, the annual lease cost was also of some concern. A suite in the city hall, at 14th and U Streets, was highly rated because its rent would be free. An old office building near the downtown bus station received a much lower rating because of its cost. Equally important as lease cost was the need for

confidentiality of patients and, therefore, for a relatively inconspicuous clinic. Finally, because so many of the staff at the clinic would be donating their time, the safety, parking, and accessibility of each site were of concern as well.

Using the factor-rating method, which site is preferred?

SOLUTION

From the three rightmost columns in Table 8.7, the weighted scores are summed. The bus terminal area has a low score and can be excluded from further consideration. The other two sites are virtually identical in total score. The city may now want to consider other factors, including political ones, in selecting between the two remaining sites.

TABLE 8.7 Potential Clinic Sites in Washington, DC

FACTOR	IMPORTANCE WEIGHT	POTENTIAL LOCATIONS*			WEIGHTED SCORES		
		HOMELESS SHELTER (2 <sup>ND</sup> AND D, SE)	CITY HALL (14 <sup>TH</sup> AND U, NW)	BUS TERMINAL AREA (7 <sup>TH</sup> AND H, NW)	HOMELESS SHELTER	CITY HALL	BUS TERMINAL AREA
Accessibility for addicts	5	9	7	7	45	35	35
Annual lease cost	3	6	10	3	18	30	9
Inconspicuous	3	5	2	7	15	6	21
Accessibility for health staff	2	3	6	2	6	12	4
Total scores:					84	83	69

\*All sites are rated on a 1 to 10 basis, with 10 as the highest score and 1 as the lowest.

**SOLUTION**

$$x\text{-coordinate} = \frac{\sum_i x_i Q_i}{\sum_i Q_i} = \frac{3(45,000) + 4(25,000) + 3(62,000) + 4(51,000) + 2(32,000) + 5(29,000)}{244,000} = 3.42$$

$$y\text{-coordinate} = \frac{\sum_i y_i Q_i}{\sum_i Q_i} = \frac{4(45,000) + 5(25,000) + 6(62,000) + 7(51,000) + 3(32,000) + 2(29,000)}{244,000} = 4.87$$

The new branch library will sit just west of Logan Square and Rogers Park, at the (3.42, 4.87) tract location.

**Problems**

Note: **Px** means the problem may be solved with POM for Windows and/or Excel OM.

**Problems 8.1–8.4 relate to Factors That Affect Location Decisions**

- **8.1** In Myanmar (formerly Burma), 6 laborers, each making the equivalent of \$3 per day, can produce 40 units per day. In rural China, 10 laborers, each making the equivalent of \$2 per day, can produce 45 units. In Billings, Montana, 2 laborers, each making \$60 per day, can make 100 units. Based on labor costs only, which location would be most economical to produce the item?
- **8.2** Refer to Problem 8.1. Shipping cost from Myanmar to Denver, Colorado, the final destination, is \$1.50 per unit. Shipping cost from China to Denver is \$1 per unit, while the shipping cost from Billings to Denver is \$.25 per unit. Considering both labor and transportation costs, which is the most favorable production location?
- **8.3** You have been asked to analyze the bids for 200 polished disks used in solar panels. These bids have been submitted by three suppliers: Thailand Polishing, India Shine, and Sacramento Glow. Thailand Polishing has submitted a bid of 2,000 baht. India Shine has submitted a bid of 2,000 rupees. Sacramento Glow has submitted a bid of \$200. You check with your local bank and find that \$1 = 10 baht and \$1 = 8 rupees. Which company should you choose?
- **8.4** Refer to Problem 8.3. If the final destination is New Delhi, India, and there is a 30% import tax, which firm should you choose?

**Problems 8.5–8.34 relate to Methods of Evaluating Location Alternatives**

- **8.5** Subway, with more than 25,000 outlets in the U.S., is planning for a new restaurant in Buffalo, New York. Three locations are being considered. The following table gives the factors for each site.

FACTOR	WEIGHT	MAITLAND	BAPTIST CHURCH	NORTHSIDE MALL
Space	.30	60	70	80
Costs	.25	40	80	30
Traffic density	.20	50	80	60
Neighborhood income	.15	50	70	40
Zoning laws	.10	80	20	90

- a) At which site should Subway open the new restaurant?
- b) If the weights for Space and Traffic density are reversed, how would this affect the decision? **Px**

- **8.6** Ken Gilbert owns the Knoxville Warriors, a minor league baseball team in Tennessee. He wishes to move the Warriors south, to either Mobile (Alabama) or Jackson (Mississippi). The table below gives the factors that Gilbert thinks are important, their weights, and the scores for Mobile and Jackson.

FACTOR	WEIGHT	MOBILE	JACKSON
Incentive	.4	80	60
Player satisfaction	.3	20	50
Sports interest	.2	40	90
Size of city	.1	70	30

- a) Which site should he select?
- b) Jackson just raised its incentive package, and the new score is 75. Why doesn't this impact your decision in part (a)? **Px**



Andrea Catemaro/Shutterstock

- **8.7** Northeastern Insurance Company is considering opening an office in the U.S. The two cities under consideration are Philadelphia and New York. The factor ratings (higher scores are better) for the two cities are given in the following table. In which city should Northeastern locate?

FACTOR	WEIGHT	PHILADELPHIA	NEW YORK
Customer convenience	.25	70	80
Bank accessibility	.20	40	90
Computer support	.20	85	75
Rental costs	.15	90	55
Labor costs	.10	80	50
Taxes	.10	90	50

## CASE STUDIES

### Southern Recreational Vehicle Company

In October 2015, the top management of Southern Recreational Vehicle Company of St. Louis, Missouri, announced its plans to relocate its manufacturing and assembly operations to a new plant in Ridgecrest, Mississippi. The firm, a major producer of pickup campers and camper trailers, had experienced 5 consecutive years of declining profits as a result of spiraling production costs. The costs of labor and raw materials had increased alarmingly, utility costs had gone up sharply, and taxes and transportation expenses had steadily climbed upward. Despite increased sales, the company suffered its first net loss since operations were begun in 1982.

When management initially considered relocation, it closely scrutinized several geographic areas. Of primary importance to the relocation decision were the availability of adequate transportation facilities, state and municipal tax structures, an adequate labor supply, positive community attitudes, reasonable site costs, and financial inducements. Although several communities offered essentially the same incentives, the management of Southern Recreational Vehicle Company was favorably impressed by the efforts of the Mississippi Power and Light Company to attract “clean, labor-intensive” industry and the enthusiasm exhibited by state and local officials, who actively sought to bolster the state’s economy by enticing manufacturing firms to locate within its boundaries.

Two weeks prior to the announcement, management of Southern Recreational Vehicle Company finalized its relocation plans. An existing building in Ridgecrest’s industrial park was selected (the physical facility had previously housed a mobile home manufacturer that had gone bankrupt due to inadequate financing and poor management); initial recruiting was begun through the state employment office; and efforts to lease or sell the St. Louis property were initiated. Among the inducements offered Southern Recreational Vehicle Company to locate in Ridgecrest were:

1. Exemption from county and municipal taxes for 5 years
2. Free water and sewage services
3. Construction of a second loading dock—free of cost—at the industrial site

4. An agreement to issue \$500,000 in industrial bonds for future expansion
5. Public-financed training of workers in a local industrial trade school

In addition to these inducements, other factors weighed heavily in the decision to locate in the small Mississippi town. Labor costs would be significantly less than those incurred in St. Louis; organized labor was not expected to be as powerful (Mississippi is a right-to-work state); and utility costs and taxes would be moderate. All in all, the management of Southern Recreational Vehicle Company felt that its decision was sound.

On October 15, the following announcement was attached to each employee’s paycheck:

To: Employees of Southern Recreational Vehicle Company  
From: Gerald O’Brian, President

The Management of Southern Recreational Vehicle Company regretfully announces its plans to cease all manufacturing operations in St. Louis on December 31. Because of increased operating costs and the unreasonable demands forced upon the company by the union, it has become impossible to operate profitably. I sincerely appreciate the fine service that each of you has rendered to the company during the past years. If I can be of assistance in helping you find suitable employment with another firm, please let me know. Thank you again for your cooperation and past service.

#### Discussion Questions

1. Evaluate the inducements offered Southern Recreational Vehicle Company by community leaders in Ridgecrest, Mississippi.
2. What problems would a company experience in relocating its executives from a heavily populated industrialized area to a small rural town?
3. Evaluate the reasons cited by O’Brian for relocation. Are they justifiable?
4. What legal and ethical responsibilities does a firm have to its employees when a decision to cease operations is made?

Source: Reprinted by permission of Professor Jerry Kinard, Western Carolina University.

### Locating the Next Red Lobster Restaurant

#### Video Case

From its first Red Lobster in 1968, the chain has grown to 705 locations, with over \$2.6 billion in U.S. sales annually. The casual dining market may be crowded, with competitors such as Chili’s, Ruby Tuesday, Applebee’s, TGI Friday’s, and Outback, but Red Lobster’s continuing success means the chain thinks there is still plenty of room to grow. Robert Reiner, director of market development, is charged with identifying the sites that will maximize new store sales without cannibalizing sales at the existing Red Lobster locations.

Characteristics for identifying a good site have not changed in 40 years; they still include real estate prices, customer age, competition, ethnicity, income, family size, population density, nearby hotels, and buying behavior, to name just a few. What *has* changed is the powerful software that allows Reiner to analyze a

new site in 5 minutes, as opposed to the 8 hours he spent just a few years ago.

Red Lobster has partnered with MapInfo Corp., whose geographic information system (GIS) contains a powerful module for analyzing a trade area (see the discussion of GIS in the chapter). With the U.S. geo-coded down to the individual block, MapInfo allows Reiner to create a psychographic profile of existing and potential Red Lobster trade areas. “We can now target areas with greatest sales potential,” says Reiner.

The U.S. is segmented into 72 “clusters” of customer profiles by MapInfo. If, for example, cluster #7, Equestrian Heights (see MapInfo description below), represents 1.7% of a household base within a Red Lobster trade area, but this segment also accounts

analysis to help decide whether to purchase land and build, or to remodel an existing facility.

Currently, Munday is considering four European cities for Hard Rock’s next expansion. Although he could not provide the names, for competitive reasons, the following is known:

FACTOR	EUROPEAN CITY UNDER CONSIDERATION				IMPORTANCE OF THIS FACTOR AT THIS TIME
	A	B	C	D	
A. Demographics	70	70	60	90	20
B. Visitor market	80	60	90	75	20
C. Transportation	100	50	75	90	20
D. Restaurants/nightclubs	80	90	65	65	10
E. Low political risk	90	60	50	70	10
F. Real estate market	65	75	85	70	10
G. Comparable market analysis	70	60	65	80	10

**Discussion Questions\***

1. From Munday’s Standard Market Report checklist, select any other four categories, such as population (A1), hotels (B2), or restaurants/nightclubs (D), and provide three sub-categories that should be evaluated. (See item C1 [airport] for a guide.)
2. Which is the highest rated of the four European cities under consideration, using the table?
3. Why does Hard Rock put such serious effort into its location analysis?
4. Under what conditions do you think Hard Rock prefers to franchise a cafe?

\*You may wish to view the video case before answering the questions.

- **Additional Case Study:** Visit [MyOMLab](#) for this free case study: **Southwestern University (E):** The university faces three choices as to where to locate its football stadium.

**Endnote**

1. Equations (8-1) and (8-2) compute a center of gravity (COG) under “squared Euclidean” distances and may actually result in transportation costs slightly (less than 2%) higher than an *optimal* COG computed using “Euclidean” (straight-line) distances. The latter, however, is a more complex and involved

procedure mathematically, so the formulas we present are generally used as an attractive substitute. See C. Kuo and R. E. White, “A Note on the Treatment of the Center-of-Gravity Method in Operations Management Textbooks,” *Decision Sciences Journal of Innovative Education* 2: 219–227.

# Chapter 8 *Rapid Review*

Main Heading	Review Material	MyOMLab
<b>THE STRATEGIC IMPORTANCE OF LOCATION</b> (pp. 340–341)	<p>Location has a major impact on the overall risk and profit of the company. Transportation costs alone can total as much as 25% of the product's selling price. When all costs are considered, location may alter total operating expenses as much as 50%. Companies make location decisions relatively infrequently, usually because demand has outgrown the current plant's capacity or because of changes in labor productivity, exchange rates, costs, or local attitudes. Companies may also relocate their manufacturing or service facilities because of shifts in demographics and customer demand.</p> <p>Location options include (1) expanding an existing facility instead of moving, (2) maintaining current sites while adding another facility elsewhere, and (3) closing the existing facility and moving to another location.</p> <p>For industrial location decisions, the location strategy is usually minimizing costs. For retail and professional service organizations, the strategy focuses on maximizing revenue. Warehouse location strategy may be driven by a combination of cost and speed of delivery.</p> <p><i>The objective of location strategy is to maximize the benefit of location to the firm.</i></p> <p>When innovation is the focus, overall competitiveness and innovation are affected by (1) the presence of high-quality and specialized inputs such as scientific and technical talent, (2) an environment that encourages investment and intense local rivalry, (3) pressure and insight gained from a sophisticated local market, and (4) local presence of related and supporting industries.</p>	Concept Questions: 1.1–1.4 <b>VIDEO 8.1</b> Hard Rock's Location Selection
<b>FACTORS THAT AFFECT LOCATION DECISIONS</b> (pp. 341–344)	<p>Globalization has taken place because of the development of (1) market economics; (2) better international communications; (3) more rapid, reliable travel and shipping; (4) ease of capital flow between countries; and (5) large differences in labor costs.</p> <p>Labor cost per unit is sometimes called the <i>labor content</i> of the product:</p> $\text{Labor cost per unit} = \text{Labor cost per day} \div \text{Production (that is, units per day)}$ <p>Sometimes firms can take advantage of a particularly favorable exchange rate by relocating or exporting to (or importing from) a foreign country.</p> <ul style="list-style-type: none"> <li>■ <b>Tangible costs</b>—Readily identifiable costs that can be measured with some precision.</li> <li>■ <b>Intangible costs</b>—A category of location costs that cannot be easily quantified, such as quality of life and government.</li> </ul> <p>Many service organizations find that proximity to market is <i>the</i> primary location factor. Firms locate near their raw materials and suppliers because of (1) perishability, (2) transportation costs, or (3) bulk.</p> <ul style="list-style-type: none"> <li>■ <b>Clustering</b>—Location of competing companies near each other, often because of a critical mass of information, talent, venture capital, or natural resources.</li> </ul>	Concept Questions: 2.1–2.4 Problems: 8.1–8.4
<b>METHODS OF EVALUATING LOCATION ALTERNATIVES</b> (pp. 344–350)	<ul style="list-style-type: none"> <li>■ <b>Factor-rating method</b>—A location method that instills objectivity into the process of identifying hard-to-evaluate costs.</li> </ul> <p>The six steps of the factor-rating method are:</p> <ol style="list-style-type: none"> <li>1. Develop a list of relevant factors called <i>key success factors</i>.</li> <li>2. Assign a weight to each factor to reflect its relative importance in the company's objectives.</li> <li>3. Develop a scale for each factor (for example, 1 to 10 or 1 to 100 points).</li> <li>4. Have management score each location for each factor, using the scale in step 3.</li> <li>5. Multiply the score by the weight for each factor and total the score for each location.</li> <li>6. Make a recommendation based on the maximum point score, considering the results of other quantitative approaches as well.</li> </ol> <ul style="list-style-type: none"> <li>■ <b>Locational cost–volume analysis</b>—A method used to make an economic comparison of location alternatives.</li> </ul> <p>The three steps to locational cost–volume analysis are:</p> <ol style="list-style-type: none"> <li>1. Determine the fixed and variable cost for each location.</li> <li>2. Plot the costs for each location, with costs on the vertical axis of the graph and annual volume on the horizontal axis.</li> <li>3. Select the location that has the lowest total cost for the expected production volume.</li> </ol>	Concept Questions: 3.1–3.4 Problems: 8.5–8.34 Virtual Office Hours for Solved Problems: 8.1, 8.2 <b>ACTIVE MODEL 8.1</b>

Main Heading	Review Material	
	<p>■ <b>Center-of-gravity method</b>—A mathematical technique used for finding the best location for a single distribution point that services several stores or areas.</p> <p>The center-of-gravity method chooses the ideal location that minimizes the <i>weighted</i> distance between itself and the locations it serves, where the distance is weighted by the number of containers shipped, <math>Q_i</math>:</p> $x\text{-coordinate of the center of gravity} = \frac{\sum_i x_i Q_i}{\sum_i Q_i} \quad (8-1)$ $y\text{-coordinate of the center of gravity} = \frac{\sum_i y_i Q_i}{\sum_i Q_i} \quad (8-2)$ <p>■ <b>Transportation model</b>—A technique for solving a class of linear programming problems.</p> <p>The transportation model determines the best pattern of shipments from several points of supply to several points of demand to minimize total production and transportation costs.</p>	Virtual Office Hours for Solved Problem: 8.3
<b>SERVICE LOCATION STRATEGY</b> (pp. 350–351)	<p>The eight major determinants of volume and revenue for the service firm are:</p> <ol style="list-style-type: none"> <li>1. Purchasing power of the customer-drawing area</li> <li>2. Service and image compatibility with demographics of the customer-drawing area</li> <li>3. Competition in the area</li> <li>4. Quality of the competition</li> <li>5. Uniqueness of the firm's and competitors' locations</li> <li>6. Physical qualities of facilities and neighboring businesses</li> <li>7. Operating policies of the firm</li> <li>8. Quality of management</li> </ol>	Concept Questions: 4.1–4.4
<b>GEOGRAPHIC INFORMATION SYSTEMS</b> (pp. 351–353)	<p>■ <b>Geographic information system (GIS)</b>—A system that stores and displays information that can be linked to a geographic location.</p> <p>Some of the geographic databases available in many GISs include (1) census data by block, tract, city, county, congressional district, metropolitan area, state, and zip code; (2) maps of every street, highway, bridge, and tunnel in the U.S.; (3) utilities such as electrical, water, and gas lines; (4) all rivers, mountains, lakes, and forests; and (5) all major airports, colleges, and hospitals.</p>	Concept Questions: 5.1–5.4 <b>VIDEO 8.2</b> Locating the Next Red Lobster Restaurant

## Self Test

■ **Before taking the self-test**, refer to the learning objectives listed at the beginning of the chapter and the key terms listed at the end of the chapter.

**LO 8.1** The factors involved in location decisions include

- a) foreign exchange.
- b) attitudes.
- c) labor productivity.
- d) all of the above.

**LO 8.2** If Fender Guitar pays \$30 per day to a worker in its Ensenada, Mexico, plant, and the employee completes four instruments per 8-hour day, the labor cost/unit is

- a) \$30.00.
- b) \$3.75.
- c) \$7.50.
- d) \$4.00.
- e) \$8.00.

**LO 8.3** Evaluating location alternatives by comparing their composite (weighted-average) scores involves

- a) factor-rating analysis.
- b) cost-volume analysis.
- c) transportation model analysis.
- d) linear regression analysis.
- e) crossover analysis.

**LO 8.4** On the cost-volume analysis chart where the costs of two or more location alternatives have been plotted, the quantity at which two cost curves cross is the quantity at which:

- a) fixed costs are equal for two alternative locations.
- b) variable costs are equal for two alternative locations.
- c) total costs are equal for all alternative locations.
- d) fixed costs equal variable costs for one location.
- e) total costs are equal for two alternative locations.

**LO 8.5** A regional bookstore chain is about to build a distribution center that is centrally located for its eight retail outlets. It will most likely employ which of the following tools of analysis?

- a) Assembly-line balancing
- b) Load-distance analysis
- c) Center-of-gravity model
- d) Linear programming
- e) All of the above

**LO 8.6** What is the major difference in focus between location decisions in the service sector and in the manufacturing sector?

- a) There is no difference in focus.
- b) The focus in manufacturing is revenue maximization, while the focus in service is cost minimization.
- c) The focus in service is revenue maximization, while the focus in manufacturing is cost minimization.
- d) The focus in manufacturing is on raw materials, while the focus in service is on labor.

Answers: LO 8.1. d; LO 8.2. c; LO 8.3. a; LO 8.4. e; LO 8.5. c; LO 8.6. c.