Chapter 8

Location Planning and Analysis
Need for Location Decisions

- Marketing Strategy
- Growth
- Depletion of Resources
- Cost of Doing Business
Nature of Location Decisions

• Importance
  - Long term commitment/costs
  - Impact on investment requirement, operating costs and revenues

• Objectives
  - Profit potential
  - Acceptable alternatives

• Options
  - Expand existing facilities
  - Add new facilities
  - Move
  - Do nothing
Location Decision Factors

Regional Factors

Community Considerations

Multiple Plant Strategies

Site-related Factors
Regional Factors

- Location of raw materials
- Location of markets
- Labor factors
- Other factors
  - climate
  - taxes
  - utilities cost and availability
  - input cost and availability
Community Considerations

- Facilities for education, shopping, recreation, transportation, religious worship, and entertainment
- Quality of police, fire, and medical services
- Local attitudes toward the company
- Size of the community
- Cost and availability of utilities, environmental regulations, taxes, and incentives
Site-related Factors

- Land
- Transportation
- Zoning or other restrictions
Multiple Plant Strategies

• Product Plant Strategy
• Market Area Strategy
• Process Plant Strategy
Multiple Plant Strategies

• **Product plant strategy**
  - entire product lines are produced in separate plants
  - decentralized approach
  - specialization of resource
Multiple Plant Strategies

• Market area strategy
  – plants designed to serve a particular geographic area
  – rapid delivery and response to customer needs
  – low transportation cost
  – operating cost high due to product variety
Multiple Plant Strategies (cont.)

- **Process plant strategy**
  - plants concentrate on different aspects of a process
  - coordination is a major issue
  - plants highly specialized; economies of scale
Service and Retail Locations

• Traffic volume and convenience
• Location of other retailers or similar service providers
• Demographic analysis of drawing area
• Transportation and/or parking facilities
• Customer safety and security
Trends in Locations

• Foreign producers locating in U.S.
  - “Made in USA”
  - Currency fluctuations

• Just-in-time manufacturing techniques

• Microfactories
  – narrow product focus
  – located near major markets

• Information highway
Methods of Evaluating Location Alternatives

• Locational Cost-Profit-Volume Analysis
• The Factor Rating Method
• The Transportation Model
  – The Center of Gravity Method
Locational Cost-profit-volume Analysis

- Determine fixed and variable costs
- Plot total costs
- Determine lowest total costs

Example:
Fixed and variable costs for two potential locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Fixed cost</th>
<th>Variable cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$800,000</td>
<td>$14,000</td>
</tr>
<tr>
<td>B</td>
<td>$920,000</td>
<td>$13,000</td>
</tr>
</tbody>
</table>
A Total cost

920,000

Volume (units)

800,000

Optimal total cost line

X
At a crossover volume, $X$, the total cost of one alternative equals the total cost of another alternative

$$TC_A = TC_B$$

$$FC_A + VC_A(X) = FC_B + VC_B(X)$$

$$VC_A(X) - VC_B(X) = FC_B - FC_A$$

$$(VC_A - VC_B)(X) = FC_B - FC_A$$

$$X = (FC_B - FC_A) / (VC_A - VC_B)$$
\[ X = \frac{FC_B - FC_A}{VC_A - VC_B} \]

\[ X = \frac{920,000 - 800,000}{14,000 - 13,000} \]

\[ X = 120 \text{ units} \]
Factor-rating Method (1 of 2)

• Allows consideration of both quantitative and qualitative factors
• Different factors can be assigned different weights
Factor-Rating Method (2 of 2)

• The six steps in the factors-rating method

1. Develop a list of relevant factors
2. Assign a weight to each factor to reflect its relative importance to the company’s objectives
3. Develop a scale for each factor
4. Have management score each location for each factor, using the scale developed in the previous step
5. Multiply the scores times the weights for each factor, and total the score for each location
6. Make a recommendation based on the maximum point score
## Factor-Rating Method

<table>
<thead>
<tr>
<th>Factor</th>
<th>Weights</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 1</th>
<th>Alt 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity</td>
<td>0.2</td>
<td>100</td>
<td>60</td>
<td>0.2*100=20</td>
<td>0.2*60=12</td>
</tr>
<tr>
<td>Traffic</td>
<td>0.3</td>
<td>60</td>
<td>60</td>
<td>0.3*60=18</td>
<td>0.3*60=18</td>
</tr>
<tr>
<td>Rental cost</td>
<td>0.4</td>
<td>70</td>
<td>90</td>
<td>0.4*70=28</td>
<td>0.4*90=36</td>
</tr>
<tr>
<td>Size</td>
<td>0.1</td>
<td>86</td>
<td>60</td>
<td>0.1*86=8.6</td>
<td>0.1*60=6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1.00</td>
<td></td>
<td></td>
<td>74.6</td>
<td>72.0</td>
</tr>
</tbody>
</table>
Evaluating Locations

• **Transportation Model**
  - Objective is to determine the best pattern of shipments to minimize production and transportation costs
  - A special case of the linear programming problem
  - Center of gravity is one method

![Candidate location diagram]
The Center-of-Gravity Method (1 of 2)

• Mathematical technique to minimize distribution costs

• Takes into account
  – location of markets
  – the volume of goods shipped to those markets
  – shipping costs

• Assumes that shipping cost is directly proportional to both distance and volume shipped
Determine the coordination of the location that will minimize distribution cost.

<table>
<thead>
<tr>
<th>Destination</th>
<th>(x, y)</th>
<th>Weekly Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5, 7</td>
<td>15</td>
</tr>
<tr>
<td>B</td>
<td>6, 9</td>
<td>20</td>
</tr>
<tr>
<td>C</td>
<td>3, 9</td>
<td>25</td>
</tr>
<tr>
<td>D</td>
<td>9, 4</td>
<td>30, 90</td>
</tr>
</tbody>
</table>
The Center-of-Gravity Method

\[ x_i = \text{x coordinate of destination } i \]
\[ y_i = \text{y coordinate of destination } i \]
\[ Q_i = \text{demand quantity of destination } i \]
\[ \bar{x} = \text{x coordinate of location (decision variable)} \]
\[ \bar{y} = \text{x coordinate of location (decision variable)} \]

\[
\bar{x} = \frac{\sum_{i} x_i Q_i}{\sum_{i} Q_i}
\]

\[
\bar{y} = \frac{\sum_{i} y_i Q_i}{\sum_{i} Q_i}
\]
Chapter 8
Location Planning and Analysis

• Solved problems
  – 1, 2, 3

• Discussion questions
  – 3, 4, 5, 6, 7

• Assigned problems
  – 4, 9, 14