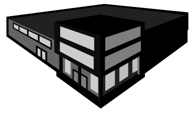
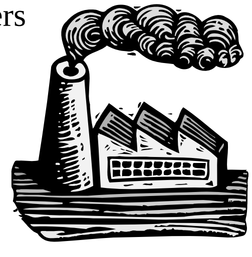
Chapter 14
Network Design and Facility Location

- Reasons for Location Decision
- Steps in the Location Decision
- Location Determinants
- Case Studies
- Quantitative Analysis
  - Grid Method
- Transportation Pragmatics

Strategic Location of Facilities

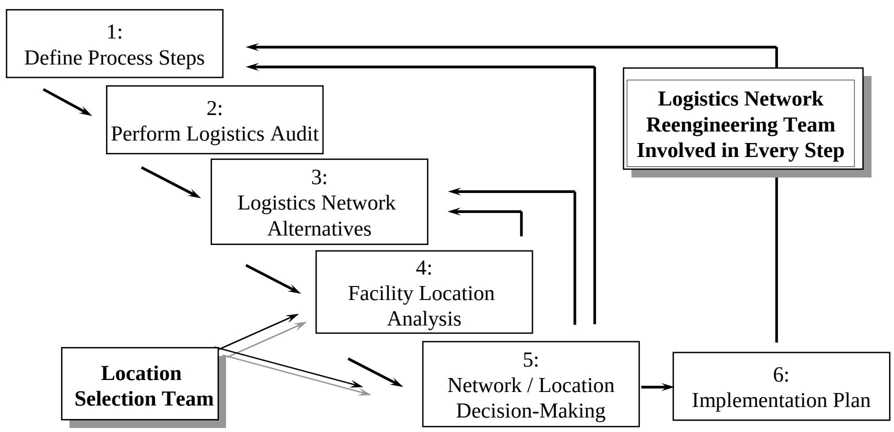
- Types of Location Decisions
  - Suppliers
  - Manufacturing
  - Distribution
  - Customers



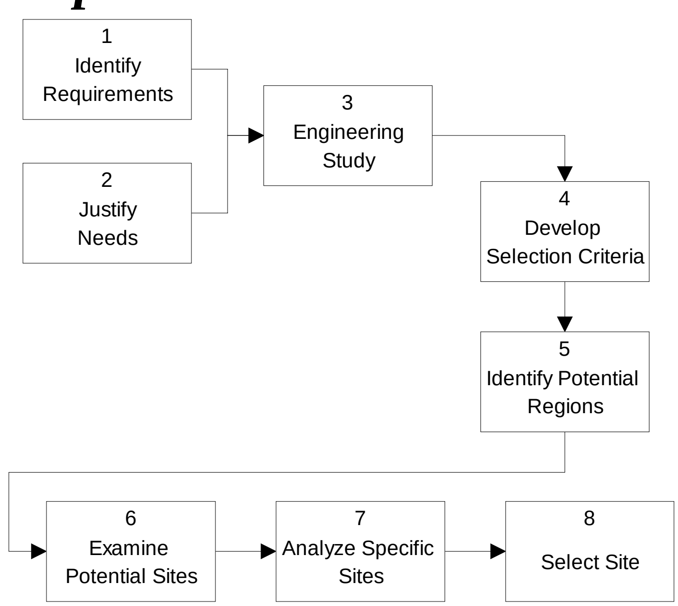


- Reasons for the Location Decision
  - New Markets / New Products
  - Facility Modernization
  - Shifts in Economic Conditions
  - Competitive Pressures
  - Global Issues
  - Increased Customer Service Requirements

Logistics Network Design Process



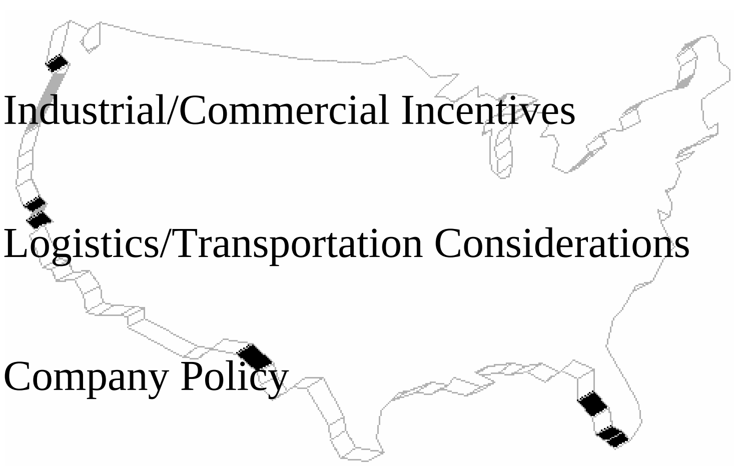
Steps in the Location Decision



Location Determinants

- Favorable Labor Climate
- Proximity to Markets, Suppliers, & Resources
- Quality of Life

Location Determinants (cont'd)



- Industrial/Commercial Incentives
- Logistics/Transportation Considerations
- Company Policy

Site Selection Factors

Ranked in order of importance

Factor	1995			
	Overall	Manuf.	Retailer	Dist.
Transportation access	1	1	2	1
Outbound transportation	2	2	4	4
Customer proximity	3	3	3	9
Labor availability	4	4	1	3
Labor costs	5	5	5	2
Inbound transportation	6	6	6	6
Union environment	7	7	7	10
Taxes	8	9	-	9
JIT Requirements	9	8	-	7
Land costs	10	10	8	7
Utilities	-	-	9	8
State incentives/laws	-	-	10	-

Source: *Transportation & Distribution*, June 1990

Top Criteria for Industrial Site Section

1. Roadway access for trucks
2. Reasonable cost of property
3. Availability of labor with necessary skills
4. Favorable attitude of community
5. Ample area for expansion
6. Reasonable or low taxes
7. Reasonable cost of construction
8. Favorable political climate towards business
9. Access to utilities
10. Favorable business climate

Source: Industry Week, 1997

Case Studies of Logistics Decisions

Top 10 US Cities according to *Fortune*

	1991	1996	1999
1.			
2.		Denver	San Jose
3.	Pittsburgh	Philadelphia	Austin
4.	Kansas City	Minneapolis	NYC
5.	Nashville	Raleigh-Durham	Atlanta
6.	Salt Lake City	St. Louis	Seattle
7.	Charlotte	Cincinnati	SF
8.	Orlando	Wash DC	Denver
9.	Austin	Pittsburgh	Boston
10.	Phoenix		Chicago

TOP RANKED LOGISTICS QUOTIENT OF AMERICAN CITIES

Rankings	2002	2001
Savannah, GA	1	1
Jacksonville, FL	2	6
Atlanta, GA	3	12
Minneapolis-St. Paul, MN-WI	4	9
Chattanooga, TN-GA	5	4
Anchorage, AK	6	51
Louisville, KY-IN	7	2
Charleston-North Charleston, SC	8	78
San Diego, CA	9	7
Nashville, TN	10	3
Mobile, AL	11	17
Los Angeles-Long Beach, CA	12	8
Birmingham, AL	13	20
Kansas City, MO-KS	14	21
Houston, TX	15	11

Factors considered in making rankings:

- T & D Industry
- Work Force Labor
- Road Infrastructure
- Road D/C/S
- Road Condition
- Interstate Highway
- Taxes & Fees
- Railroad
- Water
- Air

Case Studies of Logistics Decisions,
(continued)

- Automobile Assembly Plant Locations
  - Nissan
  - Saturn
  - Toyota
  - Mercedes Benz
- Nevada/California Distribution Center Locations
- Maxwell House Coffee
- J.C. Penney
- UPS

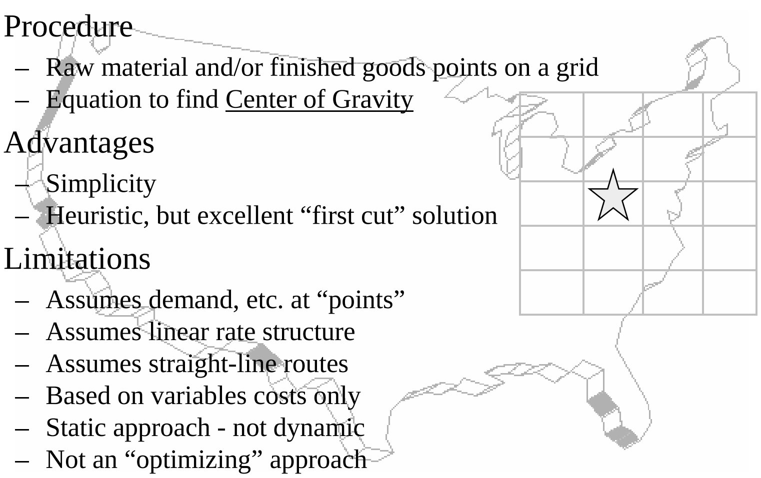
"New" Auto Plants

Types of Quantitative Analysis

- - “Best” Answer
- - “Good” Answer
- - “Computer Model” of the system
  - Identify preferred alternative
  - Sensitivity analysis

“Grid” Method for Facility Location

- Procedure
  - Raw material and/or finished goods points on a grid
  - Equation to find Center of Gravity
- Advantages
  - Simplicity
  - Heuristic, but excellent “first cut” solution
- Limitations
  - Assumes demand, etc. at “points”
  - Assumes linear rate structure
  - Assumes straight-line routes
  - Based on variables costs only
  - Static approach - not dynamic
  - Not an “optimizing” approach



Grid Method Solution Procedure

$C_{x,y}$ = center of gravity

C_x = x-coordinate for center of gravity

C_y = y-coordinate for center of gravity

d_i = distance from point 0 on grid to the grid location of raw material i

D_i = distance from point 0 on grid to the grid location of finished material i

S_i = weight (volume) of raw materials purchased at source i

M_i = weight (volume) of finished goods at market i

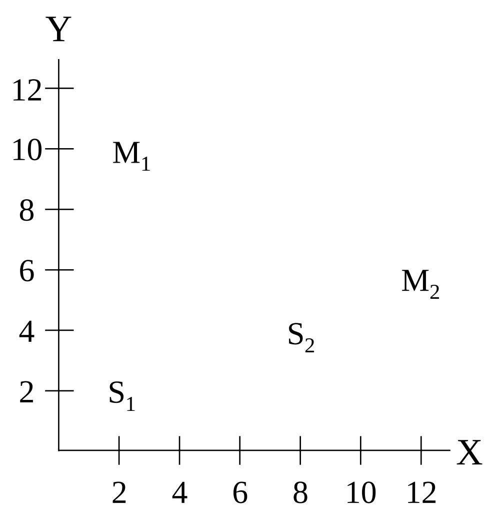
r_i = raw material rate/distance unit for raw material i

R_i = finished good rate/distance unit for finished good i

Then:

$$C = \frac{\sum r_i d_i S_i + \sum R_i D_i M_i}{\sum r_i S_i + \sum R_i M_i}$$

Grid Method



	Grid X	Grid Y	Rate r_i or R_i	Tons S_i or M_i
S_1	2	2	\$10	200
S_2	8	4	\$10	100
M_1	2	10	\$8	100
M_2	12	6	\$6	150

Grid Method, continued

$$C_x = \frac{\sum r_i d_i S_i + \sum R_i D_i M_i}{\sum r_i S_i + \sum R_i M_i}$$

$$C_x = \frac{(10x2x200) + (10x8x100) + (8x2x100) + (6x12x150)}{(10x200) + (10x100) + (8x100) + (6x150)}$$

$$C_x = \frac{4000 + 8000 + 1600 + 10800}{2000 + 1000 + 800 + 900} = \frac{24400}{4700} = 5.19$$

$$C_y = \frac{21400}{4700} = 4.55$$

Therefore:

Grid Method, continued

- For additional practice on the grid method, you may wish to solve the two problems included in Study Question #9 on page 535, CBL.
- Assume a rate of “1” if not given.
- Check answer for #9a:
  - Cx = 8.7
  - Cy= 10.5

Transportation Pragmatics

- Tapering Rates

- Transit Privileges
- Commercial Zones
- Blanket Rate
- Foreign Trade Zones

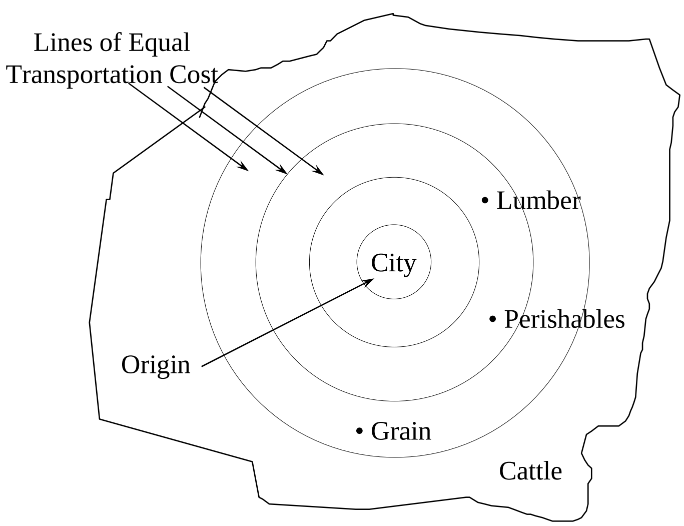
Chapter 14a
Classical Theories of Location

- von Thunen
- Weber
- Hoover
- Greenhut

von Thunen

- Agricultural activity occurs in a "limitless plain of equal fertility" with a city in the middle
- Theorized that:
  - City price = origin price + transport costs
  - Transport costs = f{weight & distance}
- As a result
  - Products having high weight/value ratio should be produced near the city (see next slide)
- Other Contributions
  - Land values decrease as move from city
  - More intense land utilization near cities

Example: von Thunen's Theory



Weber

- Classification of Materials as:
  - Localized vs. Ubiquitous
  - Pure vs. Weight-Losing
- Examples:

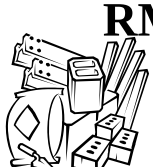
	Localized	Ubiquitous
Pure		
Weight-Losing		

One Market and One Raw Material Source

100 Miles

RM ———————————— **M**

X



RM = Raw Materials Source

M = Market

X = Midpoint between RM and M

Weber, ***continued***

- Calculate:

$$\text{Material Index} = \frac{\text{Weight of Localized Raw Materials}}{\text{Finished Product Weight}}$$

- Implications:
  - if MI > 1.0, locate plant nearer to raw materials
  - if MI = 1.0, indifferent
  - if MI < 1.0, locate plant nearer to markets

Weber, ***continued***

Example of Materials Index Approach: Toothpaste

Input	Input Weight	Source	Contribution to Finished Product
Sand	1 oz.	Knoxville	1 oz.
Soap	18 oz.	Statesboro	13 oz.
Paint	1 oz.	Atlanta	1 oz.
Marble	1 oz.	Nashville	1 oz.
Water	4 oz.	Anywhere	3 oz.

$$\text{Material Index} = \frac{\text{Weight of Localized Raw Materials}}{\text{Finished Product Weight}}$$

$$= \frac{1+18+1+1}{1+13+1+1+3} = \frac{21}{19} = 1.1$$

Since MI > 1.0, locate nearer to Raw Materials

Hoover

- First to address demand as well as cost factors
- Recognized non-linearity of transportation rates
- Emphasized that transportation costs will be more or less important depending on the firm and its industry

Greenhut

- Grouped location determinants into three groups:
  - Demand
  - Cost
  - Personal Considerations
    - Quality of Life

Extra Credit Assignment

- Voluntary assignment to provide feedback
- No more than one page typed
- Six portions to answer
  - 1. One thing you would definitely keep
  - 2. One thing you would definitely change
  - 3,4,5. Three things that could be improved
  - 6. One joke that could be told in class
- This will be due at the beginning of the next class - late assignments will receive 1/2 credit