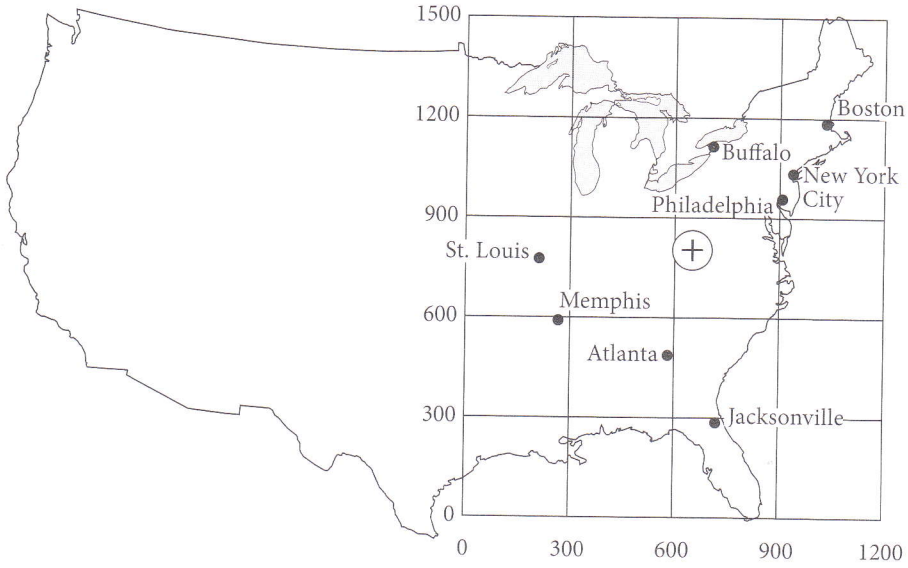
Figure 12.6 Grid Locations of Sources and Markets



	Grid Coordinates	
Sources	Horizontal	Vertical
Buffalo (S_1)	700	1,125
Memphis (S_2)	250	600
St. Louis (S_3)	225	825
Markets		
Atlanta (M_1)	600	500
Boston (M_2)	1,050	1,200
Jacksonville (M_3)	800	300
Philadelphia (M_4)	925	975
New York (M_5)	1,000	1,080

Source: Edward J. Bardi, Ph.D. Used with permission.

Example

We can visualize this technique's underlying concept as a series of strings to which are attached weights corresponding to the weight of raw materials the company consumes at each source and of finished goods the company sells at each market. The strings are threaded through holes in a flat plane; the holes correspond to the source and market locations. The strings' other ends are tied together, and the weights exert their respective pulls on the knot. The strings' knotted ends will finally reach equilibrium; this equilibrium will be the center of mass, or the ton-mile center.

We can compute this concept mathematically, finding the ton-mile center, or center of mass, as follows:

$$C = \frac{\sum_{1}^{m} d_i S_i + \sum_{1}^{n} D_i M_i}{\sum_{1}^{m} S_i + \sum_{1}^{n} M_i}$$

Example

Table 12.2 Grid Technique Analysis of Plant Location Example

SOURCES/ MARKETS	RATE $/TON-MILE (A)	TONS (B)	GRID COORDINATES		CALCULATIONS	
			HORIZONTAL	VERTICAL	(A) × (B) × HORIZONTAL	(A) × (B) × VERTICAL
Buffalo (S_1)	$0.90	500	700	1,125	315,000	506,250
Memphis (S_2)	$0.95	300	250	600	71,250	171,000
St. Louis (S_3)	$0.85	700	225	825	133,875	490,875
		1,500			520,125	1,168,125
Atlanta (M_1)	$1.50	225	600	500	202,500	168,750
Boston (M_2)	$1.50	150	1,050	1,200	236,250	270,000
Jacksonville (M_3)	$1.50	250	800	300	300,000	112,500
Philadelphia (M_4)	$1.50	175	925	975	242,813	255,938
New York (M_5)	$1.50	300	1,000	1,080	450,000	486,000
	TOTALS	1,100			1,431,563	1,293,188
					HORIZONTAL	VERTICAL
				Numerator: $\Sigma(r \times d \times S) =$	520,125	1,168,125
				$+\Sigma(R \times D \times M) =$	1,431,563	1,293,188
				Sum	1,951,688	2,461,313
				Denominator: $\Sigma(r \times S) =$	1,330	1,330
				$+\Sigma(R \times M) =$	1,650	1,650
				Sum	2,980	2,980
				Grid Center	655	826

Source: Edward J. Bardi, Ph.D. Used with permission.

least-cost location for the plant is in southeastern Ohio or northwestern West Virginia in the Wheeling-Parkersburg area.

The preceding example applied the grid technique to a plant location. Companies can use the technique to solve warehousing location problems as well. The company follows the same procedure, but the company's plants are the raw materials sources.

Advantages

The grid technique's strengths are in its simplicity and its ability to provide a starting point for location analysis. Computationally, the technique is relatively easy to use. A company can generate the necessary data from sales figures, purchase records, and transportation documents (either the bill of lading or the freight bill). More exact market and source location coding is possible, as is modifying the rate–distance relationship quantification. A computer can easily handle such refinements.