Table

Description automatically generated

To determine the best location for Beth Spenser Retailers, we need to calculate the weighted score for each location based on the given factors and their weights.

For the present location, the weighted score would be:

Factor 1: 40 \* 0.30 = 12

Factor 2: 20 \* 0.15 = 3

Factor 3: 30 \* 0.20 = 6

Factor 4: 80 \* 0.35 = 28

Total weighted score: 12 + 3 + 6 + 28 = 49

For Newbury, the weighted score would be:

Factor 1: 60 \* 0.30 = 18

Factor 2: 20 \* 0.15 = 3

Factor 3: 60 \* 0.20 = 12

Factor 4: 50 \* 0.35 = 17.5

Total weighted score: 18 + 3 + 12 + 17.5 = 50.5

For Hyde Park, the weighted score would be:

Factor 1: 50 \* 0.30 = 15

Factor 2: 80 \* 0.15 = 12

Factor 3: 50 \* 0.20 = 10

Factor 4: 50 \* 0.35 = 17.5

Total weighted score: 15 + 12 + 10 + 17.5 = 54.5

Based on the above calculations, the best location for Beth Spenser Retailers would be Hyde Park, with a total weighted score of 54.5.

Table

Description automatically generated

Here are the calculated weighted score ratings for each country:  
Germany:  
(0.05 \* 5) + (0.05 \* 4) + (0.2 \* 5) + (0.2 \* 5) + (0.2 \* 1) + (0.1 \* 4) + (0.1 \* 1) + (0.1 \* 2) = 3.35  
Italy:  
(0.05 \* 5) + (0.05 \* 2) + (0.2 \* 5) + (0.2 \* 2) + (0.2 \* 4) + (0.1 \* 2) + (0.1 \* 4) + (0.1 \* 3) = 3.45  
Spain:  
(0.05 \* 5) + (0.05 \* 1) + (0.2 \* 5) + (0.2 \* 3) + (0.2 \* 1) + (0.1 \* 1) + (0.1 \* 4) + (0.1 \* 1) = 2.7  
Greece:  
(0.05 \* 2) + (0.05 \* 1) + (0.2 \* 2) + (0.2 \* 5) + (0.2 \* 3) + (0.1 \* 1) + (0.1 \* 3) + (0.1 \* 5) = 3.05  
Based on the calculated weighted score ratings, it appears that Italy has the highest score of 3.45  
and would be the most desirable location for the consulting firm's new office

Table

Description automatically generated

a. Over what range of production is each location optimal?

For each location, we need to determine the range of production quantities for which it has the lowest total cost compared to the other locations.

Let's assume that the hub is initially located at the center of the cities, which has the coordinates (x, y) = (40, 50). We can then calculate the shipping cost for each city at different production quantities using the formula above.

For Site 1:

At 50 units: Total Cost = $500 + $11 \* 50 \* Distance between hub and city

Site 1: Total Cost = $500 + $11 \* 50 \* 30 = $19,000

Site 2: Total Cost = $1000 + $7 \* 50 \* 20 = $8,500

Site 3: Total Cost = $1700 + $4 \* 50 \* 40 = $5,900

At 100 units: Total Cost = $500 + $11 \* 100 \* Distance between hub and city

Site 1: Total Cost = $500 + $11 \* 100 \* 30 = $32,500

Site 2: Total Cost = $1000 + $7 \* 100 \* 20 = $9,000

Site 3: Total Cost = $1700 + $4 \* 100 \* 40 = $9,700

At 150 units: Total Cost = $500 + $11 \* 150 \* Distance between hub and city

Site 1: Total Cost = $500 + $11 \* 150 \* 30 = $46,000

Site 2: Total Cost = $1000 + $7 \* 150 \* 20 = $9,500

Site 3: Total Cost = $1700 + $4 \* 150 \* 40 = $13,100

At 200 units: Total Cost = $500 + $11 \* 200 \* Distance between hub and city

Site 1: Total Cost = $500 + $11 \* 200 \* 30 = $59,500

Site 2: Total Cost = $1000 + $7 \* 200 \* 20 = $11,000

Site 3: Total Cost = $1700 + $4 \* 200 \* 40 = $16,500

Based on the above calculations, we can see that Site 3 has the lowest total cost for all production quantities, followed by Site 2 and then Site 1.

b. For a production of 200 units, which site is best?

For a production of 200 units, we can see from the above calculations that Site 2 has the lowest total cost, followed by Site 3 and then Site 1. Therefore, Site 2 would be the best site for the central hub if the production quantity is 200 units

Site 2 is the best choice for a production of 200 units, as it has the lowest total cost

Table

Description automatically generated

a) To find the location of the hub using the Center of Gravity method, we need to calculate the X and Y coordinates of the center of gravity based on the shipping loads and the map coordinates of each city. The formula for X coordinate is:

X = (5\*5 + 6\*10 + 4\*15 + 9\*5 + 7\*15 + 3\*10 +2\*5) / (5+10+15+5+15+10+5) = 335 / 65

= 5.153846154

Y = (10\*5 + 8\*10 + 9\*15 + 5\*5 + 9\*15 + 2\*10 + 6\*5) / (5+10+15+5+15+10+5)  
= 475 / 65 = 7.307692308

So, the hub should be located at approximately (5.15, 7.30).

b) There are many other factors that can influence the office placement decision, such as the availability of transportation infrastructure, access to suppliers and customers, labor market, land and property costs, regulatory and legal environment, and proximity to other businesses and industry clusters. Additionally, the type of industry and the nature of the business operations can also affect the location choice, such as the need for specialized equipment, skilled labor, or specific market conditions.

c) Using the table, we can calculate the total distance for each city:  
City A: (5\*0) + (10\*2.236) + (15\*1.414) + (5\*5) + (15\*2.236) + (10\*8.062) + (5\*6.708) = 216.27  
City B: (5\*2.236) + (10\*0) + (15\*2.236) + (5\*7.071) + (15\*1.414) + (10\*7.211) + (5\*5.099) = 198.89

City C: (5\*1.414) + (10\*2.236) + (15\*0) + (5\*6.708) + (15\*1.0) + (10\*8.246) + (5\*4.243) = 181.645  
City D: (5\*5) + (10\*7.071) + (15\*6.708) + (5\*0) + (15\*4.472) + (10\*12.166) + (5\*8.246) = 426.3  
City E: (5\*2.236) + (10\*1.414) + (15\*1.0) + (5\*4.472) + (15\*0) + (10\*10.630) + (5\*8.062) = 209.29  
City F: (5\*8.062) + (10\*7.211) + (15\*8.246) + (5\*12.166) + (15\*10.630) + (10\*0) + (5\*5.099) =  
481.885  
City G: (5\*6.708) + (10\*5.099) + (15\*4.243) + (5\*8.246) + (15\*8.062) + (10\*5.099) + (5\*0) = 361.325  
Therefore, based on the Load distance method, the hub should be located near City C, which has the shortest total distance to all other cities, of 181.645.