Supply Chain optimisation

Objective function:
To find the optimal locations of manufacturing facilities to meet your customers' demand and reduce production costs.

Supply chain optimization makes the best use of data analytics to find an optimal.
In this case, we will present a simple methodology using Linear Programming for Supply Chain Optimization considering

- Fixed production costs of your facilities ($/Month)
- Variable production costs per unit produced ($/Unit)
- Shipping costs ($)
- Customer's demand (Units)

Problem Statement

To redefine the Supply Chain Network for the next 5 years considering the recent increase in shipping costs and the forecasts of future demand.

Supply Chain Network

- 2 types of manufacturing facilities: low capacity and high capacity sites.
- Shipping costs ($/container)
- Customer's demand (Units/year)
- 5 markets in Brazil, USA, India, Japan, Germany.

Manufacturing Facility Fixed Costs

- Capital Expenditure for the equipment (Machines, Storage)
- Utilities (Electricity, Water)
- Factory management, administrative staff
- Space Rental

These costs depend on the country and the type of plant.

Production Variable Costs

- Production lines operators
- Raw materials

Shipping Variable Costs

- Cost per container ($/Container)
- Assumption: 1 container can contain 1000 units.

Results

Let us try three scenarios

- Scenario 1: initial parameters
- Scenario 2: we increase the production capacity of India (x2)
- Scenario 3: surging shipping costs due to container shortage.

Scenario 1: Initial Scenario

- Brazil plant is producing for the local market and the USA.

Facilities: 1 high capacity plant

('Brazil','Brazil') = 145,000 **(Units/Month)**

('Brazil','USA') = 1,250,000 **(Units/Month)**

- India plants produce for all countries except Brazil

Facilities: 1 high capacity plant and 1 low capacity plant

('India','Germany') = 90,000 **(Units/Month)**

('India','India') = 160,000 **(Units/Month)**

('India','Japan') = 200,000 **(Units/Month)**

('India','USA') = 1,550,000 **(Units/Month)**

- Japan needs to produce locally because of the limited capacity of India.

Facilities: 1 high capacity plant

('Japan','Japan') = 1,500,000 **(Units/Month)**

Final Costs

Total Costs = **62,038,000 ($/Month)**

Scenario 2:

Outsourcing to low costs regions by double the size of high capacity plants in India.

Let us try to double the size of the India High Capacity plant with the assumption that it will double the fixed costs.

- Brazil plant is still producing for the local market and the USA.

Facilities: 1 high capacity plant

('Brazil','Brazil') = 145,000 **(Units/Month).**

('Brazil','USA') = 1,250,000 **(Units/Month)**

- India plants produce for all countries except Brazil

Facilities: 2 high capacity and 1 low capacity plants

('India','Germany') = 90,000 **(Units/Month)**

('India','India') = 160,000 **(Units/Month)**

('India','Japan') = 1,700,000 **(Units/Month)**

('India','USA') = 1,550,000 **(Units/Month)**

- Japan does not produce locally anymore.

Final Costs

-19.4(%) vs. Scenario 1

Total Costs = **51,352,000** ($/Month)

Scenario 3:

surging shipping costs due to containers shortage as a result supplying charges increases by 7 times.

- Brazil is producing for the local market only

Facilities: 1 low capacity plant

('Brazil','Brazil') = 145,000 **(Units/Month)**

- The USA started to produce for the local market and Japan

Facilities: 1 high capacity plant

('USA','Japan') = 200,000 **(Units/Month)**

('USA','USA') = 1,300,000 **(Units/Month)**

- India closed its low capacity factory

Facilities: 1 high capacity plant

('India','Germany') = 90,000 **(Units/Month)**

('India','India') = 160,000 **(Units/Month)**

('India','USA') = 1,500,000 **(Units/Month)**

- Japan starts to produce for its local market

  Facilities: 1 high capacity plant

  ('Japan','Japan') = 1,500,000 **(Units/Month)**

  Because of their limited production capacity, Japan and the USA still rely on the Indian plant.

Final Costs

Total Costs = **92,981,000 ($/Month)**