❑ Introduction

The transportation problem is one of the sub-classes of L.P.Ps. One important application of linear programming is in area of physical distribution (transportation) of goods and services from several demand centres. The origin of a transportation method dates back to **1941** when **F.L. Hitchcock** presented a study entitled **"The Distribution of a Product from Several Sources to Numerous Localities."** This presentation is considered to be the first important contribution to the solution of transportation problems. It was further developed by **T.C. Koopmans (1949)** and **G.B. Dantzig (1951)**. Several extensions of transportations models and methods have been subsequently developed.

The study of transportation problems helps to identify optimal transportation routes along with units of commodity to be shipped in order to minimize total cost.

Definition : A problem in which we optimize total transportation cost is called transportation problem. The transport problem is to transport various amounts of a single homogeneous commodity that are initially stored at various origins, to different destinations in such a way that the total transportation cost is minimum.

For example, assume that a manufacture has three factories $\mathbf{F_1, F_2}$ **and** $\mathbf{F_3}$ producing the same product. From these factories the product is transported to three warehouses $\boldsymbol{w_1, w_2}$ **and** $\boldsymbol{w_3}$. Each factory has a limited supply (capacity) and each warehouse has specific demand. Each factory can transport to each warehouse but the transportation costs vary in different combinations. The problem is to determine the quantity each factory should transport to each warehouse in order to minimize total costs.

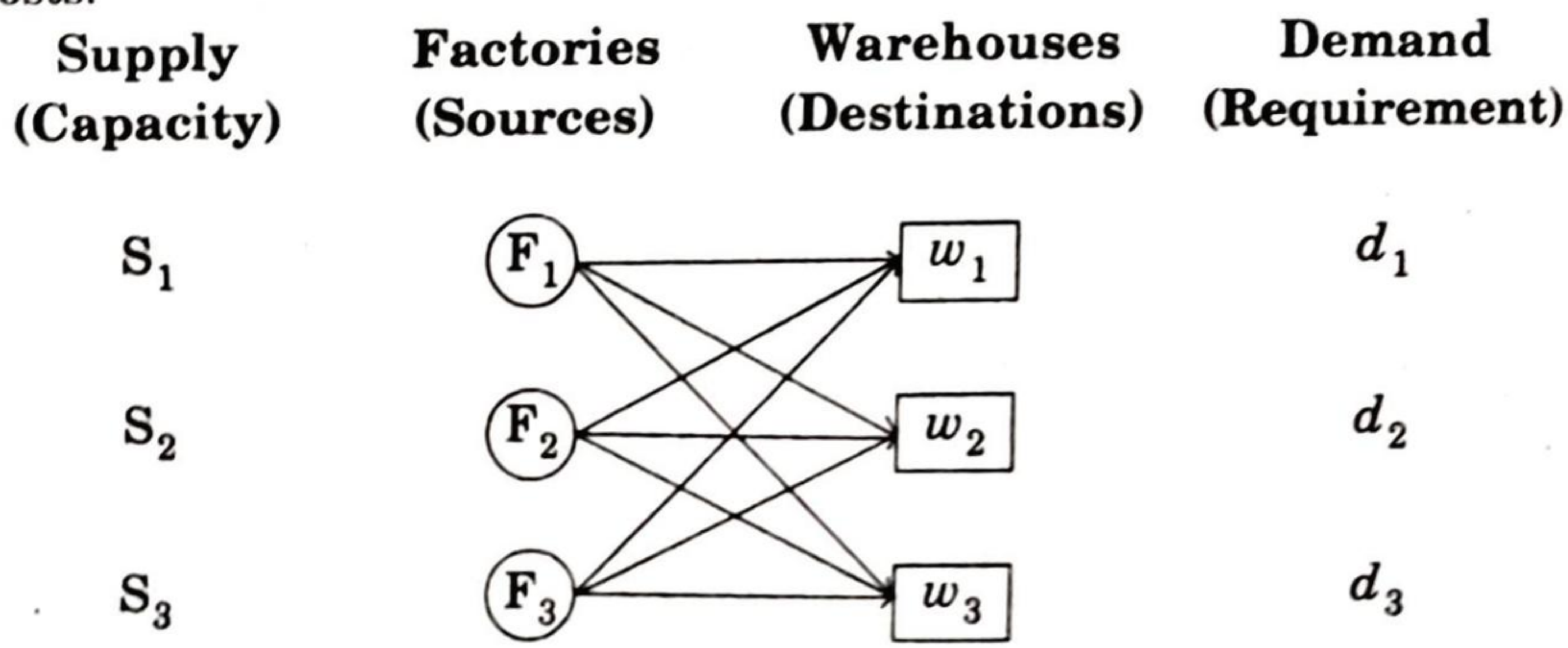

Fig.

Methods of Transportation Model-

(1) NWCM
North West Corner Method

(2) LCM
Least Cost Method

(3) VAM
Vogel's Approximation Method

(4) MODI
Modified Method

Transportation methods

North West Corner Method

The North-West Corner Rule is a method adopted to compute the initial feasible solution of the transportation problem. The name North-west corner is given to this method because the basic variables are selected from the extreme left corner.

The concept of North-West Corner can be well understood through a transportation problem given below:

Source \ To	D	E	F	Supply
A	5	8	4	50
B	6	6	3	40
C	3	9	6	60
Demand	20	95	35	150

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In the table, three sources A, B and C with the production capacity of 50 units, 40 units, 60 un of product respectively is given. Every day the demand of three retailers D, E, F is to be furnished with at least 20 units, 95 units and 35 units of product respectively. The transportati costs are also given in the matrix.

The prerequisite condition for solving the transportation problem is that demand should be ec to the supply. In case the demand is more than supply, then dummy origin is added to the tab The supply of dummy origin will be equal to the difference between the total supply and total demand. The cost associated with the dummy origin will be zero.

Similarly, in case the supply is more than the demand, then a dummy source is created who demand will be equivalent to the difference between supply and demand. Again the cost associated with the dummy source will be zero.

Once the demand and supply are equal, the following procedure is followed:

To / Source	D	E	F	Supply
A	5 20	8 30	4	50
B	6	6 40	3	40
C	3	9 25	6 35	60
Demand	20	95	35	150

1. Select the north-west or extreme left corner of the matrix, assign as many units as possible t cell AD, within the supply and demand constraints. Such as 20 units are assigned to the first cell, that satisfies the demand of destination D while the supply is in surplus.

2. Now move horizontally and assign 30 units to the cell AE. Since 30 units are available with the source A, the supply gets fully saturated 3. Now move vertically in the matrix and assign 40 units to Cell BE. The supply of source B also gets fully saturated.

4. Again move vertically, and assign 25 units to cell CE, the demand of destination E is fulfilled

5. Move horizontally in the matrix and assign 35 units to cell CF, both the demand and supply o origin and destination gets saturated. Now the total cost can be computed.

The Total cost can be computed by multiplying the units assigned to each cell with the concerned transportation cost. Therefore,

Total Cost = 20*5+ 30*8+ 40*6+ 25*9+ 35*6 = Rs 1015