considered by Von Thünen.

▢ II. LOCATION OF MANUFACTURING ACTIVITIES AND ITS THEORIES—THE THEORIES OF A. WEBER AND A. LÖSCH

The term manufacturing includes all activities whereby man assembles raw materials in an establishment, upgrades their usefulness by changing their form and distributes the finished products. The establishment that fulfills this function is the factory.

Like other economic activities, manufacturing also exhibits regional variation. It is due to the fact that the basic factor that determines the location of any manufacturing unit *i.e.* the positive cost-benefit ratio varies markedly with the process of manufacturing, inputs and the geo-economic and/or political character of the region on one hand and the tendency of the entrepreneurs to locate factories where they get the maximum profit or where the production cost is minimum so that they get the benefit of it on the other. So, to answer the question 'why the factories are there, where they are ?' the inspection requires extensive digging into the present and past relationships of individual factories with the locational factors. In other words, in considering the location of factories, the study of locational factors such as the sources of raw-materials ; market areas ; sources of labour supply ; fuel and power ; transportation lines ; local taxes etc. come into account.

An ideal manufacturing region must provide its factories with these essential requirements or atleast raw materials, power, labour and consumers. But such ideal locations rarely exist. In practice, the factory owners choose among locations that are well endowed in some of these elements according to their requirements.

Now, for a better understanding of the pattern of industrial location and to answer the question 'at which point in an economic region will a manufacturing plant tend to locate ?' usually geographers resort to theories of location. The central theme of these theories is to find the optimum location, where costs are lowest and revenues are highest for the industry. Two such theories are 'the Least Cost approach of A.Weber' and 'Maximum Revenue approach of A. Lösch'.

❐ (*a*) ALFRED WEBER

Alfred Weber, the German economist, for the first time popularised the least-cost industrial location through his book '*Uber den Standort der Industrien*' in 1909. He stressed that the manufacturer would best locate where the sum total of transport costs, involved in the collection of raw-materials and the distribution of finished products; and the processing costs, such as labour, infrastructure, service etc. is least. But Weber was certainly not the pioneer in this field. Probably Wilhelm Launhardt (1882, 1885), was the worthy predecessor of Weber, who tried to find out the optimum location within a triangle representing the corners by two sources of materials and a market.

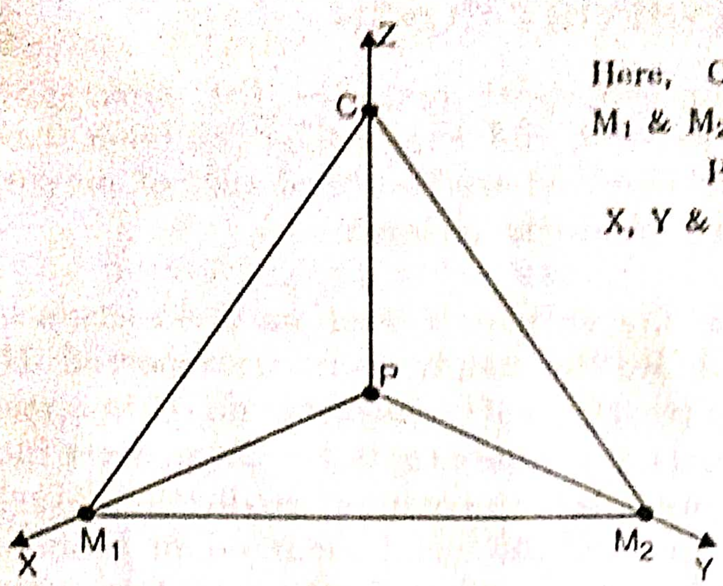

Fig. 3.6 The Locational Triangle of Launhardt

To a great extent Weber indebted to Launhardt for his idea of 'Least-Cost Locational Triangle'. Launhardt's idea could draw little attention of the outer world because it was limited to Germany only. But in comparison to Launhardt; Weber's book got wider exposition, after the publication of its English version, in 1929 (it was translated by C.J. Friedrich as 'A. Weber, Theory of Location of Industries')

Borrowing the basic idea from Launhardt, Weber limited his enquiry to the location of manufacturing only. To postulate his theory, he first simplified the real world situations by making several assumptions. His three main assumptions were—

(*i*) Raw materials (other than ubiquitous) occured at only a few locations and vary according to the weight;

(*ii*) The market existed only at specific places, where perfect competition prevails; and

(*iii*) The labour supply was immobile and available only at several specific locations, but having an unlimited supply at a specific wage level.

Besides these, his theory is also based upon a single isolated country with homogeneous conditions, where demand is uniform throughout for all the products, resulting in a uniform price, so that the plant located at the point of least cost would get the highest profit.

After simplifying the reality *i.e.* after giving the controlled laboratory condition, he visualised two general regional factors viz. **transport** and **labour costs** and an another local factor of **agglomeration** or **deglomeration** that exercise influence on industrial location.

❑ ROLE OF TRANSPORT COSTS

Weber viewed the transport costs as the most powerful determinant of plant location and sought first the least transport cost location. It is the point where the total cost of moving raw materials and finished products is least.

Weber considered the transport cost as a function of the distance to be covered and the weight to be transported. He also distinguished between two types of transportation costs—*assembly costs* and *marketing costs*. Assembly costs are those costs incurred in transporting raw materials to the point of production. Marketing costs, on the other hand are the costs incurred in transporting the produced commodity to the market. So the total transportation costs are merely the sum of assembly costs and marketing costs. Now, to him, if a plant locates at the market, then the total transportation costs will be equal to assembly costs, since marketing costs will necessarily be zero. Similarly, if a plant locates at the point where a raw material occurs, provided that it is the only raw material used, the assembly costs will be zero and only the marketing costs will be needed. If, however, a plant locates at neither the market point nor the raw-material point, both types of costs are incurred. The closer it is to the market, the greater is the assembly costs, and the smaller is the marketing costs. The closer it is to the raw-material, the smaller is the assembly costs, and the greater is the marketing costs.

To determine the role of transportation cost on manufacturing location and to find the least transport cost location, Weber classified the raw-materials on two bases—(*a*) on the basis of distribution and (*b*) whether they lose weight in the process of production or not.

Regarding the distribution, he pointed out that there are two extremes of raw material distribution. A raw material can occur everywhere throughout an economic region or at one or several particular points on it. The first type of raw materials he called *'Ubiquitous'* and the second he called *'Localised'*. Turning to the second basis, he referred to those raw materials which enter into the finished product without any weight loss as *'Pure'* and to those which lose weight, having only part of their weight in the finished product, as *"Gross"* raw-materials. He then theorised that the transport costs would operate in distinctively different ways in different cases. Let us here take two conditions to explain it :

Condition 1. If there is one market and one raw-material

- The best location for *ubiquitous* material is the market, because that will simply eliminate the transportation cost.
- The manufacturing units with *fixed* (localised) and *pure* raw materials should be located either at the market or at the source of the raw material.
- If the material is *fixed* but *gross*, then the best location will be at the source of the raw material.

Condition 2. If there are two raw materials and one market :

- If the raw materials (say M_1 & M_2) are *ubiquitous*, the best location would be at the market.
- If *one* material (say M_1) is *fixed* and the *other* (M_2) is *ubiquitous* but *both* are *pure*, the best location would be at the market, because then, only M_1 needs transportation.
- If M_1 & M_2 are *fixed* and *pure*, the best location will be at the market, because in that case lowest aggregate transportation charge will prevail.
- When M_1 & M_2 are *fixed* but *gross*, Weber used the Launhardt's 'Locational Triangle' to show how the least cost location attract industries. In this triangle; say, two raw materials M_1 & M_2 and a market C form the three corners of it. (Fig. 3.6). Now, each corner exerts a pull on the production point, according to its transportation charge and this ultimately gives rise to the least transport cost location P, where the total tonne-miles involved in getting materials to it and the finished product to the market is minimum.

The least transport cost production point P will be at the centre of the triangle, if the pulls of the three forces are equal, otherwise it will be located at or towards the point or corner of the origin of the dominant force. Generally it is seen that the weight losing manufacturing processes like iron ore smelting, tend to be located near the source of raw-materials while the weight gaining ones like baking, tend to be located near the market.

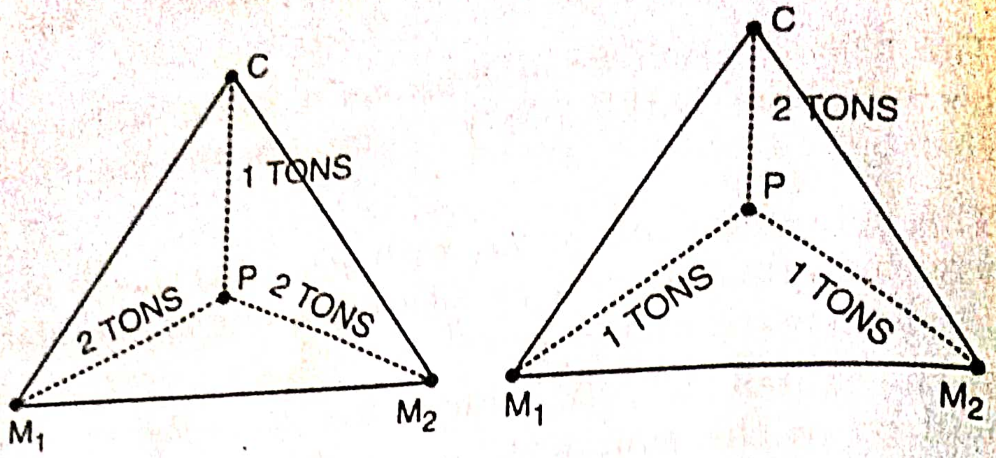

Fig. 3.7 Least transport cost location

An industry may be material or market oriented. To find out this orientation, Weber introduced the *material index* (MI) and the *locational weight*. The material index is nothing but the proportion of the used localised raw material to the weight of the finished product

$$MI = \frac{\text{Weight of the localised raw material}}{\text{Weight of the finished product}}$$

The material index can be explained with the following example. Say, the raw material used is coal. If there is no weight loss, so that 1 tonne of coal produces 1 tonne of finished product, then the material index would be 1 : 1 = 1. Similarly if 2 tonnes of coal produce 1 tonne of finished product (*i.e.* if there was weight loss), the material index would be 2 : 1 = 2.

The locational weight of a product on the other hand is the weight to be transported during the whole process of production *i.e.* the movement not only of raw materials but also the finished product. It is clear, then, that locational weight will be 1 plus the material index. If the MI = 0 (*i.e.* in the case where only ubiquitous raw materials are used), the locational weight will be 1 (1 + 0). If the MI is 0.5, the locational weight will be 1.5 (1 + 0.5). So, the locational weight of an industry increases constantly with increase in the material index.

Now, according to Weber, an industry will be material oriented, if the MI is greater than 1 *i.e.* the weight of the localised raw materials exceeds the weight of the finished product. On the other hand, if the weight of the finished product increases in the process of production, the material index becomes less than 1 and the industry will be market oriented. Generally it is seen that for pure or non-weight losing raw material, the MI is 1, but for impure or weight losing material, MI is greater than 1. Similarly, for weight gaining raw materials or industries MI becomes less than 1 and if only ubiquitous raw materials are used, then MI becomes zero. Naturally, one can visualise that industries with high locational weight will be pulled to raw material orientations and those with low locational weight (*i.e.* with low MI) will be pulled to market orientations.

❐ ROLE OF LABOUR COSTS

Turning to labour cost, the second general regional factor, Weber found out that cheap labour would divert the industry from the least transport cost location. Because, the industry would get the benefit of a cheaper labour cost. However, he pointed out that this attraction of efficient labour location is a substitute rather than an alternative.

Weber considered the labour as an important factor of production of an industry. He introduced the *labour cost index* to measure the importance of labour in an industry. Labour cost index is the proportion of labour cost to the weight of the product. The higher the index, the greater is the possibility of diversion of industry from the least transport cost location to cheap labour location. Further, according to him, when labour cost vary, an industry deviates from its transportation point in proportion to the size of its *Labour co-efficient*, which is the ratio of labour cost per unit weight of the product to the total weight of the raw material and finished product to be moved (Locational weight).

$$\text{Labour co-efficient} = \frac{\text{Labour weight}}{\text{Locational weight}}$$

In developing this analysis, Weber introduced his famous concept of isodapans (the lines joining the places of equal additional transport cost from the least transport cost point). It is quite obvious that, for labour, to pull the plant away from the least transport cost location, the savings in labour cost must exceed (or atleast equal) the additional costs above the minimum transport cost. The situation may be analysed by the following diagram.