UNIT 4: INDUSTRIAL LOCATION ANALYS

4.0 AIMS AND OBJECTIVES

The aim of this unit is to acquaint you with the factors the manufacturer should consider before setting up a factory.

After completing this unit, you will be able to:

- identify the technical, economic and institutional factors that should be considered before setting up a factory
- examine how individual firms react in locating their factories under different physical and economic circumstances
- Understand the industrial location trends in Ethiopia.

4.1 INTRODUCTION

In setting up a factory a manufacturer has to take three interrelated decisions simultaneously:

(1) The scale of operation,

(2) The technique to be adopted which involves the selection of the appropriate combination of the factors of production, and

(3) The location of the factory.

The conventional theory of the firm provides the rules or norms for taking the first two types of decisions but it ignores the third one completely. A separate branch of economics bordering with the discipline of geography, which is known as 'industrial location' or 'locational analysis', deals with the elements of the locational decision-making. In this unit we will study this branch of economics, i.e., the theories of industrial location and see how they are operationally useful in deciding the best location for an economic activity, eg, a factory in the context of industrial economics. The task of decision-making about industrial location is not very simple. A manufacturer has to consider several technical, economic and institutional factors for this. In the same unit, we will also examine the theoretical approaches to industrial locational analysis.

4.2 THE GENERAL DETERMINANTS OF INDUSTRIAL LOCATION

A factory, whose location analysis we are concerned in this unit, is a technical unit whose function is to convert a set of raw materials into some output with the help of men and machines, i.e., the factors of production. The raw materials and other inputs required by the factory for production will be rarely available at a place. The owners of the

factory will have to procure or obtain them from different places which involve transportation and other procurement costs. Similarly, the output of the factory will be rarely sold at a single place. It has to be sent to different places which again involve transportation and selling costs. Given the spatial distribution of the inputs and output markets, the owners of the factory will have to take the decision about the place where the factory should be located. All potential locations for the factory will not be equally economical. Only one of them is to be chosen which will be the most economical. How to make the choice for this? It is not very simple. A large number of technical, economic and infrastructural factors which exert pull and pressure on location of the factory in varying magnitudes are to be considered simultaneously. A general list of such factors is given below.

Technical Factors

These are the physical factors which are more or less geographical in nature related to soil, raw materials, people, climate, etc. The important factors in this category are:

1. Availability of land
2. Nature and quality of raw materials from land, eg. Forest products, agricultural inputs, minerals, and semi-finished products from existing industries.
3. Geographic situation of the factory site in relation to the transport facilities by rail, road, water and air.
4. Quantity and quality of human resources
5. Energy resources
6. Availability of water for drinking and industrial uses

7. Waste disposal facilities
8. Climate

Economic and Infrastructural Factors

Input prices, taxes, markets, skills of labour forces, availability of adequate infrastructural facilities, finance, etc, constitute together the category of economic factors. The general list of factors for this would be as follows:

1. Local markets
2. Situation in relation to export markets
3. Costs of land and buildings
4. Costs of infrastructural facilities such as transport charges, power tariffs, water-rates, etc.
5. Salaries and wages in relation to skills.
6. Taxes and subsidies
7. Cost and availability of finance
8. Structure of existing industries
9. Industrial relations and trade union activities around the proposed location sites.
10. Demographic factors such as age and sex composition of local population, literacy, professional skills, etc.
11. Local medical facilities Local cost of living
12. Housing facilities
13. Cultural facilities such as schools, clubs and other recreation centers.
14. Communication facilities.

Other factors

All other miscellaneous location factors may be put in this category. Two of them are:

1. Government policies towards location of new plants, and
2. Personal factors

Most of the governments pursue the policies of rapid industrialization of their states. They provide several facilities for locating new plants in some places or

regions. An entrepreneur has to evaluate the facilities given by the government very carefully before taking a decision location of his factory.

Personal factors also play important role in locational decision. A manufacturer may prefer to locate his factor at his birth place disregarding all economic factors. Industrial location based on such personal factors will entirely be a matter of chance or what is called as ‘historical accident’.

Most of the factors mentioned above are self-explanatory. The weights assigned to individual factors depend on the prevailing circumstances and nature of the industry. In some industries firms are located near sources of major raw materials such as iron and steel, and pulp and paper, while in other industries they are located near markets. All factors together provide a spatial configuration which is to be analyzed very carefully for the optimum location of a factory. The choice of location will not be independent of the scale of production and the technique to be used for that. They are interrelated aspects which are to be decided together. Some of the locational factors will be operative via their effect on the scale of production, some on the technique of production and some will be place-specific.
There are several theoretical and applied approaches for locational analysis based on the above mentioned factors. They are however partial in nature in the sense that they take into account only a few major locational factors assuming all other factors either constant or irrelevant. In order to understand the precise relevance of the various locational factors and the interactions among themselves. In the section that follows, the leading theoretical approaches to industrial locational analysis will be examined.

4.3 APPROACHES TO INDUSTRIAL LOCATIONAL ANALYSIS

The theoretical material on industrial location is very much diversified. Significant contributions were made to it by geographers and the economists. Their approaches however were different. The geographers, by and large, adopted intuitive conceptual base and case studies approach to arrive at some generalization about

the industrial location patterns. The economists on the other hand, followed a more formal, abstract or deductive approach_for location analysis. An integration of these two diversified approaches led to develop some operational models for location studies. Some important contributions to location theory made by the people of the two disciplines are as follows.

4.3.1 The Geographical Contributions

Geography provided several studies on this subject. A complete review of all geographical studies on industrial location is not intended here. We will rather present the runner's theory which has some theoretical relevance.

Renner's Theory

The objective of renner was to develop some general principles concerning industrial location. He classified industry into four categories: 'extractive', 'reproductive', 'fabricative', and 'facilitative'. To undertake any one of these six ingredients are required: raw materials, market, labour and management, power, capital and transportation. Keeping in mind these ingredients, renner postulated the law of location for fabricative (i.e., manufacturing) industry according to which any manufacturing industry tends to locate at a point which provides optimum access to its ingredients. It will, therefore, **locate near to**:

a) Raw materials, if it uses perishable or highly condensable raw substances; or
b) Market, where the processing adds fragility, perishability, weight, or bulk to the raw materials, or where its products are subject to rapid changes in style, design, or technological character; or
c) Power, where the mechanical energy cost of processing are the chief items in the total cost; or
d) Labor, where its wages to skilled workers are a large item of the total cost.

Apart from the above tendencies or 'laws', Renner gave a scheme for industrial symbiosis. There are different types were mentioned for this:

i) disjunctive symbiosis: where different industries having no 'organic' i.e., economic or technical connections among themselves, gain advantages by existing together at a particular place;

ii) Conjunctive symbiosis: where different industries with some 'organic' connection among themselves (i.e., inter-connections) are located together; and
iii) Co-industrialization: This is an advance stage of the conjunctive symbiosis leading thereby to a huge industrial belt of interconnected industries.

Renner's approach on industrial location is quite realistic as it tries to bring together the major determinants for that. However, he has not been able to go deep in analyzing the effects of spatial cost variation and industrial symbiosis, i.e., agglomeration an on industrial location. He merely describes the tendencies of industrial location based on these factors.

4.3.2 The Economic Theories of Industrial Location

The major theories of industrial location were developed by the economists. Some of them which we consider pioneering and useful in understanding the locational behavior of the firm are as follows:

Weber's Theory

Alfred Weber, a German economist, has developed one of the earliest approaches to explain the location of manufacturing industry. Earlier to Weber, another German economist Launhardt has given a simple principle of industrial location based on minimum transport cost. Weber followed Launhardt's principle in his theory and made it more rigorous and analytical. Ever since his theory is being used in practice.

Weber's main interest was to construct a general theory of location which could be applied to all industries at all times. For this he has taken into account the general factors of location which were relevant to all industries. The factors considered by him were divided into two groups: those influencing inter-regional location of industries (i.e., regional factors) and those influencing intra-regional location (i.e., agglomerating factors). He found three general factors which vary regionally: raw material costs, transport costs and labour costs. The fluctuations in raw material

costs were however included within transport costs. The approach followed by weber was to explain industrial location in terms of transport cost first and then to examine the effects of changes in labour cost and agglomerative factors on it. He made some simplifying assumptions for analysis such as:

i) the locations of raw materials including fuel are fixed;
ii) situation and size of consuming centers are given; and
iii) there are several fixed labour supply centers, labour is immobile and unlimited in supply at fixed wage rate.

Apart from these assumptions, Weber implicitly assumed the institutional factors like taxation, interest, insurance, etc., as insignificant locational factors. The economic culture and political system are treated to be uniform and stable across the locations. On the whole Weber assumed perfect competition for his model.

Weber started his analysis with the proposition that a manufacturing unit tends to locate where the number of ton miles of raw materials and finished product to be moved per ton of product would be minimum. Weber used the 'locational triangle' of Launhardt to find the place of minimum transport cost. He assumed a simple spatial situation in which there is only one consumption center (c) and two fixed supply centers (M_1 and M_2) for two most important raw materials (see fig. 4.1)

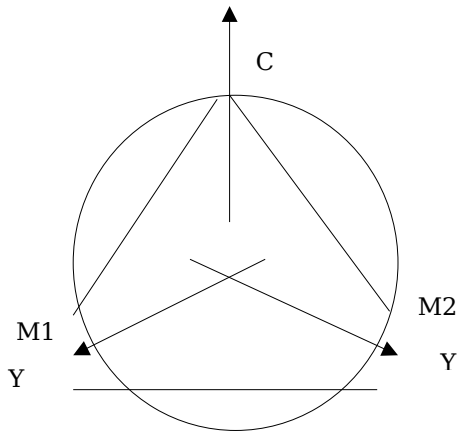


Fig4.1 The Location Triangle

There may be other consumption points and raw material supply centers but Weber did not consider all of them together. According to Weber, the least cost point will be located with in triangle CM_1M_2 such as the one shown by P. The three corner points of the triangle will be pulling the location point (P) towards themselves. The position of the point will depend on the balance of the pulls exercised by them. If the pull of any one corner is greater than the sum of the pulls of the other corners, production will be located at the point or corner of origin of the dominant force.

Central Place Theory of Losch

August Losch developed a general theory of location. He assumed a broad homogeneous plain with uniform resource endowment. This implies virtually rejection of all cost difference factors affecting industrial location. In such situation, the right approach to decide about the location is to maximize total revenue. An individual locates his plant at that particular site, where revenue is maximum. The maximization of revenue implies profit maximization because of the assumption of uniform cost conditions across the locational plain in losch model. To explain his theory, let us take a simple situation in which there is only one producer who is located at a central place. He sells his product around the location point in circular belt, the extent of which depends on the economies of scale accruing to the producer and the transportation, i.e., distribution cost of the product. The demand for the product falls with distance. The maximum extent of the market area for the producer is given by the distance when demand falls to zero because of high price for the product. This is shown by OF in Fig. 4.2

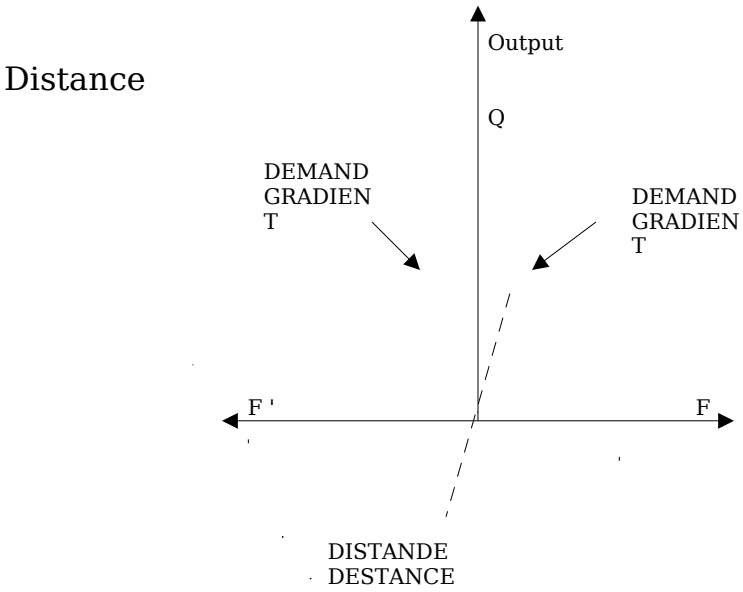


Fig. 4.2 Market area of firm (Losch model)

The circle with OF as radius defines the market area for the producer. O is the location of the producer at which OQ is the demand for his product. The producer being only one in the market makes profits. This attracts other competitors in the industry. They put up their plants in the area. There is no restriction for that. The resources are available. The entry of new producers gradually reduces the market area of the existing firms. Their markets will not continue to be circular but some irregular in shape.

Losch's theory is not giving anything about the factors which determine the location of individual firms. In fact, the assumptions of the theory are such that the location is indeterminate. The rejection of cost differences as locational factors is a major weakness of losch's theory. The theory being too much abstract in nature has limited usefulness for practical purposes.

NB: We may say that the economic theories of industrial location broadly fall into three categories:

- The least-cost school: which emphasize on cost factors neglecting the effect of the demand.
- The market-area school: It is the opposite of the above school. It considers the demand factors neglecting the cost factors.
- The interdependence school: concerned with finding the factors which attract producers towards each other.

4.4 OPERATIONAL APPROACHES TO INDUSTRIAL LOCATION

A manufacturing firm takes location decision right at the planning stage of its business. Once a factory is set up it cannot be shifted to any other place very easily. The firm therefore has to be very careful in making the locational choice for its factory. If there are mistakes in such decision the firm would not be able to correct them. There are several mistakes in such decision the firm would not be able to correct them. There are several geographical and economic approaches for location analysis, the important of which we have discussed above.

From operational point of view there are two general methods which may be used for locational decisions.

1. The linear programming framework

In this method the objective of cost-minimization or revenue or profit maximization is pursued subject to a set of constraints, related to location of a plant. The specification of the objective function and constraints and solution of such programming model for location analysis may not be simple enough. The investor who makes the location decision may therefore ignore this method in spite of its operational usefulness.

2. Project appraisal criteria

In this method, the investor identifies the location sites for its plant. Obviously, there will be only a few alternative sites and not infinite form which the investor will make the choice. Through a comparative study of costs and benefits at each site, the firm can make the optimum choice of location for its plant. This is simpler approach

free from computational complexities. What the firm has to do is to estimate the costs and benefits carefully by considering the technical, economic and other locational factors at the sites. There may be some subjectivity in assessing the benefits and costs of alternative locations but subjectivity is a normal feature of a business so one need not worry very much in this regard. In general, at present there is not unique or complete operational method for such decision-making. The application of the cost-benefit analysis is the only practical approach