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LOCATIONAL DETERMINANTS OF MANUFACTURING:

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CHAPTER I

INTRODUCTION

The increased awareness by states and individual communities of the benefits to be gained from increased industrialization has created a situation where a large number of localities compete for a scarce and limited amount of capital and entrepreneurship.

In recent years, as this competition has become keener, the role of attracting new industry has been assumed by state and community industrial developers. Fundamentally, the problem faced by industrial development agencies is one of salesmanship--how to "sell" the state or community to prospective investors. Like any other sales project, this one depends on a thorough knowledge of the product and the prospective buyer.

Specifically, the first step in an industrialization program requires a detailed knowledge of an area's locational inventory. In this context an area's inventory is the sum total of fixed and augmentable factors of

production--quantity, quality and cost. A detailed analysis of locational factors includes, among other factors, labor supply, skills and wage levels, raw materials availability, markets, transportation facilities, financial aids and tax structures.

Once the area's inventory is compiled, the best sales results can be arrived at when efforts are concentrated on firms and industries which are most suitable to locate in the area. This requires a method of analysis which will reveal the nature of firms in terms of their locational requirements.

Based upon those observations, it is the objective of this study to develop a model which will enable community industrial developers to predict the adaptability of a specific firm to a community, given the community's inventory of locational factors and the firm's operational needs. The aim of such a model is to supplement the existing methods of analysis currently employed by industrial developers in their attempt to solve industrialization problems. To convince the reader of the need and usefulness of the model, a brief exposition of the problems incurred in the locational choice and the traditional methods used to analyze these problems is in order.

The Locational Problem and Methods of Analysis

A simplified scheme of the operation of manufacturing will include these three broad operations:

1. The accumulation of productive factors and raw materials in one point.
2. Processing raw materials into a finished product.
3. Distribution of the product to markets.

Fundamentally, these three broad operations include a detailed assembly of labor, machinery, energy, raw materials, and management at the point of production, applying these productive factors, or inputs, to obtain a product, or output, and the distribution of that output to the firm's customers. At each stage of operation, the firm will try to minimize its costs so that the spread between cost and revenue, for a given output, will be maximized. In order to do so, the firm is confronted with an initial problem: given the firm's type of factor inputs, process of production and level of output, what location will allow for the most efficient operation?

To appreciate the complexity of the locational choice a few additional observations should be noted. First, although cost differentials among locations are realized by manufacturers and communities alike, it should also be realized that any given location might simultaneously

represent a point of high cost for one industry and a point of low cost for another.[1] Furthermore, the same might hold true for any two firms within an industry. This statement might apply to any two firms producing the same product but selling in different markets, or it might also be true for two firms, classified in the same industry, yet their product and type of operations differ (especially as to the need for factor inputs).

Secondly, the problem of industrial location becomes increasingly complex when the dynamics of technology, environment and institutions are realized. Specifically, technological advancement might add or subtract from a location's advantage through the invention of new raw materials and development of new techniques. Environmental changes, in the form of new transportation facilities, air-conditioning and institutional changes in the form of tax incentive legislation might affect a location in the same manner. As a result of this, the map of probable industrial sites has increased in area, making the choice of manufacturing more complex and the competition among localities keener.

How do industrial developers analyze and approach this competitive situation? Relying primarily on the broad

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[1]As has been termed by Joseph A. Russell, in "Geography of Industrial Cost." Leonard C. Yaseen, Plant Location (New York: American Research Council, 1956), p. 1.

principles of location theory and the factual findings of empirical studies, industrial developers employ a variety of means in their attempt to attract industry. The most fundamental approach taken by the states was an attempt to convince industry that their communities offer a maximum quantity and quality of locational and environmental factors. Among these factors, labor supply, low wage levels, raw materials, transportation facilities, schooling systems, and recreation facilities were the most commonly discussed. To supplement this approach, in recent years states started to offer a variety of inducements in the form of tax concessions, financial aid, and free training programs.

The inadequacy of this approach is demonstrated by considering the geographical distribution of manufacturing employment where some regions are over industrialized while others suffer an acute problem of under industrialization. To justify this statement, a detailed analysis of the empirical methods of investigation, which the above illustrated approach is based on, is needed.

A common method of determining locational factors of manufacturing is the subjective approach. By this method, in which manufacturing as a whole is studied empirically, firms are asked to rank, in order of importance, locational factors which attracted them to locate in their respective sites. The term subjective is being used since firms express

their value judgments with respect to locational factors. The result of such a study provides a broad idea of the array of reasons why manufacturing located in a specific area.[2]

The second method of analysis is a study of locational factors of specific industries. The method is objective in nature since industries are evaluated objectively with respect to their locational needs. Usually this is accomplished through an interegional comparison and cost differential analysis. The emphasis in this type study is placed on locational inventories and cost differential comparisons among regions in order to arrive at an optimal location for the industry under consideration.[3]

These methods of investigation seem to suffer from major shortcomings and thus their usefulness is somewhat limited.

Clearly, the subjective study, where all manufacturing is analyzed, is too broad in scope for practical purposes. This is so because the subjective study tells the investigator that, for example, 65 percent of the firms in the area view labor supply as a favorable locational

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[2]For an example of such a study see Melvin L. Greenhut, "An Empirical Model and Survey: New Plant Locations in Florida," The Review of Economics and Statistics, Vol. 41, 1959, pp. 433-438.

[3]A good example of such a study is Joseph Airov's The Location of the Synthetic-fiber Industry (New York: John Wiley & Sons Inc., 1959).

factor. To make use of such information, the analyst needs to know what are the characteristics of a firm which is attracted by the availability of labor supply. This information is not furnished by the subjective study. Thus, based on a previous observation that the analyst needs to know both the locational inventory of the area and the type of firm which might be attracted to it, this method provides only a partial answer.

In addition, the subjective study usually investigates all firms. This includes both in and out-of-state ventures. The fundamental difference between these two types of firms is the almost "accidental" choice of location by the in-state firms and the deliberate choice of site by the out-of-state firm.[4] This fact obviously introduces a bias in the conclusion of such studies.

On the other hand, the objective study, where individual industries are analyzed, offers only a limited answer when a range of firms are considered. To obtain a total picture of the probable adaptability of all industries to a specific area will require a lengthy and costly process of investigation. Because of the excessive cost associated

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[4]The reader is referred to a study by Eva Muller of Michigan's locational factors which shows that a high percentage of natives of Michigan chose that state as a location mainly because this was their home state. Location Decision and Industrial Mobility in Michigan, 1961 (Ann Arbor: Institute for Social Research, The University of Michigan, 1961), p. 16.

with such a project, communities usually analyze only a limited number of industries and thus run the risk of ignoring some potential investors.

Objective and Methodology

In recognition of the shortcomings of these studies the need arises to devise a method of analysis which will close the gap between the broad and specific studies. This gap can be closed when the analysis concentrates on specific types of operations, associating them with specific locational needs.

This last statement provides the cornerstone for the construction of the proposed model. Essentially, it is based upon two premises. First, assuming a rational behavior on the part of firms which located in a specific area, it might also be assumed that they were attracted to the area because of the availability of a satisfactory quantity and quality of locational factors.

The second premise is that firms can be categorized into groups, based upon common operational characteristics regardless of their industrial affiliation or product.

Based upon these premises, the question that needs to be answered is: what kind of firms were attracted to the area by which locational factors? This question can be answered by first asking firms to list the prime factors which attracted them to the area, and secondly, by grouping

firms according to common locational requirements and determining the major features of such firms. In statistical terms, an attempt should be made to correlate the nature of the firm with specific locational factors.

The main advantage of such an approach is twofold: First, it reveals what are the most attractive locational factors of an area as viewed by firms which build and operate their plants in the area. Secondly, once it is established what type of firm sought, and found in the area, a particular set of locational factors, potential investors whose nature of operations is similar in terms of locational needs can be isolated and approached.

Note that "nature of operations" is emphasized. This emphasis stems from the premise that locational requirements are determined by the firm's type of operation rather than by industrial classification or product. The entire study adheres to this premise.

The analysis of firms and locational factors has been pursued in the following manner: A group of two hundred firms which moved to Oklahoma in the last ten years has been approached. These firms were asked to provide two sets of data: first, a complete picture of the firm's operation in terms of structure, production and sales. Secondly, firms were asked to rank in order of importance the reasons which attracted them to their respective sites. To supplement this information, firms were also asked to

mention those locational factors particularly needed for the firm's type of operation.

Equipped with this information, a statistical technique known as discriminant analysis was utilized[5] to correlate groups of firms with specific locational factors. To illustrate the analysis consider the following example: the group of firms which indicated that the availability of labor supply attracted them to this state was isolated. This group was then compared to two other isolated groups of firms: those firms which placed minor importance on labor supply as locational attributes and those firms which did not mention this factor at all (thus indicating that labor supply was of no importance in their locational decision).

The aim in following this procedure was to determine whether the first group is significantly different from the two other groups. And if this group is different, how are the differences manifested. As was expected, the group of firms which was attracted to Oklahoma because of its satisfactory labor supply differed from the other groups primarily in being a labor intensive type of operation (high labor cost as a percentage of total cost and low investment per production worker).

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[5]A discussion of discriminant analysis is presented in pp. 28-29.

It should be emphasized that firms in this group belonged to different industries and produced different products. However, they did share some common denominators. The attempt to determine these common features and correlate firms sharing them with specific locational factors is the crux of this study.

Ten major locational factors have been mentioned by the firms in the survey. These factors, categorized as labor, operation cost and market factors are the following:

I. labor factors
   - A. wage levels
   - B. labor supply
   - C. labor and community attitude

II. operating cost factors
   - A. transportation
   - B. energy
   - C. proximity to raw materials
   - D. taxes

III. market factors
   - A. proximity to markets
   - B. competition
   - C. future markets.

Following the procedure outlined above for all ten factors provided a complete econometric model. This model defines and estimates the parameters of firms' characteristics with respect to locational needs. The model, or picture, reveals

to the investigator both Oklahoma's locational inventory as viewed by manufacturing and the nature of firms attracted to it.

Through the use of the complete model the probable adaptability to the state of a prospective investor can be evaluated. The precise procedure is described in Chapter II. Briefly, the procedure consists of determining the operational nature of the prospective firm and evaluating how closely it resembles the nature of the firms included in the model in terms of their locational factor preferences.

Following this procedure, the investigator can decide whether the new firm, given the nature of its operations, will find, based upon the experience of similar firms, its needs fulfilled in Oklahoma.

To achieve the objectives of this study, Chapter II presents an outline of location theory and the complete model. Chapters III, IV and V present the ten locational factors as categorized above. In each of these chapters the applicable part of the model is presented and evaluated for each locational factor. In addition to the quantitative depiction of the nature of firms associated with this factor, the study explores the theory and findings of some empirical studies concerning that factor.

To round out the picture, for each locational attribute, the study presents the applicable locational inventory in the region. The region in this study is comprised of the following states: Oklahoma, Texas, Arkansas, Kansas and Missouri. The purpose of this presentation is not to compare the states in terms of their locational inventory but to recreate the set of conditions that firms faced while choosing their respective sites. Chapter VI presents the findings and conclusions of the study.

Summary

The basic points of this study can be recapitulated as follows:

1. Approximately two hundred firms moved to Oklahoma in the last ten years.
2. Through a questionnaire and personal interviews it was discovered what attracted each firm to the state.
3. Firms were grouped by their locational factor preferences.
4. For each locational factor, the nature of the group of firms attracted by it was determined.
5. To predict the probable adaptability of a potential investor to the state, the study porposes

to check for each locational factor, whether the nature of the new firm corresponds to the nature of operations of the firms which established plants in the state.

6. The central premise was the following: These firms were attracted to the state because of the existence of a set of favorable locational factors. If the nature of operations of the potential investor resembles the nature of these firms, there is a high probability, based on the experience of these firms, that the new firm might operate successfully in Oklahoma.

CHAPTER II

THE THEORETICAL FRAMEWORK AND THE MODEL

The purpose of this chapter is to provide the general theoretical framework for the study and to present and explain the model. The first part of the chapter outlines the development of plant location theory, its basic principles and underlying assumptions. Part II follows in detail the construction of the model and its practical applications. Both model and theory are combined in one chapter because the former gains its validity from the latter.

Review of Plant Location Theory[1]

The theory of the firm analyzes the individual firm as a producer, buyer of factor inputs and seller. For the purpose of simplicity, the analysis is one dimensional and activities are assumed to be conducted at a homogeneous point in space (homogeneous with respect to factor inputs).

[1]The review of plant location theory draws on the following works: M. L. Greenhut, Microeconomics and the Space Economy (Chicago: Scott Foresman and Co., 1963) and Plant Location in Theory and Practice (Chapel Hill, North Carolina: North Carolina Press, 1956); A. Weber, The Theory of Location of Industries (Chicago: The University of Chicago Press, 1929); and W. Isard, Location and Space Economy (New York: John Wiley & Sons, 1956).

Following the assumptions of profit maximization, the firm will substitute among factor inputs, within technical limits, so that total costs will be minimized and, hence, profits maximized. Factor inputs are reduced to the compact form of land, labor and capital.

Location theory, being an extension of the theory of the firm, has added another dimension to the analysis by observing the firm as it operates in space rather than at a point. By adding the spatial aspect, the analysis is expanded through the relaxation of the homogeneity assumption and the dispersion of markets. In addition, modern location theory gives cognizance to and specifies costs, other than those associated directly with the process of production. In short, location theory recognizes that there exists a set of factors, external to the firm, which influence the firm's cost-profit structure. Since these factors vary from location to location and since it is assumed that the rational firm tries to maintain the most favorable cost-profit structure, a fundamental question which the firm has to provide an answer for is: where to produce? The theory of the location of manufacturing deals with this question.

The presentation of plant location theory will follow its chronological development with emphasis on various schools of thought. By no means does this presentation intend to explore each school fully. Rather, a summary of the essential points and contributions of each school will

be presented to show the development of the various partial theories and their integration into a general theory of plant location.

Historically, the development of interest in the problem of the spatial aspects of economic activity--agriculture and manufacturing--is attributed to three German economists: Launhardt,[2] von Thünen[3] and Weber.[4]

The following discussion will concentrate on von Thünen and Weber. Although von Thünen's theory intended to explain the location of agricultural activity, some inferences can be made to the location of manufacturing units. In order to do so cost determinants of produce--rent and transportation--should be changed to costs of factor inputs at different locations plus transportation costs.

Some simplifying assumptions are utilized; locational alternatives are assumed to be homogeneous with respect to factor inputs--their cost and productivity. Variations among locations are attributed to rent and transportation costs.

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[2]W. Launhardt, Mathematische Begründung der Volkswirtschaftslehre (Leipzig: B. G. Teubner, 1885).

[3]J. H. von Thünen, Der Isolierte Staat in Bezichung auf landwirtschaft und Nationalökonomie 3rd ed. (Berlin: Schumacher-Zarchlin, 1875).

[4]Weber, The Theory of Location.

Von Thünen's analysis can be presented graphically as follows:

A Representation of Von Thünen's Approach

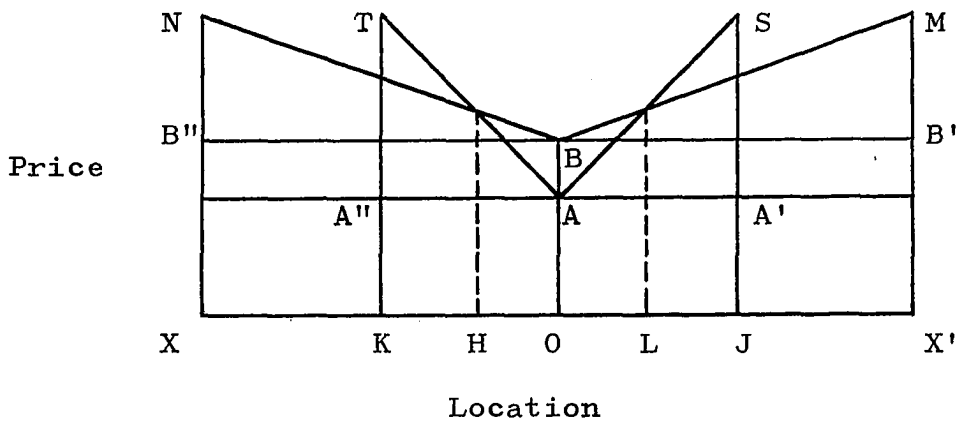

Figure 1

Cost of production of crops A and B is OA and OB respectively. The cost of transporting a unit of crop A over a distance OK (or OJ) in A'S while the per unit transportation cost of crop B over a distance OX (or OX') is B'M. It is obvious that the cost of transportation of crop A is higher than crop B. (Compare distance differences and slopes of AS and BM.)

Given the previous assumptions of uniformity in cost of production and productivity at all locations, transportation costs differentials will cause crop A to be grown in region OL (OH) and crop B in region LX' (HX).

Weber approaches the problem from the same angle. Like von Thünen, he is concerned with the cost aspect.

However, while both agree on finding an optimum location where total costs are minimized, Weber expands the primary locational factors and adds agglomeration or deglomeration[5] influences to labor and transportation. Since the manufacturer seeks to minimize his costs, he will locate at a point where the combination of labor and transportation costs yield the lowest total costs. The analysis, however, gains complexity when agglomeration forces are introduced. Here external economics or diseconomics may change the firm's cost structure. The movement to or from a location will depend now on a combined effect of three forces on the firm, where each may be pulling in a different direction. The optimum location, therefore, will be arrived at by substituting between cost of transportation and the cost of other factors as affected by agglomeration or deglomeration forces.

These two theories are partial in nature since they ignore both demand and institutional cost factors such as taxes and cost of capital. Emphasis is being put on least cost combinations of factor inputs and transportation.

The least cost approach to plant location continued to dominate plant location analysis in the Weberian tradition.

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[5]Agglomeration and deglomeration forces in the Weberian system refer to external economies and diseconomies respectively. The advantages of a trained labor force and auxiliary industries signifies the former and the disadvantages of higher rents and competition for factor inputs appear in the latter.

The main features of this approach were the desire to find an optimum cost location, the assumption of a purely competitive market and the existence of a central buying point and hence disregard for demand factors. It should be mentioned at this point that writers such as Polanders and Hoover[6] did take into account the size of the market in their analysis which inherently implies interest in demand factors.

The development of the theory of plant location followed a similar route to that of the theory of value. The writings of Fetter,[7] Hotelling,[8] Lerner,[9] Smithies[10] and Chamberling[11] were concerned with market and demand factors in the locational decision, as opposed to early writers who were concerned almost exclusively with cost aspects. The synthesis of both and the expansion of the

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[6]Greenhut, The Space Economy, pp. 160-161.

[7]F. Fetter, "The Economic Laws of Market Areas," Quarterly Journal of Economics, XXXVIII, 1924, p. 520-529.

[8]H. Hotelling, "Stability in Competition," Economic Journal, XXXIX, 1929, p. 41-57.

[9]A. P. Lerner and H. W. Singer, "Some Notes on Duopoly and Spatial Competition," Journal of Political Economy, XLV, 1937, p. 445-486.

[10]A. F. Smithies, "Optimum Location in Spatial Competition," Journal of Political Economy, XLIX, 1941, p. 423-439.

[11]E. H. Chamberlin, The Theory of Monopolistic Competition, 5th ed. (Cambridge: Harvard University Press, 1946).

theory to include institutional and personal factors were provided by the writings of Isard[12] and Greenhut.[13] The forthcoming discussion will present a summary of the market-demand and general synthesis approaches.

The basic assumption in the market-demand approach to the locational decision was that costs of production were equal at all locations. The locational decision, therefore, is influenced primarily by the firm's desire to dominate the largest market area. This stems from the idea that buyers are scattered, rather than concentrated at a point. Delivery cost, therefore, or the cost incurred by the customer traveling to the selling point, becomes the factor which influences most the selection of plant location.

The question then, becomes, at what location will the firm be able to sell at the "best" price (where the spread between costs and revenue is the highest) to the largest number of customers. This inevitably depends on the location of competitors. This approach, therefore, stresses the locational interdependence of firms.

The major points of interest investigated are:

a. The shape of the demand curve for the industry.

b. The shape of the marginal cost curves.

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[12]Isard, Location of Space Economy.

[13]Greenhut, Plant Location in Theory and Practice.

c. Freight rates.[14]

Where variations in elasticity of demand, the slope of the marginal cost curves (its characteristics) and freight rates will determine the degree of dispersion or concentration of firms within an industry.

The synthesis of the least cost and market demand approaches has been provided by August Lösch.[15] Cost of production at alternative sites and the controllable market area at each location are determinants of plant location in the Löschian system. The writings of Lösch and Hoover[16] are characteristics of the development of classical location theory. Although both cost and markets were recognized by most writers and synthesized by some of them (especially Lösch and Hoover), the nature of their models were such that variations were allowed in either cost or markets but not in both. Thus, these theories can be described as partial in nature.

The synthesized conclusions of these theories are described by Melvin Greenhut:[17]

> (1) When firms sell to a given buying point, they seek the least cost location and ignore the location of rivals.

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[14]Greenhut, Plant Location. For more details, see discussion of competition as a locational factor in Chapter IV of the study.

[15]August Lösch, The Economics of Location (New Haven: Yale University Press, 1954).

[16]Hoover, Location of Economic Activity.

[17]Greenhut, Plant Location, pp. 268-269.

(2) When firms sell over a market area, their site selection is influenced by the location of rivals.

(3) In selecting a plant site each firm seeks the place which offers the optimum sales output at a cost that cannot be matched elsewhere.

(4) When firms sell over a market area, the tendency to disperse depends upon the height of freight cost, the elasticity of the demand function, the characteristics of the marginal costs, the degree of competition in location, the degree of competition from substitutable products at the various locations, and the homogeneity or heterogeneity of the firms belonging to the industry.

Modern plant location theory, through the introduction of empirical research, gives cognizance to the fact that the locational decision of the firm is motivated by an array of factors both internal and external to the firm. Instead of investigating the cost of production in the classical tradition, the modern theory deals with the cost of operations. Cost of transportation, taxes, financial aids and investment incentives, labor climate and personal motives are an integral part of the firm's cost of operation (either direct money outlay or opportunity costs) and, therefore, influential factors in the locational decision.

Also, instead of analyzing market demand in terms of a given market area, the modern theory explores the effect of close contact between buyer and seller, prompt service, anticipated future markets and personal relationships on the firm's locational choice.

No theory of location can be complete if the assumed profit maximization behavior of the firm is not questioned. It has been pointed out by Eva Muler in her study of Michigan's locational factors that personal location preferences might be strong enough a motive to influence the firm's locational decision.[18] Here, the desire to maximize utility rather than profits dominates.

Another case to consider is where the firm's decision to attain a certain rate of profits or a specific volume of sales might take precedence over profit maximization goals. The firm's locational choice in such a case is motivated and directed by these objectives; and, the optimal site, from the firm's point of view, will be the one which will offer an environment conducive to the attainment of such goals.[19]

These conclusions were arrived at with the introduction of empirical studies to supplement the pure theory. Admittedly, the quantification of such motives is impossible. However, no model depicting the locational decision of the firm is complete when personal considerations are ignored.

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[18]Eva Muller, Arnold Wilken and Margaret Wood, Location Decision and Industrial Mobility in Michigan 1961 (Ann Arbor: Institute for Social Research, The University of Michigan Press, 1961), p. 15.

[19]These goals, termed "satisficing" appear in Herbert A. Simon, Theories in Decision Making in Economics and Behavioral Sciences. The American Economic Review, XLIX, June, 1959, p. 263.

The main contribution of empirical studies to the theory of plant location is the provision of checks and its expansion of the explanatory and predictive attributes of the pure theory. This is accomplished through the study of individual firms and the motives behind their locational choice. Good examples of such studies are An Explanation of Plant Location in Tennessee, 1955-65[20] and Why Industry Moves South.[21]

The conclusions of these and other studies show the importance of labor supply and its attitude, existence of markets and raw materials and the role of personal considerations in the firm's locational decision. The relative importance of each of these factors is dominated by the firm's orientation.

The present study is empirical in nature. Its findings, however, are supported by both theory of plant location and the conclusions of other empirical studies. The presentation of the model in the following pages and the analysis of locational factors in Chapters III, IV, and V are expected to reaffirm this statement. In each of these chapters, the discussion of each of the ten major

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[20]William R. Schriver and Ronald E. Carrier, An Explanation of Plant Location in Tennessee, 1955-1965 (Bureau of Business and Economic Research, Memphis State University, 1966).

[21]Glen E. McLaughlin and Stefan Robock, Why Industry Moves South (National Planning Association, Committee of the South, 1949).

locational factors will be supplemented by theoretical principles and empirical findings of this and other studies.

Construction of the Model

The purpose of this model is to aid industrial developers to predict the probable adaptability of a specific firm to the state of Oklahoma--given the firm's nature of operations and locational needs and the state's locational inventory.

The data upon which the model is constructed fall into two categories:

1. Profiles of firms
2. Locational factors which attracted these firms to the state.

This data was assembled through a questionnaire sent to approximately two hundred firms which moved to the state from 1959 to 1969.

The information pertaining to the profiles of firms included the following:[22]

A. General information
   1. Initial investment
   2. Annual sales
   3. Number of employees and production workers
   4. Product

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[22]For more details see questionnaire in Appendix I.

B. Processing information

1. Type and origin of raw materials
2. Means of transportation for raw materials delivery
3. Type of workers (by skill)
4. Percentage of total cost for labor, transportation and energy
5. Types and sources of energy

C. Marketing information

1. Location of markets and percentage sold in each
2. Means of transportation of finished product

The second set of data pertains to the locational decision of the firm. In this part of the questionnaire firms were asked to rank in order of importance (1 to 6) the factors which were most influential in their locational choice.[23] All locational factors which were ranked by at least ten percent of the firms were included in the model. These factors are:

1. Wage levels
2. Labor supply
3. Labor and community attitude
4. Transportation facilities
5. Energy

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[23]For detailed instructions see questionnaire in Appendix I.

6. Proximity to raw materials
7. Taxes
8. Proximity to markets
9. Competition
10. Future markets

In the construction of the model these two sets of data are utilized in the following manner. For each locational factor, a question is asked: Can the group of firms, specifying the importance of this factor, be distinguished from any other group of firms? A second question is: If this group is different, can the differences be specified and quantitatively determined?

To answer these questions, firms in the study have been divided into three groups. With respect to each locational factor, group A includes firms placing high priority on the factor (ranking 1 to 3); group B placing a lesser degree of importance to this factor (ranking 4 to 6); and group C, a group of firms which placed no importance on the factor (no ranking). This ranking is indicative of the degree of importance that firms in the survey attached to each locational factor. To determine whether any differences exist among groups A, B and C the method of discriminant analysis[24] is used.

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[24]For a detailed discussion of discriminant analysis see Gerhard Tintner, Econometrics (N.Y.: John Wiley and Sons, 1952), pp. 96-102. See also R. A. Fisher, "The Use of Multiple Measurements in Taxonomic Problems."

In general, this statistical method is designed to analyze a set of variables and estimate a function which best distinguishes among the groups. More specifically, the analysis determines the linear combination of the various measurements which best discriminates among the groups. For simplicity, consider an example of two groups. Assume N normally distributed observations on p variables X_i, denoted by X_{it} ($i = 1,2,\ldots p$; $t = 1,2 \ldots N$) and which are classified into two groups where $t = 1,2 \ldots N_1$ and $t = N_1 + 1, N_1 + 2, \ldots N_1 + N_2 = N$. The group means are:

$$(1) \quad \bar{X}_i^* = \sum_{t=1}^{N_1} \frac{X_{it}}{N_1}, \qquad \bar{X}_i^{**} \sum_{t=N_1+1}^{N_2} \frac{X_{it}}{N_2} \qquad (i = 1,2,\ldots p)$$

and the difference of the means is:

$$(2) \quad d_i = \bar{X}_i^{**} - \bar{X}_i^* \qquad (i = 1,2,\ldots p)$$

what is the linear function of the mean differences:

$$(3) \quad Z = k_i d_i + k_2 d_2 + \ldots + k_p d_p$$

which best discriminates between the two sets of variables?

Annals of Eugenics, Vol. 7, 1936, p. 179 and C. R. Rao on 'Some Problems Arising out of Discrimination with Multiple Variables," Sankhya, Vol. 9, 1944, p. 343. For a practical application of discriminant analysis see James R. Prescott and William C. Lewis, "State and Municipal Tax Incentives: A Discriminant Analysis," National Tax Journal, Vol. XXII, No. 3, September 1969.

To best perform this task, a multiple discriminant analysis in a stepwise manner has been selected.[25] The discriminant function is arrived at by following this procedure:

Given a set of variables, at each step one variable is entered into the set of discriminating variables according to the following criteria:

(1) The variable with the largest F value.

(2) The variable which when partially correlated with the previously entered variables has the highest multiple correlation with the groups.

(3) The variable which gives the greatest decrease in the ratio of within to total generalized variance.

Computational Procedure:

Notation: p = number of variables

g = number of groups used for the analysis

n_m = number of cases in group m

n = total number of cases

x_{mki} = value of variable i for case k of group m

Assume for simplicity that the first t of the g groups are

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[25] The description of this analysis is taken from the BMD07M computer program written by Paul Sampson of the Health Science Computing facility, UCLA, 1967. The practical application of stepwise discrimination analysis can be seen in Irma Adelman and C. T. Morris, "An Econometric Model of Socioeconomic and Political Change in Underdeveloped Countries," The American Economic Review, LVIII, No. 5, December, 1968, pp. 1184-1219.

used for the analysis,

Step 1. The following are formed:

$$\text{Means } \bar{x}_i = \frac{1}{n} \sum_{m=1}^{g} \sum_{m=1}^{n_m} x_{mki} \qquad i = 1,2,\ldots,p$$

$$\text{Group means } \bar{x}_{mi} = \frac{1}{n_m} \sum_{k=1}^{n_m} x_{mki} \qquad \begin{matrix} i = 1,2,\ldots,p \\ m = 1,2,\ldots,t \end{matrix}$$

Group standard deviations

$$s_{mi} = \sqrt{\frac{1}{n_m - 1} \sum_{k=1}^{n_m} (x_{mki} - \bar{x}_{mi})^2} \qquad \begin{matrix} i = 1,2,\ldots,p \\ m = 1,2,\ldots,t \end{matrix}$$

Within and total cross-product matrices

$$W = \{w_{ij}\};\ w_{ij} = \sum_{m=1}^{g} \sum_{k=1}^{n_m} (x_{mki} - \bar{x}_{mi})(x_{mkj} - \bar{x}_{mj})$$

$$T = \{t_{ij}\};\ t_{ij} = \sum_{m=1}^{g} \sum_{k=1}^{n_m} (x_{mki} - \bar{x}_i)(x_{mkj} - \bar{x}_j) \qquad \begin{matrix} i = 1,2,\ldots,p \\ j = 1,2,\ldots,p \end{matrix}$$

Within groups covariance matrix

$$V = \{v_{ij}\};\ v_{ij} = \frac{1}{n-g} w_{ij} \qquad \begin{matrix} i = 1,2,\ldots,p \\ j = 1,2,\ldots,p \end{matrix}$$

Within groups correlation matrix

$$R = \{r_{ij}\};\ r_{ij} = \frac{w_{ij}}{\sqrt{w_{ii} w_{jj}}} \qquad \begin{matrix} i = 1,2,\ldots,p \\ j = 1,2,\ldots,p \end{matrix}$$

Step 2. At each step of the procedure the variables are divided into two disjoint sets; those included in the discriminant functions and those not included. Assume for simplicity that the first r are included.

$$\text{Let } W = \begin{bmatrix} W_{11} & W_{12} \\ W_{21} & W_{22} \end{bmatrix} \qquad \text{and} \qquad T = \begin{bmatrix} T_{11} & T_{12} \\ T_{21} & T_{22} \end{bmatrix}$$

where W_{11} and T_{11} are rxr.

$$\text{Let } A = \begin{bmatrix} W_{11}^{-1} & W_{11}^{-1} W_{12} \\ W_{21} W_{11}^{-1} & W_{22} - W_{21} W_{11}^{-1} W_{12} \end{bmatrix} = \left\{ a_{ij} \right\}$$

$$\text{and } B = \begin{bmatrix} T_{11}^{-1} & T_{11}^{-1} T_{12} \\ T_{21} T_{11}^{-1} & T_{22} - T_{21} T_{11}^{-1} T_{12} \end{bmatrix} = \left\{ b_{ij} \right\}$$

The coefficients and constant terms of the discriminant functions are computed:

$$c_{ki} = (n-g) \sum_{j=1}^{r} \bar{x}_{kj} \, a_{ij} \qquad \begin{matrix} i = 1,2,\ldots,r \\ k = 1,2,\ldots,g \end{matrix}$$

$$c_{ko} = -\frac{1}{2} \sum_{i=1}^{r} c_{ki} \, \bar{X}_{ki} \qquad k = 1,2,\ldots,g$$

In addition, the program classifies each case (firm) into each group and the probability of belonging to the group is calculated.

Based on this procedure the model consists of eleven equations and twenty variables. The variables were gathered and calculated from the information concerning the profiles of firms in the survey.

Variable Notation:

X_1 = Total initial investment

X_2 = Annual sales

X_3 = Number of employees

X_4 = Ratio of sales to production workers

X_5 = Ratio of investment to production workers

X_6 = Ratio of sales to investment

X_7 = Percentage cost of labor out of total cost

X_8 = Percentage cost of energy out of total cost

X_9 = Percentage cost of raw materials transportation out of total cost

X_{10} = Percentage cost of finished product transportation out of total cost

$X_{11} = X_9 + X_{10}$

X_{12} = Percentage sales in Oklahoma out of total sales

X_{13} = County labor force (site of plants)

X_{14} = Average percentage of unemployment in county (site of plants)

X_{15} = Number of major skills required in the process of production.

X_{16} = Skilled or unskilled labor index (assigning 1 to skilled labor and 0 to unskilled labor)

X_{17} = Unionization index (assigning 1 to a unionized plant and 0 to nonunion plant)

X_{18} = Distribution index = $\frac{r.D}{100}$ where

r = Percentage sales of total in a specific market
D = Distance to market (miles)

X_{19} = Product index (assigning 1 to consumer good and 0 to industrial product)

X_{20} = Number of raw material sources

These twenty variables were chosen to represent the characteristics of the firms. The value of investment

sales and number of employees are indicative of the relative size of the firm. The ratios of sales to production worker, investment to production worker and sales to investment show whether the firm is labor or capital intensive (relative to other firms). The percentage cost of labor, energy and transportation of raw materials and finished product offer some clue as to the firm's orientation--labor, raw materials or markets.

X_{13} and X_{14} have been introduced into the model in order to examine the attractiveness of the existence of a large labor force available to be hired as indicated by the size of county labor force and average unemployment. X_{16} examines the needs for skilled or unskilled labor given the firms type of operations. X_{17} checks the firm's acceptance of unionized labor and X_{18} differentiates between firms whose markets are the state, region or national markets. X_{19} categorizes firms into producers of consumer or industrial goods.

The choice of variables in the attempt to determine the nature of firms preferring a specific locational factor is arbitrary. The alternative to an arbitrary choice of variables in the analysis of each factor is the introduction of all twenty variables. This might have resulted in nonsense correlation such as firms attracted to Oklahoma's labor supply are characterized by high percentage cost of transportation of finished product.

To avoid this pitfall this study attempts to develop a functional relationship between a locational factor and the type of firm. For example, it is expected that a low wage level as a locational factor will be desired by a firm which is characterized by a relatively large labor force, the expenditures on labor as a percentage of total cost is relatively high and a low ratio of investment to production worker (indicating labor intensiveness). Therefore, the choice of variables to be introduced into the analysis of wage level was restricted to those which bear some relationship to wage levels as a desired locational factor.

A similar approach has been taken with respect to all other locational factors. This procedure has been selected in order to obtain a clue as to the general orientation of the group of firms which were attracted to the state because of a specific factor. The model's results are expected to reaffirm the principles of location theory outlined at the outset of this chapter; the firm's orientation guidelines its locational choice.

The Model

The following model, arranged in order of labor, operating cost and market factors, identifies the major characteristics of firms attracted to Oklahoma by various locational factors. For each factor, the model presents

the linear combination of firms' characteristics that best discriminate among the three groups of firms. The variables appearing in the function are those which distinguish the group of firms attracted by a specific factor, from firms which either placed minor importance or were indifferent to that factor.

A. Labor factors

1. Wage level = $f(X_3, X_7, X_6, X_{15})$
2. Labor supply = $f(X_3, X_7, X_4, X_5, X_6, X_{13}, X_{14}, X_{15}, X_{16})$
3. Labor and Community Attitude = $f(X_2, X_3, X_{17}, X_5)$

B. Operation cost factors

1. Transportation = $f(X_{12}, X_{18}, X_{19})$
2. Energy = $f(X_6, X_8)$
3. Proximity to raw materials = $f(X_2, X_9, X_4)$
4. Taxes = $f(X_1)$

C. Market factors

1. Proximity to markets = $f(X_{12}, X_{19})$
2. Competition = $f(X_{18}, X_4, X_{19})$
3. Future markets = $f(X_1, X_2, X_{18})$

To illustrate the significance of the functions consider function 1 where: Wage level = $f(X_3, X_6, X_7, X_{15})$

The following ten variables were used in the analysis:

1. Size of employment (X_3)
2. Cost of labor as a percentage of total cost (X_7)

3. Ratio of sales to production worker (X_4)
4. Ratio of investment to production worker (X_5)
5. Ratio of sales to investment (X_6)
6. Size of county labor force (X_{13})
7. Average unemployment in county (X_{14})
8. Number of skills required in operations (X_{15})
9. Index of skilled/unskilled labor needs (X_{16})
10. Unionization index (X_{17})

The problem was to identify the variables (characteristics) which best distinguish the group of firms attracted by Oklahoma's wage level from the firms which placed intermediate importance on this factor and a group of firms which were indifferent to wage levels.

The ten variables in the analysis were chosen on the basis of their effect on a firm's policy with respect to wage level. The assumption is that a change in magnitude in one or a combination of the variables will affect the firm's desire for or indifference to a low wage level. The aim was to develop a functional relationship between the factor and the variables in the analysis.

Note that X_{13} and X_{14} are variables external to the firm. They were introduced, nevertheless, to check whether prospective plant sites were influenced by the existence of a large labor force (which might indicate the availability of diversified skills) and the rate of unemployment (which might indicate the availability of

ready labor). X_{16} and X_{17} were introduced to explore whether the need for skilled or unskilled labor and whether a plant is unionized or not bears any effect on the firm's wage policy.

The function itself should be interpreted as follows:

> The group of firms which expressed a desire for a low wage level and were satisfied with this locational factor in Oklahoma are distinguished from the other two groups by:
>
> a. Size of labor force (X_3)
>
> b. The ratio of sales to investment (X_6)
>
> c. Labor cost as a percentage of total (X_7)
>
> d. Number of major skills required

The other six variables were found to be similar in magnitude for the three groups and, hence, deleted from the function.

To supplement the model, in addition to the presentation of the discriminant function, for each factor, the mean profile of firms belonging to the first and third groups will be presented. (Firms with high ranking and with no ranking for a factor.) A comparison between means will give a clue as to the relative magnitude of the variables included in the function. In the above example, a comparison of means between the two groups reveals that the group of firms which ranked wage rates as an important

locational factor is characterized by:

a. Relatively large size labor force.

b. Labor intensiveness (relatively high ratio of sales to investment).

c. Relatively high labor cost (as a percentage of total cost).

d. The need for diversified skills.

The Application of the Model

The purpose of the analysis is to determine the nature of the firms specifying the importance of various locational factors for their type of operation. The nature of these firms is determined by a statistical selection of the set of variables which best distinguishes this group of firms (as compared to other firms).

The model as a whole describes the nature of firms with respect to all locational factors.

The practical application of the model can be demonstrated as follows: For any firm, either showing interest in locating in the community or being solicited by the community, first determine the nature of the firm quantitatively. This is done by estimating the probable size of investment, sales, labor force, the set of ratios and the rest of the variables described on page 32.

The probable adaptability of the firm to the existing stock of locational factors may be investigated in either of the following methods (in order of accuracy).

a. Compare the value of the variables describing the firm with the average profile of firms ranking each locational factor as important. Determine how closely does the firm under investigation resemble these average profiles.

b. Insert the applicable variables describing the firm under investigation into each function. Compare the scores obtained to check how closely they resemble the scores for each function in the model.[26]

c. Using the procedure describing the stepwise discriminate analysis, for each locational factor, determine the value of the applicable variables for the firm under investigation. Insert these values in one of the three groups and have the program classify the firm. This classification process will determine whether the firm, given the value of its various variables, belongs to group A, B, or C.[27]

By using one of the three methods described above potential firms can be evaluated against the existing stock of locational factors. Once the nature of the firm has been analyzed, and its probable adaptability to the state

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[26]For sample calculation of a function's score and the model's complete list of scores, see appendix of this chapter.

[27]The variable needed for each locational factor is presented in the tables showing the average profile of firms.

determined, it can be directed to locations which offer an optimum quantity and quality of locational factors conducive to successful operations of the firm.

In the forthcoming chapters all ten locational factors, in the order described on page 27 will be analyzed. The discussion will present the theoretical background and findings of empirical studies concerning each factor. This discussion will be followed by the presentation of the pertinent locational inventory in the region, a table depicting the average profile of firms and the function that best describes the nature of firms attracted to the state largely because of the availability of the locational factor under consideration.

This analysis will provide the investigator with most of the pertinent information needed to make an intelligent decision with respect to the probable adaptability of any firm to the state.

A Word of Caution

In the preface to his book Economics, Statistics and Econometrics, Edward J. Kane[28] writes: ". . . an economic model is a small scale imitation patterned upon an observable reality: hopefully, a judicious simplification which captures the essential structure of an economic

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[28]Edward J. Kane, Economics, Statistics and Econometrics (New York: Harper & Row), 1968.

problem or situation. . . . Interaction of economic variables goes as far and no further than the assumed system of relations allows. . . . Any model, by virtue of being a model, leaves out a number of realistic details."

The basic ideas which the writer tries to convey in this quotation is one of cautiousness. The model in this study can accomplish only what it was designed to accomplish--to predict the probable adaptability of a new firm to the state, given the state's inventory of locational factors and the firm's locational requirements.

The underlined words require special attention. Given the model as it appears in the study, the investigator might discover that uranium mining might be adaptable to the state simply because the nature of operations in this industry closely resembles the operations in other mining industries operating in Oklahoma. However, one variable is not covered by the model--the specific raw material which, when taken into consideration, will disprove the investigator's initial conclusions. That's where the judicious evaluation of the investigator is called for.

This model provides an initial approximation of the probable adaptability of specific firms' operations to the state. Its usefulness is the relative ease by which an array of firms can be scanned and evaluated. By itself, however, the model provides only a partial

answer which should be further supplemented by value judgment and some more detailed investigation not covered by the model.

APPENDIX IIa

To illustrate the practical application of the model to predict the probable adaptability of a new firm to the state--with respect to each locational factor--consider the following example:

The linear combination which distinguished firms attracted to Oklahoma by its wage rates from firms which were indifferent to this factor is:

(1) $W = -5.9618 + 0.0055X_3 + 0.1137X_7 + 0.1433X_6 + 1.6499X_{15}$

The average value for the variables X_3, X_7, X_6 and X_{15} for the two groups of firms is:

Variable	Group A (Rank 1 to 3)	Group B (No Ranking)
X_3 (Employment)	194	111
X_7 (Cost of labor as a percentage of total cost)	44	19
X_6 (Ratio of sales to investment)	6.29	4.84
X_{15} (Number of major skills required by the firm)	3.0	3.6

Inserting these averages into the function gives the following scores:

(2) Group A = $-5.9618 + 0.0055(194) + 0.1137(44) + 0.1433(6.29) + 1.6499(3.0) = 5.9590$

(3) Group B = -5.9618 + 0.0055(111) + 0.1137(19) + 0.1433(4.84) + 1.6499(3.6) = 3.4421

To investigate the probable adaptability of a firm with respect to Oklahoma's wage rates, estimate the value of the four variables for the new firm and insert them into equation (1), obtaining a score closer to 5.9590 than to 3.4421 will mean that:

a. Given the firm's nature of operations (in terms of the four variables) and

b. Based on the experience of firms with a similar nature operating in Oklahoma

c. There is a high probability that such a firm will find Oklahoma's wage rates an attractive factor.

The same analysis should be performed for the rest of the factors, comparing in each case the score of the firm to the model's score.

For the rest of the model, these are the following scores:

Locational Factor	Score Favoring the Factor	Score Indifferent to the Factor
Labor supply	14.9407	8.0546
Labor and community attitude	-0.5640	0.6451
Transportation	-1.6414	-7.0122
Energy	3.2046	-2.5189
Proximity to raw materials	3.1565	-4.1114
Taxes	0.2513	0.2817
Proximity to markets	1.2892	0.1551
Competition	-0.3216	-0.6390
Future markets	0.7080	0.3565

CHAPTER III

LABOR FACTORS

Labor, as a factor in the locational decision, will be analyzed within the context of wage rates, labor supply and labor and community attitude.

In general, it is assumed that in the locational decision the labor force is examined as to its availability, productivity, wage level, attitude, labor laws and unionism. The relative importance of each of these factors depends on the firm's type of operation. For example, a firm requiring skilled labor and having a capital intensive type operation will tend to stress less the importance of wage rates and emphasize the availability of skilled labor. Conversely, a firm requiring a relatively large number of unskilled workers will seek a location, all other things being equal, which offers a low wage rate, availability of such work force and a favorable attitude. The conclusions reached by studies concerning the movement of industry to the South[1] supports the above hypothesis. Specifically, it

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[1]See Glen E. McLaughlin and Stephen Robock, Why Industry Moves South (Kingsport: National Planning Association, 1949).

was concluded that the bulk of industries requiring a large unskilled labor supply has moved south because of the availability of labor, the relatively low wage level and a history of good labor management relations, all which, when compared to changing conditions in the North, gave the South a locational competitive edge.

Two tentative conclusions can be drawn. First, a region, state or town can not be classified as having a "good" or "bad" labor force. Rather, labor should be examined with the needs of a particular firm or industry in mind. Secondly, labor, as a factor input is a dynamic phenomenon subject to constant change. The introduction of new techniques and improved methods of production may add to or subtract from a region's labor advantage. The concentration or dispersion of industries might result with the same effects. The ensuing discussion will attempt to support these conclusions.

a. Wage Rates

> Wages, being another price within the economy's price system, assume the distinct purpose of allocating labor, as a productive resource, and providing the incentive to work.[2]

Assuming a rational behavior on the part of labor, it will move to locations which will offer the best

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[2]A. L. Gitlow, "Wages and the Allocation of Employment," Southern Economic Journal, 21, 1954, p. 62.

material well being. Hence, labor compares wage differentials and alternative jobs in various geographical locations. This process results in the allocation of labor in various locations and in each location within its industries and firms.

The reasons accounting for geographic wage differentials are numerous. In general, these differentials might be attributed to differences in the ratios of labor to capital, the rate of population growth, migration or immigration out of and into an area, historical concentration of industry, labor laws and unionism and the type of locality, i.e., urban or rural areas (which also implies variations in the cost of living). The fact that some markets may suffer from under or unemployment while other markets are witnessing a shortage in the supply of labor creates the need for a reallocative process. This process will tend to reallocate labor and capital, pulling the two to the location where both will be utilized in the most efficient way where the instruments performing this function are wages and prices.

The following example should partially illustrate this process. It was noted[3] that improvements in agricultural production methods in the South have created an

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[3]See Frank T. DeVyver, "Labor Factors in the Industrial Development of the South," Southern Economic Journal, 18, 1951, pp. 189-195.

abundance of unskilled labor supply moving out of farm work. Some Northern industries, requiring a large supply of unskilled labor and facing competition in the labor market in Northern urban areas, found it advantageous to move to small communities in the South. A few things happened simultaneously in the process. New technology displaced farm workers in the South, creating an over-supply of labor. Capital was pushed out of the North, due to shortage of labor and hence, higher wages, and attracted to lower waged labor force in the South. On the labor side, workers changed their geographical location from farms and rural areas to urban and semi-urban communities to take advantage of job opportunities and higher wages.

Some qualifications should be made with respect to the aforementioned example. It has been noted[4] that wage level differentials among localities within a region might have the same magnitude as wage differentials among regions. Secondly, in many cases, wages might cease to be a geographical variable when union contracts are bound by nation-wide agreements, and thirdly, wage rate differentials might offer only a short run competitive advantage due to concentration of industry, creation of unions and rising costs of living. The basic premise, nevertheless, that wages are

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[4]See Victor R. Fuchs, "Hourly Earning Differentials by Region and Size of City," Monthly Labor Review, 90, 1967, pp. 22-26.

one instrument which helps to reallocate resources in an economy still holds true.

b. Skills and Productivity

The acquisition of skills is a function of schooling, training programs and the time and effort "invested" in mastering an occupation. The disutility (sacrifice of time) and foregone opportunities (sacrifice of income) involved in the process are compensated by occupational wage differentials.

Productivity depends, in addition, on attitudes of workers, management and technology. Again, referring to studies comparing North-South in terms of skills and productivity[5] it was concluded that although the Northern textile worker was better skilled than his Southern counterpart, productivity per worker was higher in the South. The reasons behind this phenomenon are difficult, if not impossible, to trace. The important point, however, is the fact that lower wages in the South, for the same type industry, did not stem from lower productivity or efficiency.

Whereas the evaluation of wage rate differentials is a possible task, the evaluation and measurement of skills and productivity differentials among localities

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[5]Commonwealth of Massachusetts Reports of Special Commission Relative to the Textile Industry and to Prevent the Removal from the Commonwealth (Boston, 1950).

presents a very difficult undertaking, especially when similar firms do not operate in the location under consideration.

c. Labor Attitude, Labor Laws and Unionism

About 54 percent of the firms in the present study have pointed to labor and community attitude as an influential factor in selecting Oklahoma as a plant site. Twenty-eight percent of the firms indicated that labor attitude is one of the prime factors sought when a location is considered.

Unlike productivity, where its measurement necessitates an interindustry and similar firm comparison, labor attitude could be compared among regions and localities. It is not within the realm of this study to determine what accounts for a favorable labor attitude in any specific region. It is important, however, to point out what are some labor qualities which constitute a favorable attitude. The basic impression of firms which moved into Oklahoma was that, in general, labor in this state has a willingness to be trained, the rate of turnover is relatively low (as compared with the firms' operations in other parts of the country) and, in most cases, whenever unions are involved, they are milder in nature as compared with Northern locations (milder in terms of disputes, settlements and contract agreements).

The concept of labor attitude can not be isolated from community attitude since both are interrelated in terms of the general attitude towards labor and are manifested in labor legislation and the attitude towards unions. To the firm seeking a location for its plant, labor and community attitude is not a matter of ideology but rather another factor which directly affects the cost of production. Labor turnover means additional expenditures on training and lower productivity. Absenteeism means disturbances in production schedules. Workmen's compensation and unemployment compensation laws, laws regulating hours of work and the employment of women are other factors which affect costs.

The role of unions has a similar effect on the locational decision. It is assumed that in most cases a firm will prefer to avoid dealing with organized labor and, when all other things are equal, the firm will choose the location where organized labor is at a minimum. The main reason for this is lower wage rates and the avoidance of having to negotiate with unions. To illustrate the importance of unions as a locational factor, one could refer to a study conducted in Massachusetts where it was recommended that the Taft-Hartley Act be repealed so that labor could be more easily organized in the South and thus equalize North and South in terms of labor's competitive advantage.[6]

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[6]Massachusetts Report, op. cit., p. 50.

On the whole, the existence or lack of unions in an area does not seem to be a major factor in the locational decision. It is acknowledged by firms that unions may be formed in places where they are not in existence and, thus, no location is immune to union penetration. It is also acknowledged that higher wage rates in an area mean higher purchasing power with its favorable impact on the local economy. The present study shows that 50 percent of the firms moving into Oklahoma have an organized labor force which supports the hypothesis that the existence of unions did not hinder the entrance of industry.

As a conclusion to this section, it might be appropriate to present the findings of other studies of locational factors.[7] In most cases, labor factors were of prime importance in the locational decision. Labor supply and its quality and attitude, however, were more important than wages. In fact, it has been found that there exists a low correlation between low wages and areas' industrial growth.[8] Also, the magnitude of wage differentials was found to be

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[7]See William E. Morgan, "The Effects of State and Local Tax and Financial Inducements on Industrial Location" (unpublished Ph.D. dissertation, University of Colorado, 1964, p. 47. A summary of nine locational studies shows that labor factors rated second to market factors.

[8]Victor Fuchs, Changes in the Location of Manufacturing in the United States since 1929. Social Science Research Council, 1962.

diminishing among regions and thus eliminating any such competitive advantage.

To summarize these observations, the locational choice with respect to labor will depend on the firms' specific needs. A labor-oriented firm will place more importance on labor factors than non-labor oriented firms. Generalizations therefore, with regard to a local labor force, are meaningless unless the type of firm is first specified. All of the firms, nevertheless, analyze labor, its quality, its attitude, labor legislation and unions in monetary terms where each such factor has its cost increasing or cost reducing results.

In the forthcoming sections, wages, labor supply and labor and community attitude as locational factors will be discussed. For each factor, the finding of the survey will be presented and analyzed. A partial picture of wage differentials and employment characteristics for the five state area will be depicted in a tabular form and for each factor the applicable part of the model will be presented and interpreted.

I. Wage Rates as a Locational Factor

In the present survey, 27 percent of the firms indicated that the wage level in Oklahoma was one of the factors attracting them to locate in this state. Out of the 25 firms mentioning this factor, only 2, however, ranked it as number 1. According to this study's criteria of ranking

a locational factor as important (rank 1 to 3) and less important (rank 4 to 6), 20 percent of the firms ranked wages as important and the remaining 7 percent as less important. These figures coincide with the number of firms indicating that a low wage level is one factor looked for when a plant site is considered.

Table 1 represents a partial list of occupations employed by firms in the survey. With the exception of Kansas City, Missouri, it should be noted that no one metropolitan area has a distinct wage advantage with respect to all occupations. This fact supports the hypothesis of rejecting the universality of an absolute locational advantage of any particular factor. In other words, an area might offer a locational advantage with respect to any factor <u>given</u> the need of a specific type operation, or, the needs of a specific firm. To illustrate this, observe that Oklahoma City has a slight advantage for firms employing a large number of mechanics and Little Rock offers a low wage to firms employing laborers. However, for firms employing any combination of these occupations, no one location has a complete advantage. A few qualifications should be made with regard to the aforementioned observations. First, for lack of wage information for other than urban areas within the respective states, only metropolitan areas were presented. It is undoubted that in each state there exist other locations which offer a lower waged labor.

TABLE 1

MIDDLE RANGE EARNINGS FOR MAINTENANCE AND MATERIAL MOVEMENT OCCUPATIONS--
MANUFACTURING ESTABLISHMENTS IN FIVE METROPOLITAN AREAS
JULY-DECEMBER 1968
(Dollars per Hour)

	Oklahoma	Missouri	Arkansas	Kansas	Texas
Occupation	Oklahoma City	Kansas City	Little Rock	Wichita	Dallas
Machinists	3.27-3.67	3.87-4.51	3.49-4.25	3.81-4.19	2.83-3.61
Mechanics	2.83-3.45	3.44-3.89	2.95-4.04	3.34-4.17	2.87-3.50
Tool & die makers	3.63-3.95	3.81-4.30	3.36-3.84	3.58-4.37	3.61-4.42
Laborers	1.87-2.68	2.67-3.36	1.69-2.03	2.55-2.70	1.78-2.46
Packers, Shipping	2.13-2.59	2.73-3.33	1.89-2.24	2.28-3.14	1.89-2.44
Truckers, Power	2.34-3.25	3.02-3.44	1.75-2.32	2.60-3.46	2.01-2.67

Source: United States Department of Labor, Bureau of Labor Statistics Area Wage Survey, July-December 1969.

The assumption here, nevertheless, is that if this is the case, the relative wage differential in other locations will follow the same pattern which exists among metropolitan areas. Secondly, for lack of information, no assumptions are made as to the availability and productivity of labor in the respective states (for these occupations and at these hourly wages).

Table 2 presents the profile of the grouped firms which indicated that Oklahoma's wage level was an important locational factor and a randomly selected group of firms which did not place any importance to this factor. It should be noted that the figures represent averages of the firms' characteristics. (Eleven firms in Group A and 10 firms in Group B.)

In accordance with the statement made in Chapter II, the description of firms (profile) is not an all inclusive picture but rather, it takes into account only those features which might be directly associated with a specific locational factor. In the case under analysis, it is assumed that each, or a combination of the features, might have some bearing on the firm's desire for (or rejection of) a low wage level as an important (or unimportant) locational factor. Specifically, the outstanding features of a firm looking positively at Oklahoma's wage level are:

a. Relatively high level of employment

b. Relatively high percentage of total cost spent

TABLE 2

"AVERAGE" PROFILE OF FIRMS RANKING WAGES AS IMPORTANT AND UNIMPORTANT LOCATIONAL FACTORS

Firms' Profile	Group A Ranking 1 to 3	Group B No Ranking
1. Employment	194	111
2. Cost of labor as a percentage of total cost	43.8	19.0
3. Sales per production worker (dollars)	45,000	46,000
4. Investment per production worker (dollars)	15,000	21,000
5. Ratio of sales to investment (dollars)	6.29	4.84
6. County labor force[a]	88,000	98,000
7. County average unemployment (percentage)[a]	5.0	5.4
8. Number of major skills required[b]	3	3.6
9. Skilled/unskilled index[c]	0.27	0.30
10. Union/non union index[d]	0.27	0.50

Source: Author's survey.

[a]County labor force and average unemployment figures are for counties where firms in the sample are located.

[b]The number represents major skills required in each operation.

[c]Assigning 1 to skilled labor and 0 to firms hiring unskilled labor.

[d]Assigning 1 to unionized firms and 0 to non union firms.

on labor

c. Relatively labor intensive operation

d. A policy of hiring mostly unskilled workers

e. Mostly non union establishments

These conclusions are arrived at when Group A is compared to Group B.[9] The notion of labor intensiveness is derived from the comparison of the ratios of investment to production worker (group A lower by 6,000 dollars per worker) and the ratio of sales to investment. It should also be noted that firms pleased with Oklahoma's wage level located in middle size counties. (In the sample, the average size labor force is 88,000 and the range is 3,000 for small counties to 282,000 in Oklahoma County.)

In the discriminant analysis, out of the ten initial variables six have been deleted. The remaining four included in the function below are those which best discriminate among the groups; thus, the function describing the firms which see the wage level in Oklahoma as an important locational factor is:

$$W = -5.9618 + 0.0056X_3 + 0.1137X_7 + 0.1433X_6 + 1.6499X_{15}$$

where

W = Wage rates

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[9]Although three groups were compared in the discriminant analysis (group of firms with high ranking for a factor, low ranking and no ranking), for simplicity only groups A - high ranking and group B - no ranking, will be presented in subsequent analysis.

X_3 = Employment

X_7 = Percentage cost of labor

X_6 = Ratio of sales to investment

X_{15} = Number of major skills

and the function's interpretation is as follows: for a given firm, as the number of employees is increasing, the percentage cost of labor, out of total cost, is increasing, the number of various skills required is increasing, and the firm is characterized by labor intensiveness; there is a high probability, based on similar firms' experience, that such a firm might find Oklahoma's wage level a satisfactory locational factor.

II. Labor Supply as a Locational Factor

When labor supply, as a locational factor, is analyzed, the picture seems to change considerably. Whereas only 27 percent of the firms mentioned the level of wages in Oklahoma as being attractive, 55 percent of the firms found the labor supply in this state as being a strong motive in their locational decision. Of these, 38 percent ranked this factor as very important and 17 percent as being less important.

In general, it is a difficult task to evaluate a state's labor supply, mainly because no assumption can be

made as to its productivity. Also, a state's labor supply is too broad a term since some areas within the state might suffer from shortage of a particular skill, while other areas might witness unemployment and overabundance of certain skills. The broad labor picture which will be faced by the firm seeking to locate in the region is presented in tables 3, 4, and 5.

The main purpose of the three tables is to present some quantitative assessment of the general characteristics of the population, level of education and vocational training and employment in the region. Table 3 presents the general population characteristics which might interest a firm with respect to its employment needs. No mention is being made as far as specific skills are concerned, nevertheless. The population composition in terms of median age and percent of the population between the ages of 18 to 44 might be indicative of a potential labor supply. The general picture shows no substantial differences within the region. With the exception of Missouri, where this age group accounts for only 22 percent versus an average of 33 percent for the region, all states offer a similar population composition.

Table 4 compares employment and average weekly hours worked and earnings. The relatively low average weekly and hourly earnings in Arkansas as compared to the rest of the region might indicate a relatively lower wage

TABLE 3

POPULATION CHARACTERISTICS BY ANNUAL INCREASE, GEOGRAPHICAL CONCENTRATION AND AGE - FIVE STATE AREA 1967

State	Population (1950) (000)	Average Annual Increase 1960-1968 (percent)	Urban Population (percent)	Median Age (years)	Population 18-44 (percent)	Population over 65 (percent)
Missouri	4,587	0.8	66.6	31.6	22.0	11.7
Kansas	2,281	0.6	61.0	29.9	33.2	11.3
Arkansas	1,972	1.3	42.8	29.0	33.0	11.2
Oklahoma	2,516	0.9	62.9	30.0	34.8	11.0
Texas	10,857	1.6	75.0	27.0	35.2	8.2

Source: Statistical Abstract of the United States, 1969, pp. 12, 17, and 25.

TABLE 4

EMPLOYMENT CHARACTERISTICS BY NUMBER, AVERAGE WEEKLY AND HOURLY EARNINGS AND AVERAGE WEEKLY HOURS WORKED BY STATE, FIVE STATE AREA - 1965

State	Employment (1000)	Average Weekly Earnings ($)	Average Hourly Earnings ($)	Average Weekly Hours Worked
Missouri	1,476	101.51	2.62	40.3
Kansas	600	113.95	2.69	42.3
Arkansas	455	75.00	1.83	41.0
Oklahoma	648	101.22	2.41	42.0
Texas	2,925	103.91	2.48	41.9

Source: Statistical Abstract of the United States, 1969, pp. 216, 229.

level in this state. It should be cautioned again that this fact alone does not make Arkansas a more attractive location for manufacturing (especially if the lower wage level comes as a result of lower productivity).

To round out the picture, Table 5 presents information concerning the educational level (in terms of years of schooling) and state expenditures on vocational training. Two extremes are noticed here. Representing the low is Arkansas with an average of 15.4 percent of the population of age 25 and younger with less than 5 years of schooling and 28.9 percent, for the same population, with more than high school education. On the other hand, Kansas had only 3.7 percent of the same age group with less than 5 years of schooling and a high of 48.2 percent for high school or higher education.

By no means does this presentation include all the pertinent information concerning the composition of population and employment in the five state area. Also, the intention was not to compare states with respect to these features. The main purpose of the analysis was to show the type of information required to make an intelligent locational decision in terms of labor supply. For example, it might be assumed that a firm seeking relatively uneducated labor at a low wage level might favor Arkansas as a location for its plant. However, this will be true if, and only if, other requirements of the firm can be

TABLE 5

LEVEL OF EDUCATION FOR PERSON 25 YEARS AND OVER, AND EXPENDITURES ON VOCATIONAL TRAINING BY STATE FIVE STATE AREA - 1965[a]

State	Median School Years Completed (Years)	Less Than 5 Years (Percent)	High School or More (Percent)	State Funds to Vocational Training[b]			Per Capita Expenditure on Vocational Training[c]
				Trade & Industry ($1,000)	Technical ($1,000)	Office ($1,000)	
Missouri	9.6	7.1	36.6	1,906	605	476	0.66
Kansas	11.7	3.7	48.2	1,578	571	328	1.10
Arkansas	8.9	15.4	28.9	1,086	128	231	0.74
Oklahoma	10.4	8.6	40.5	2,054	677	455	1.29
Texas	10.4	13.4	39.5	5,789	2,471	1,026	0.88

Source: Statistical Abstract of the United States, 1969, and County and City Data Book, Statistical Abstract Supplement, 1967.

[a]Level of education has been compiled from County Data Book.

[b]Compiled from Statistical Abstract, p. 131.

[c]Calculated by dividing total expenditure by population.

satisfied in this state, thus making Arkansas an optimal location from the firm's standpoint.

In table 6, eighteen firms in group A and 12 in group B represent the average characteristics of firms ranking Oklahoma's labor supply as an important and unimportant locational factor, respectively. Unlike the picture revealed in the analysis of wages, very few similarities exist between these two groups. The striking features of a firm favoring Oklahoma's labor supply, when compared to a firm not placing any importance to this locational factor, are the relatively high level of employment, low investment and high ratio of sales to investment (labor intensive). In most cases (13 out of 18 firms), plants were located in nonmetropolitan areas which might indicate that a satisfactory labor supply was available in less congested areas. Another feature of such firm is its policy of hiring unskilled labor, a fact which supports the practice of locating in semi rural areas.

The function which best discriminates among the groups is:

$$L.S = -18.9337 + 0.006X_3 + 0.2661X_7 + 0.1286X_4 - 0.0231X_5 + 0.1372X_6 + 0.0298X_{13} + 2.9853X_{14} + 2.0399X_{15} + 6.3154X_{16} \text{ where}$$

L.S = Labor supply

X_3 = Number of employees

X_4 = Ratio of sales to production workers

TABLE 6

AVERAGE PROFILE OF FIRMS RANKING LABOR SUPPLY AS IMPORTANT AND UNIMPORTANT LOCATIONAL FACTORS

Firms' Profile	Group A 1 to 3	Group B No Ranking
1. Employment	368	144
2. Cost of labor as percentage of total cost	34.5	28.5
3. Sales per production worker ($)	45,900	49.800
4. Investment per production worker ($)	12,500	28,700
5. Ratio of sales to investment ($)	12.2	3.6
6. County labor force	60,000	127,000
7. Average unemployment in county (percent)	5.0	4.5
8. Number of skills required	3.3	2.5
9. Skilled/unskilled index	0.2	0.3
10. Union/non union index	0.4	0.4

Source: Author's Survey.

X_5 = Ratio of investment to production worker

X_6 = Ratio of sales to investment

X_7 = Percentage cost of labor out of total cost

X_{13} = County labor force

X_{14} = Average unemployment in county

X_{15} = Number of major skills required

X_{16} = Skilled/Unskilled index

Out of ten initial variables, nine are included in the function. Again, it should be noted that variable X_{13} and X_{14} are external to the firm. They were included in the analysis in an attempt to correlate firms emphasizing or de-emphasizing labor supply as a locational factor with the type of county selected as plant site (in terms of size of labor force and average unemployment). Also, it should be noted that variable X_5 has a negative sign indicating that as investment per production worker is increasing, or, as the firm becomes more capital oriented, the less labor supply will be emphasized. The function and the average profile of firms indicate that major features of firms attracted to Oklahoma by its labor supply are associated with labor orientation. These features are primarily manifested by the relatively large size of the labor force, low ratio of investment per production worker and the need for unskilled labor. Based on the experience of these firms, Oklahoma might be an attractive location for firms with similar needs.

III. Labor and Community Attitude as a Locational Factor

The reasons for combining the analysis of labor attitude towards work and community attitude towards labor and industry have been mentioned in the introduction to this chapter. It will suffice to say here that, based upon in-depth interviews with businessmen, when plant location is reviewed, the firm will observe, with equal interest, the local labor force and the community as far as their attitudes are towards labor and industry. The basic reason accounting for this phenomenon is that labor's attitude can not be separated from the general atmosphere in the community, or, in other words, labor and community are one inseparable body.

The question is, how are community and labor attitudes measured? No precise yardstick to measure community attitude exists. However, when asked to evaluate a community in these terms, the consensus of businessmen indicated the approach and help provided by the community's leaders, i.e. municipality officers, industrial development officers and Chambers of Commerce, as one measure of community acceptance. Another interviewee cited a city's self imposed sales tax to finance a bond issue as another indication of the community's good will. As far as labor itself is concerned, ignoring the question of productivity, which the study will not deal with, its attitude was evaluated in terms of workers' willingness to be trained, lack of

absenteeism and a relatively low turnover. All these attributes were mentioned by the majority of answered questionnaires and by corporate officers who were personally interviewed.

An overall comparative picture of some variables, which might be indicative of general labor climate in the five state area and state expenditures on major services are presented in Tables 7 and 8.

Oklahoma's businessmen's views that unions in Oklahoma are more cooperative relative to other states are supported by the fact that 50 percent of the firms moving into Oklahoma were unionized, yet Table 8 shows that Oklahoma had fewer work stoppages and fewer work stoppages per employee when compared to the other four states.

In answering the questionnaire 54 percent of the firms indicated that labor and community attitude were an attractive locational factor. Of these, 20 percent placed prime importance on the factor and 34 percent placed secondary importance. The same number of firms indicated that these attributes are sought when a new location is considered.

The general profile of firms, those ranking this locational factor high and those unconcerned with labor and community attitude is presented in Table 9.

The basic differences between the groups are represented by the discriminant function below:

TABLE 7

EXPENDITURES BY STATE AND LOCAL GOVERNMENTS
FIVE STATE AREA - 1967

State	Total		Education		Highways		Public Wel.		Health		Other	
	Mill. $	$ per Capita	$ per Capita	Per-cent	$ per Capita	Per-cent	$ per Capita	Per-cent	$ per Capita	Per-cent	$ per Capita	Per-cent
Missouri	1,831	398	169	42.4	61	15.3	38	9.5	29	7.4	100	25.3
Kansas	1,020	448	203	45.3	82	18.3	31	7.0	32	7.0	100	22.6
Arkansas	697	354	140	39.5	67	19.0	42	11.9	24	6.8	81	22.7
Oklahoma	1,157	464	185	39.9	73	15.7	83	18.0	24	5.2	98	21.2
Texas	4,163	383	171	44.7	72	18.9	27	7.0	22	5.8	90	23.7

Source: Statistical Abstract of the United States, 1969, p. 417.

TABLE 8

UNION MEMBERSHIP, WORK STOPPAGES AND RIGHT TO WORK LAWS, BY STATE - FIVE STATE AREA - 1965

State	Union Membership		Work Stoppages			Idleness as a Percent of Estimated Working Time	Right to Work
	Total (1000)	As Percent of Non-Agric. Employees	Total	Per Employee	Per Union Member		
Missouri	550	35.6	117	0.00008	0.0002	0.34	-
Kansas	110	18.6	40	0.00006	0.0003	0.06	X
Arkansas	83	17.0	32	0.00007	0.0003	0.12	X
Oklahoma	102	15.0	23	0.00003	0.0002	0.12	-
Texas	423	13.7	143	0.00004	0.0003	0.18	X

Source: Statistical Abstract of the United States, 1969, pp. 236, 241.

TABLE 9

AVERAGE PROFILE OF FIRMS RANKING LABOR AND COMMUNITY ATTITUDES AS IMPORTANT AND UNIMPORTANT LOCATIONAL FACTORS

Firms' Profile	Group A Ranking 1 to 3	Group B No Ranking
1. Investment ($)	573,000	1,410,000
2. Sales ($)	2,625,000	3,963,000
3. Employment	79	163
4. Skilled/unskilled index	0.25	0.35
5. Unionization index	0.33	0.32
6. Sales per production worker ($)	42,000	65,000
7. Investment per production worker ($)	11,000	19,000
8. Ratio of sales to investment ($)	6.58	8.30
9. Distribution index	901	641
10. Sales in Oklahoma as percentage of total sales	16.1	32.7
11. Product index	0.58	0.50

Source: Author's Survey.

$$L.C.A = -1.7320 + 0.1615X_2 + 0.0037X_3 + 1.5191X_{17} = 0.0207X_5$$

where

L.C.A = Labor and community attitude

X_2 = Sales

X_3 = Employment

X_{17} = Unionization index

X_5 = Investment per production worker

With eleven initial variables, seven were deleted and four included in the function.

The differences among the groups are manifested by size of sales, employment, unionization, and investment per production worker (negative indicating that as the firm becomes more capital intensive, labor attitude is stressed less). It might be mentioned here that, given the nature of the factor, it was expected that most if not all variables would be deleted, indicating the universality of this factor with respect to all firms. However, given the three groups of firms under analysis, enough differences were found to form the discriminating function, where the four variables above discriminate best among the groups. Thus, as the size of the firm is increasing (manifested by sales and employment), the lower the investment per production worker (indicating labor intensiveness) and as this hypothetical firm becomes unionized the more conscious it is of labor and community attitude. This locational factor might be a point of attraction to a

firm which is distinctly characterized by these features.

Summary

The analysis of labor as a locational factor dealt with wages, labor supply and labor and community attitude. The first aim of this analysis was to determine the magnitude of importance that firms place on each of these components. Not surprisingly, and in accordance with other studies, wage levels trailed labor attitude and labor supply in order of importance. Surprisingly, more firms emphasized the importance of labor attitude than labor supply.

When firms were isolated by dominant features, matching each group of firms with one of the above locational factors, the following emerged:

a. Firms desiring and finding a satisfactory wage level in Oklahoma are best distinguished from other firms by their size of labor force, the cost of labor as a percentage of total cost, the ratio of sales to investment (indicative of labor intensiveness) and the need for diversified skills.

b. Firms which are satisfied with Oklahoma's labor supply are distinguished from other firms by size of labor force, labor intensiveness, percentage cost of labor, tendency to locate in relatively small counties and the need for unskilled labor.

c. The analysis of labor attitudes, as a locational factor, revealed that firms which emphasized this factor, and found it satisfactory in their respective site, are best recognized by the volume of sales, size of employment, the ratio of investment to production worker and the degree of unionization.

Labor orientation is the summation of most of the features cited above. Therefore, it might be concluded that, based on the experience of Oklahoma-located firms with such an orientation, other labor oriented firms might find Oklahoma attractive with respect to its labor needs.

CHAPTER IV

OPERATING COST FACTORS

The term operating costs, in this study, implies all costs, direct and indirect, incurred by the firm from delivery of raw materials to plant to delivery of final product to customers. In between these two points lies an array of costs, fixed and variable, which are the firm's total expenditures of operations. A detailed analysis should include rent, interest charges, cost of labor--direct and indirect,--management, expenditures on training programs, energy, and taxes. Also, negative costs such as financial aids, tax incentives and subsidies and state or federally supported training programs should be included. This study will concern itself with only four[1] aspects of operating costs:

a. Transportation

b. Energy

c. Proximity to raw materials

d. Taxes

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[1]It is realized that labor cost is part of the firm's cost of operations. However, because of the lengthy discussion, Labor factors were presented in a separate chapter.

The main reason for excluding the other operating cost factors is the low response, or the relatively low magnitude of importance placed by interviewees on these factors. The percentage of firms mentioning financial aids, cost of land or cost of capital as a favorable locational factor never exceeded ten percent. The study, therefore, will concentrate only on the four factors mentioned above.

In general, operating costs will become an important locational factor or the decisive factor in selecting a specific site, when the firm is not a market oriented type operation. To illustrate this problem consider the following example: All cement producing firms in the survey indicated that proximity to raw materials and the cost of energy were the most important locational factors in deciding to locate in their respective sites. A close analysis of this industry indicates that expenditures on the movement of raw materials and energy represents a substantial percentage of total cost. The decision, therefore, has been made by these firms to locate at a point which will offer the best (optional) combination of proximity to raw materials and the lowest cost of energy. Can it be concluded that labor supply, proximity to markets and other locational factors were excluded from the locational decision? The answer is no. The firm, however, gravitates towards the site which best answers the firm's orientation. In this specific case it was concluded that

proximity to raw materials (distance to source) should be substituted for proximity to markets (distance to customers) so that total costs will be minimized. The same principle of substitution applies to all types of operations where the aim is to minimize total costs.

To illustrate another extreme, most producers of perishable food products (bread, for example) are located close to their markets. Here, proximity to markets, which means lower cost of transportation of finished product and fast and prompt delivery, is substituted for lower rent and lower wages which are assumed to be found outside of metropolitan areas. This is so because the advantage (spread between cost and revenue) of locating closer to the market outweighs the disadvantage of the higher cost (relatively) of other factor inputs.

The reasons for locational differences of operating costs are numerous. As a partial illustration, however, consider the cost of land in metropolitan versus rural areas where the fixed and limited amount of land in the former and the relative abundance in the latter accounts for rent differentials between the two locations. As another example, consider property taxes in metropolitan areas and rural areas. It is obvious that the rates in the former are higher than in the latter location (adding to this tax incentive and subsidies frequently allowed to firms locating in rural areas and which are negative costs).

The total result is a lower tax bill which might be substituted for higher transportation cost, arising from greater distance to markets, so that total costs are minimized.

From the above observations it should be concluded that the overall motive behind the selection of a specific site is the firm's particular needs or orientation. This does not necessarily imply that firms will locate at either the source of raw material or at the center of markets. The exact location will be determined when all other operating costs are taken into consideration, substituting, whenever possible and within technical limits, low cost for high cost factors so that an optional mix, or the best location, is chosen.

The ensuing discussion will analyze transportation, energy, proximity to raw materials, and taxes as four locational factors. Findings of the survey and the applicable part of the model for each factor will be presented.

I. Transportation facilities as a Locational Factor

Observing the behavior of a growing portion of the nation's industrial establishment with respect to its attitude towards transportation as a locational factor, Marvin Barloon concluded that "Transportation is very probably a minor influence in the determination of plant

location."[2] The reason accounting for this attitude is that with the passage of time a larger portion of industry requires higher standards of transportation service, accepting as inevitable the associated higher costs. And since this quality transportation service can be had at a wide range of sites, locational factors other than transportation will more often be the final determinants of site selection. The above observation, nevertheless, does not diminish the importance of transportation facilities and rates as a locational factor as far as the individual firm is concerned, since the aim of the firm is to achieve the best combination of locational factors. Stated another way, the firm is seeking a location which provides an optimal mix of factors so that total cost will be minimized. As a result, the firm will select a site which provides the best answer to its transportation needs, given its requirements for other factor inputs. In addition, given the firm's type and nature of raw materials, component parts and finished product, the firm will evaluate freight cost for each and arrive at a decision whether it needs to economize on transportation charges to plant or from the plant.

Essentially then, the problem faced by the firm

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[2]Marvin J. Barloon, "The Interrelationship of the Changing Structure of American Transportation and Changes in Industrial Location," Land Economics, 41, 1965, p. 169.

is not one which involves the availability of transportation facilities or transportation rates (which are fairly uniform according to Barloon's observation) but rather, what location offers the best transportation in terms of cost given the firm's orientation. To better illustrate this problem consider the following examples of two fundamental type operations:

A. The transport aspect of firms with raw material orientation.

Generally, firms which are characterized by raw material orientation share the following common denominators:

1. The variations in transportation charges of raw materials are wider than other costs at alternative locations.
2. The final product output is lighter in weight and more compact than the raw materials (input) used.
3. As a result, transportation rates of raw materials are equal or higher than the rates on the transportation of finished products.[3]

The tendency of such firms will be to locate near its source of raw materials. There are some exceptions, however, to this rule. First, if the nature

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[3]Greenhut, Plant Location, p. 114.

of the final product requires close and fast service to customers, the firm may sacrifice lower transport cost of raw materials in order to fulfill this requirement. Secondly, when the final output requires several raw material inputs, the location of the plant will depend on the relative pull of each of the raw materials (in terms of transport cost) and the sum of all transfer charges for raw materials weighted against transportation costs of final product.

B. The transportation aspect of firms with market orientation.

Here, too, some generalizations can be made with respect to firms characterized by market orientation.

1. Transportation cost of finished products are higher than the cost of transporting raw materials.
2. The finished good is perishable.
3. The firm's share of the market can be maintained and/or increased only when there exists a close contact between seller and buyer.[4]

Two common factors accounting for higher transfer cost of the finished product as compared to the cost of moving

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[4]Greenhut, p. 119.

raw materials are often cited. First, when water is added to a basic raw material, thereby increasing the weight of the finished product. A good example of such a case is bottling plants of carbonated drinks. Second, in cases where the final product requires special packaging and handling. As an example of such a case consider the production of potato chips where raw materials can be handled in bulk with no special transport arrangement while the finished product is light in weight but large in volume and necessitates special packaging and careful handling due to the product's fragility.

In either case, whether the firm is market or raw-material oriented, the locational choice will be controlled, to a large extent, by the distance relations in transport prices. This distance scale evaluates the changes in movement prices relative to changes in movement distance.[5] This scale can be an upward-sloping curve containing a series of transport prices (per load or weight of unit). Or, it can consist of a series of distance segments that are not always of equal length, shown in figure 2.

Within such segments, the transport price is constant, but it increases between segments, where each

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[5]For a detailed discussion of the term see Emory Troxel, Economics and Transport (New York: 1955), pp. 301-312.

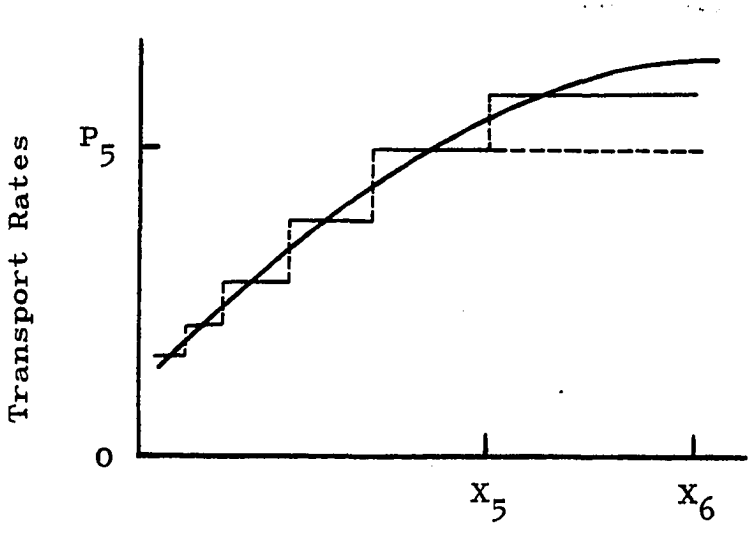

Figure 2

segment is referred to as "rate groups."[6] This distance-cost relation, combined with specific needs arising from the nature of the produce (or market) is the main problem which has to be tackled when transportation as a locational factor is considered.

Some fundamental conclusions which can be arrived at are the following:

a. The weight of the product or the raw materials are not the only transport determinant of location.

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[6]Troxel, p. 306.

b. The nature of raw materials, its composition and the number used as input bear heavily on the locational decision.

c. Similarly, the nature of the finished product, its composition and the nature of the market (with respect to the product) will have to be considered when a site is selected.

d. Given the complexity of operations in terms of supply of raw materials, component parts and semi-finished goods, and the nature of the product in terms of the market requirement, the optimal location of the firm will be the site which provides the lowest possible total transport charges and at the same time provides the firm's other needs.

The data furnished in tables 10, 11, and 12 represent only a portion of the information required for the assessment of a state's transportation profile. Concretely, the firm needs to know the number of trucking companies, routes and frequency of service, destinations and rates for points within and out of state. For firms employing their own transportation facilities, information concerning availability and quality of roads is important. For other firms, employing a combination of truck-railroad service, still more information will be needed.

Turning to the firms in the survey, 23 percent

of the firms indicated that transportation facilities were one of the factors attracting them to Oklahoma. The same has been said by 6 percent of the firms with respect to transportation rates. Only 1 percent of the firms, however, saw transportation rates as a prime locational factor while 10 percent of the firms viewed in the same manner Oklahoma's transportation facilities. Close to one fifth of the firms indicated that while searching for a location, the available transportation facilities are closely scrutinized.

An examination of the modes of transportation used by the sample of firms reveals the following:

TABLE 10

MODES OF TRANSPORTATION FOR RAW MATERIALS AND FINISHED PRODUCT - 72 FIRMS

Mode of Transportation	Raw Materials (Percent of Firms)	Finished Product (Percent of Firms)
Truck	61	68
Rail	10	7
Combination of Truck and Rail	29	25

Source: Author's Survey.

As can be seen, the dominant mode of transportation, for either raw materials or finished products, is trucking. Again, based on the assumption of rational behavior on the part of firms, it might be concluded that,

TABLE 11

MUNICIPAL AND RURAL HIGHWAY MILEAGE, STATE EXPENDITURES ON HIGHWAYS BY STATE, FIVE STATE AREA - 1967

State	Municipal and Rural (miles)			Type of Road (miles)		State Highway Expenditures		Exp per mile $
	Total	Municipal	Rural	Surfaced	Non-Surfaced	Capital Outlay ($1,000,000)	Maintenance ($1,000,000)	
Missouri	114,285	14,665	99,620	91,717	7,903	146	42	367
Kansas	133,232	9,905	123,327	85,170	38,157	61	26	195
Arkansas	79,211	8,247	70,964	47,517	23,447	78	18	227
Okla.	106,955	12,921	94,034	64,095	29,939	97	20	127
Texas	237,719	40,775	196,994	131,231	65,763	475	73	307

Source: Statistical Abstract of the United States 1969, p. 542, p. 545.

TABLE 12

MOTOR TRUCKS BY SIZE-CLASS, RANGE OF OPERATIONS AND MAJOR USE, BY STATE, FIVE STATE AREA - 1967

State	Total	Size-Class (1,000)			Range of Function (1,000)			Major Use (1,000)	
		Light	Medium	Heavy	Local	Short	Long	Agri.	Whol. & Net Trade
Missouri	436	230	119	87	121	17	9	158	44
Kansas	381	264	82	35	108	11	1	189	23
Arkansas	288	231	35	23	58	9	4	81	22
Oklahoma	412	315	62	34	84	14	7	159	25
Texas	1,227	1,027	108	92	178	46	19	291	139

Source: Statistical Abstract of the U.S., 1969, p. 553. Calculated by dividing total m/g shipment by number in wholesale and vertical use only.

TABLE 13

RAILROADS - MILES OF ROAD OWNED, AND ROAD/MILE PER DOLLAR SHIPMENT OF MANUFACTURING BY STATE, FIVE STATE AREA - 1967

State	Miles	Manufacturing[a] Shipment Per Mile ($)
Missouri	6,414	2,134,000
Kansas	7,871	648,000
Arkansas	3,611	1,060,000
Oklahoma	5,056	633,504
Texas	14,051	1,882,000

Source: Statistical Abstract of the United States, 1969, p. 561.

[a]Calculated by dividing total value of mfg. shipment by miles of road.

TABLE 14

AVERAGE PROFILE OF FIRMS RANKING TRANSPORTATION FACILITIES AS AN IMPORTANT AND UNIMPORTANT LOCATIONAL FACTOR

	Group A Ranking 1 to 3	Group B No Ranking
Sales ($)	4,200,000	4,600,000
Cost of Transportation - Raw Material (percent of total cost)	3.6	5.6
Cost of Transportation - Finished Product (percent of total cost)	4.5	3.0
Sales in Oklahoma (Percent)	14.0	27.0
Distribution Index	1299	561
Number of Raw Material Sources	2.4	2.3
Product Index	0.2	0.7
Total Cost of Transportation (percent)	8.1	8.7

Source: Author's Survey.

given the firms' type of operations, products, availability of transportation facilities and rates and the location of markets, trucking was found to be the most efficient mode of transportation.

The profile of firms finding Oklahoma's transportation facilities an attractive locational factor is compared to firms with no ranking for this factor in Table 14.

The most substantial differences between the two groups are noticed in the relatively low percentage of sales in Oklahoma (out of total sales) and, hence, the higher distribution index for the group of firms with high ranking for transportation. Another feature shows group A leaning towards the production of industrial products while group B is occupied, mostly, in production of consumer goods.

The discriminant function for this locational factor or the function which best discriminates among the firms emphasizing transportation facilities and those placing less or no importance on this factor is:

$$T = 7.8995 - 0.0216X_{12} + 0.0054X_{18} - 2.2707X_{19}$$ where

T = Transportation

X_{12} = Percentage sales in Oklahoma (out of total sales)

X_{18} = Distribution index[7]

X_{19} = Product index

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[7]The distribution index for a firm is derived by multiplying the percentage sold in each market by the

As can be seen the discriminate function is dominated by market factors (in terms of distance). It should also be noted that transportation facilities and rates are more important to producers of industrial goods than to consumer good manufacturers (as indicated by the negative sign). The negative sign of X_{12}--percentage sales in Oklahoma indicates that as the firm increases its sales within the state, the less sensitive it becomes to transportation needs. Firms which sell in regional and national markets, therefore, are aware of the needs for adequate transportation facilities.

II. Energy as a Locational Factor

Electricity, gas and water, respectively, were the major types of energy used by the firms surveyed. The sources of energy varied from private utility companies to municipality owned and operated power generating companies. Of the 16 percent of the firms ranking utilities as a favorable locational factor, 10 percent ranked it as being important and 6 percent as less important. Nine percent of the firms indicated that cost of utilities

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distance to the market. Since no exact locations of markets within states have been established, central locations were chosen. Thus, a firm selling in Oklahoma was assigned a distribution index of 0 and 1500 to a firm selling its products in East or West Coast markets. In the case above the average distribution index is 1299 indicating that the average firm favoring Oklahoma's transportation system sells the major share of its output in other than the region's markets.

are of prime importance in selecting a plant site. The majority of firms ranking utilities can be categorized into extractive industries (copper sulfide, cement, glass) and highly mechanized firms.

Table 15 presents a typical net monthly electricity bill for industrial service in the five state area. To supplement this information, the "power" picture in the area is presented in table 16.

TABLE 15

TYPICAL NET MONTHLY BILL COMPARISON FOR INDUSTRIAL SERVICE AS OF JANUARY 1, 1968, 1,000 KW; 400,000 KWH PER MONTH

Community	Monthly Billing
Oklahoma City, Oklahoma	$4,014
Austin, Texas	4,145
Topeka, Kansas	4,482
Little Rock, Arkansas	4,503
St. Louis, Missouri	5,118

Source: Federal Power Commission report of typical electric bills for cities of 50,000 population and more - 1968.

It should be emphasized here that rates usually vary with volume of consumption and the type of supplier; i.e., private utility or municipality owned company. Also, the type of locality may influence utility rates.

TABLE 16

ELECTRIC UTILITIES, WATER AND GAS PRODUCTION CAPACITY AND SALES, BY STATE, FIVE STATE AREA - 1967

State	Electric Utilities			Water Power		Gas	Utility
	Capacity (1,000 KW)	Production (1,000,000 KWH)	Sales	Developed (1,000 KW)	Under-Developed (estimated) (1,000 KW)	Industrial Customers (1,000)	Sales (1,000,000 dollars)
Missouri	4,821	16,784	20,323	393	2,025	5	1,554
Kansas	3,367	12,948	10,801	5	303	5	2,615
Arkansas	2,713	6,058	10,519	900	915	3	1,884
Oklahoma	3,444	15,423	12,140	363	914	4	1,255
Texas	19,638	76,833	69,765	434	1,160	25	11,831

Source: Statistical Abstract of the United States, 1969, pp. 513, 518, 519.

The average profile of firms ranking energy as an important locational factor and those which did not mention this factor at all are presented in Table 17.

TABLE 17

AVERAGE PROFILE OF FIRMS RANKING ENERGY AS IMPORTANT AND UNIMPORTANT LOCATIONAL FACTOR

		Ranking 1 - 3	No Ranking
1.	Cost of energy (percent of total cost	14.8	1.5
2.	Sales (dollars)	5,666,000	4,858,000
3.	Sales per production worker (dollars)	69,000	36,000
4.	Investment per production worker (dollars)	88,000	12,000
5.	Ratio of sales to investment (dollars)	1.07	4.75

Source: Author's survey.

The most distinguished characteristics of a firm emphasizing the importance of energy as a locational factor are the relatively high percentage expenditure on energy, high investment per production worker and low ratio of sales to investment, where the latter two characteristics indicate capital intensiveness.

The discriminant function for this factor is:

$E = 3.2196 + 0.4333X_8 + 0.0107X_6$ where

E = Energy

X_8 = Percent cost of energy out of total cost.

X_6 = Ratio of sales to investment.

From the information gathered in Tables 15 and 16 it can be concluded that, given Oklahoma's relatively low utility rates, firms characterized by capital intensiveness and large usage of electricity found this locational factor attractive in this state.

III. Proximity to Raw Materials as a Locational Factor

Three outstanding features characterize firms with proximity to raw materials preferentials. These features and firms can be categorized as follows:

a. Firms which use a multiplicity of component parts as input per unit output.

b. Firms which process extractive materials to be later used as input (by these or other firms).

c. Food processing firms.

The following examples should illustrate some firms belonging to each group. Firms belonging to group A are of the assembly type operation dominated by producers of electrical equipment. For example, component parts used in the production of electrical motors are procured in regional markets and assembled at a centrally located point.

Firms belonging to group B include plants which rely primarily on extractive material for its inputs. The final output of such plants is either an intermediate or

final product. For example, a producer of copper sulfide is located at the source of raw materials; the extracted material is processed and sold to commercial users of copper sulfide, who, in turn, use it as input. Window glass, which is the final product, is produced at the site of raw materials--primarily sand--and then shipped to centers of consumption. Similar industries such as cement, clay pipes and ceramic shingles share the same characteristics.

In group C, plants are characterized by use of vegetation or livestock as inputs in the production of its product. Two examples of such plants are peanut processors and meat plants. In the former and latter processing plants are located at the center of supply.

It should be pointed out that products produced by plants belonging to groups B and C are usually of the "weight losing" nature (weights of raw materials per unit output are equal or larger than the weight of the final product). This is not always the case with products produced by firms in group A. However, due to the multiplicity of component parts and semi-finished parts used as inputs, which means dependency on a large number of independent and scattered suppliers, the advantage of being close and in fast contact with sources of supply outweigh the disadvantages of relative remoteness from centers of consumption.

Tables 18 and 19 present the major mineral, mining and agricultural inventory of the five state area. Some lesser quantities of other minerals exist in most states but are not mentioned in the tables. With respect to manufacturing firms in Oklahoma, most of the firms which ranked proximity to raw materials as an important locational factor were engaged in processing of either mineral, agricultural or livestock products. The average profile of such firms is presented in Table 20.

The function which best discriminates among the groups is:

$.R.M. = -7.7550 + 0.4426X_2 + 1.1383X_9 + 0.0686X_4$ where

.R.M. = Near Raw Materials

X_2 = Sales

X_9 = Percentage cost of transporting raw materials

X_4 = Ratio of sales to production worker

The three variables included in the function (out of six initial variables) are the level of sales, percentage expenditure on transporting raw materials and the ratio of sales to production worker. The relative high volume of sales, and especially the high ratio of sales to production worker are characteristic of extractive industries. And it is obvious that these firms in the sample determined the nature of the discriminant function. Firms of this nature constituted the majority of the 32 firms indicating the importance of proximity to raw

TABLE 18

PRODUCTION OF MINING AND MINERAL PRODUCTS,
BY STATE, FIVE STATE AREA - 1967[a]

State	Coal (1,000 ST)[b]	Crude Petroleum (1,000,000 Barrels)	Natural Gas (1,000,000 Cf)[c]	Portland Cement (1,000 Barrels)	Zinc (1,000 ST)	Lead (ST)
Missouri	3,696	---	---	14,888	---	152,647
Kansas	---	99	872	9,023	5	---
Arkansas	---	21	117	---	---	---
Oklahoma	---	231	1,413	---	11	2,727
Texas	---	1,120	7,189	32,277	---	---

Source: Statistical Abstract of the United States, 1969, pp. 669-670, 672-673, 681-682.

[a]Blanks indicate no, or very little, production of such mineral.

[b]Short tons.

[c]Cubic feet.

TABLE 19

VALUE OF ALL FARM PRODUCTS SOLD, BY SOURCE OF INCOME, BY STATE, FIVE STATE AREA - 1965
(Millions Dollars)

State	Field Crops	Vegetables	Fruits & Nuts	Horticultural Specialties	Dairy Products	Poultry and Poultry Products	Livestock and Livestock Products
Missouri	384	3	4	13	102	64	481
Kansas	440	1	1	6	62	18	646
Arkansas	530	4	6	6	26	195	62
Oklahoma	244	2	3	7	47	22	275
Texas	1,122	42	10	20	128	151	746

Source: Statistical Abstract of the United States, 1969, p. 597.

TABLE 20

AVERAGE PROFILE OF FIRMS RANKING PROXIMITY TO RAW MATERIALS AS IMPORTANT AND UNIMPORTANT LOCATIONAL FACTORS

	Group A Ranking 1 - 3	Group B No Ranking
Sales ($)	5,600,000	1,500,000
Cost of Transporting Raw Materials (percentage of total cost)	7.3	2.6
Sales in Oklahoma (percentage of total sales)	31.6	43.6
Sales per Production Worker ($)	66,900	32,000
Investment per Production Worker ($)	45,000	12,000
Ratio of Sales to Investment ($)	9.98	7.77

Source: Author's Survey.

materials for their type operations. Out of these 32 firms, representing 25 percent of the sample, 26 percent ranked this factor as very important and 6 percent as less important. Again, indicating the non-compromising attitude of such firms for the need to locate in the vicinity of their raw material source.

IV. Taxes as a Locational Factor

A total of 16 firms, or 18 percent of the sample, have indicated that Oklahoma's tax structure was an attractive locational factor offered by this state. Out of these 16 firms, less than half considered the tax structure of Oklahoma as a very important locational factor. These low figures are in accordance with the findings of other studies concerning the effects of tax structure and tax exemptions on the location of industries. Before the explicit findings of this and other studies are presented, some general observations will help to illuminate the problem.

Business investment decisions--how much and where to invest--involve a large number of factors which should be considered. The basic effect of financial inducements in the form of tax exemptions, loans and subsidies is the reduction of the firm's cost of production; it makes funds available to businessmen and presents good will on the part of the community.

From the state's point of view, all these inducements, in all forms, involve both costs and benefits.

The analysis, therefore, of the effectiveness of such programs should be carried on with these costs and benefits in mind.

Assuming that tax inducements accomplish what they are designed to do, namely, attract industry, the state may realize benefits in the form of increased population (discouraging emigration and encouraging immigration), increased level of employment and income (primarily through the investment-multiplier effects) and a general increase in economic activity.

Relating to costs, tax exemptions and subsidies should be evaluated as follows: first, the loss of revenue (opportunity cost) should be compared to the stream of revenues arising from the increased level of income. Secondly, the increased tax burden on citizens in terms of loss of income and/or loss of services (actual or potential) should be evaluated against the gains arising from the increase in the level of economic activities.

With regard to other programs such as Local Industrial Bond financing, and state and local Development Credit Corporations, their operation is similar to any other financial institutions and, thus, the costs and benefits to the state should be evaluated according to the performance of each such program. The basic problem confronting state Industrial developers evaluating the cost and benefits of such programs evolves around two questions:

a. Would firms locate in the state without financial

inducement, or are such programs a major locational factor?

b. Is there a better use for the state's financial resources?

The answers provided to the first question by most studies are unequivocally uniform:

1. Taxation is a minor factor in plant location.[8]
2. The assertion that tax exemptions attract capital to the state has very little statistical proof.[9]
3. Local tax concessions account for only a small portion of costs; hence, businessmen are not impressed by such programs.[10]
4. The quantitative evidence available about the effectiveness of industrial development bond financing is not conclusive, largely because it is only one of a legion of continually changing factors influencing economic behavior.[11]

In addition to the conclusions of this sample of studies, it has been noted that any cost-benefit analysis

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[8]Irene Hanning, How North Dakota Taxes Industry (Bismarck, North Dakota: Economic Foundation, 1947).

[9]George Steiner, The Tax System and Industrial Development (University of Illinois, 1937).

[10]Glenn McLaughling and Stefan Robock, "Why Industry Moves South"(Washington, D.C.: National Planning Association, 1949).

[11]Industrial development Bond Financing, Advisory Commission on Intergovernmental Relations, Washington, D.C., March, 1962, pp. 78-88.

of state financial inducements is based on the assumption that the increased use of such inducements in a given state does provoke such programs in neighboring states, thus weakening the given state's competitive position.[12] In the five state area analyzed in the present study only Texas does not offer any financial inducement program. Oklahoma, Arkansas, Kansas and Missouri offer various programs and therefore to a certain extent the states "cancel" each other in terms of this locational advantage. The second question offers a twofold problem. As far as the state as a whole is concerned, it has been suggested that, due to the general notion of the relative ineffectiveness of such programs, state monies should be channeled into vocational education and job retraining programs,[13] apparently, working under the assumption that a skilled and trained labor supply is a more attractive locational factor than financial inducements.

With respect to the second part of the problem--namely, is there better use for money invested by individuals in inducement programs, mainly individual's expenditures on industrial bonds--no clear cut answer is provided. To

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[12]Benjamin Bridges, State and Local Industrial Development Incentives: Wisconsin, Its Neighbor States and the Nation (Madison, Wisconsin: Wisconsin Department of Resource Development, 1965). Reprinted in: Locational Analysis for Manufacturing by G. Karaska and David Bramhall (Cambridge, Massachusetts: The M.I.T. Press, 1969), p. 205.

[13]Bridges, Ibid., p. 205.

the extent that such bonds are financed by out-of-state residents, the state clearly gains. However, when bonds are primarily financed by the state's residents, the question arises, can this money be used more effectively? This depends on the existence of other investment opportunities in the state. Thus, the question can be answered only when it is established that individual and institutional monies are diverted from practical use by local businessmen to the use of out-of-state firms.

From the aforementioned observation, which constitutes only a small part of the bulk of studies, it can be concluded that financial inducements of the type now in common use are, at most, only a secondary locational factor. Based on the various studies, it is very difficult to assess how important a secondary locational factor financial inducements are. In this study, some individual cases indicated that without state financial help, establishing a plant would have been impossible. Other cases indicated that the primary merit of such programs is the display of good will and acceptance by the community. Nevertheless, the fact that so few firms placed any importance on inducements as a locational factor supports the hypothesis that these programs are only secondary in importance when a plant site is considered.

The general tax information which might interest firms considering the five state areas as a probable site

is presented in Table 21.

The following are "Aid to Industry" programs for the five state area:[14]

Oklahoma:

Financial Assistance: The Oklahoma Industrial Finance Authority, working through a local industrial development agency, will lend up to 25 percent of a project's cost on a mortgage basis. Machinery and equipment is not covered under this arrangement. Municipalities and counties can issue revenue and general obligation bonds for periods up to 30 years in order to provide facilities for industrial purposes.

Special Laws: None.

Tax Relief: Under the constitution of the state, cities and towns may grant a five-year exemption from municipal taxes in industrial properties except land. This provision is seldom used, however. The "Free Tax Port" law exempts from property taxes, goods moving throughout the state in interstate commerce and temporarily warehoused in Oklahoma while in transit.

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[14]Assembled from Richard B. Miller, Plant Location Facts, U.S. (Park Ridge, N.J.: Doyer Development Corporation, 1966).

TABLE 21

TAX STRUCTURE AS APPLIED TO MANUFACTURING, BY STATE, FIVE STATE AREA - 1966 (PERCENT)

State	Corporate Income	Personal Income	Sales	Property	Unemployment	Corporate Franchise
Missouri	2	1-4[1]	3[2]	Local Rates	1-5[3]	0.5
Kansas	4.5	2.5-6.5	3[4]	Local Rates	1[5]	Rates Change[6]
Arkansas	1-5[7]	1-5[8]	3	Local Rates	1.5[9]	0.11
Oklahoma	4	1-6[10]	2[11]	Local Rates	1.5[12]	Rates Change[13]
Texas	None	None	2[14]	---[15]	1[16]	Rates Change[17]

Source: Richard B. Miller, Plant Location Facts, U.S. (Park Ridge, N.J.: Doyer Development Corporation, 1966).

[1]Rates range from 1% on income up to $1000 to 4% on income in excess of $9000.

[2]Some exemptions on machinery, materials and property.

[3]On the average.

[4]See footnote 2.

[5]See footnote 3.

[6]Rates range from $10 on capital stock of $10,000 or less, to $2500 for stock in excess of 5 million dollars.

[7]Rates change from 1% on the first $3000 to 5% on income in excess of $25,000 taxable income.

[8]Same as corporate income tax.

[9]See footnote 3.

[10]Rates range from 1% on the first $1500 to 6% on income over $7500.

[11]Machinery and equipment for use in new manufacturing or processing plants is exempt.

[12]See footnote 3.

[13]The rate is $1.25 per $1000 of capital used in the state. The minimum is $10, the maximum $20,000.

[14]See footnote 3.

[15]Real and personal property, both tangible and intangible are assessed at 60% of full value.

[16]See footnote 3.

[17]The rate is $225 per $1000 of capital stock, surplus and undivided profits. There is a minimum tax of $25.

Texas:

Financial Assistance: There are no state-wide programs. However, some 2000 industrial development foundations in cities throughout the state do provide financial assistance through loans of leasing of facilities.

Special Laws: None.

Tax Relief: None.

Arkansas:

Financial Assistance: A community may elect to issue general obligation bonds at a rate of not less than 6 percent, for the purpose of securing and developing industry within or near the community. The community may levy a special tax, not to exceed 5 mills on the dollar, to pay for the principle and interest on the bonds. Municipalities and counties may issue revenue bonds to secure or develop industry within or near the area. Such action requires an approval by the voters, and the amount must be sufficient to pay all financing costs. An Arkansas Industrial Development Commission has been created and the formation of local non-profit industrial development commissions have been authorized. Currently, 154 towns and counties have formed such corporations. The corporation, supervised by the commission, may issue first

mortgage bonds up to 75 percent of the appraised value of the land and buildings to be financed. Heavy machinery may be included in the appraisal. The local corporation may also issue second lien obligations for any remaining financing needed, but they may not be for less than 25 percent of the appraised value of the land and buildings. 100 percent financing may thus be arranged in three ways. The first two methods are more frequently used for financing than are the Industrial Development Corporations.

Special Laws: Arkansas allows the formation of development financing corporations to loan money when credit is not readily available elsewhere. In one of these corporations, the First Arkansas Development Finance Corporation, the state has no investment.

Tax Relief: All capital invested in textile mills are granted a seven-year tax exemption.

Kansas:

Financial Assistance: Municipalities have the power to issue Economic Development Revenue Bonds and use the proceeds to purchase, construct, reconstruct, equip, maintain or repair facilities; to acquire sites; to make improvements; and to lease such facilities. Under legislation passed in 1955,

local Industrial Development Corporations may be formed to assist industries to locate in their areas. There are currently 86 such corporations. Under the same law, a state-wide Industrial Corporation has also been formed.

Special Laws: None.

Tax Relief: Properties acquired and constructed by the issuance of revenue bonds may be exempted from local ad valorem taxation for periods not to exceed 10 years.

Missouri:

Financial Assistance: Industrial revenue bonds may be issued by any municipality to provide funds for the purchase of industrial sites, construction of facilities, and the purchase of machinery and other facilities. Municipalities located in counties of under 400,000 population may also issue general obligation bonds. Industrial Development Organizations (there are more than 300 in the state) have been formed to assist a resident in enlarging his facilities, offer sites and buildings to new prospects, provide local financing, and build plants to prospect specifications.

Special Laws: None.

Tax Relief: None.

The average profile of firms which indicate the importance of Oklahoma's tax structure as a locational factor and the randomly selected group of firms which did not mention this factor at all are presented in Table 22.

TABLE 22

AVERAGE PROFILE OF FIRM RANKING TAX STRUCTURE AS AN IMPORTANT AND UNIMPORTANT LOCATIONAL FACTOR

	Group A Ranking 1 to 3	Group B No Ranking
Investment ($)	990,000,000	1,050,000
Sales ($)	4,000,000	6,000,000
Employment	99	323
Sales per Production Worker ($)	36,000	44,000
Percentage Sales in Oklahoma (of total sales)	21	22
Investment per production worker ($)	15,000	15,500
Ratio of sales to investment ($)	4.21	14.9
Product Index	0.4	0.3

Source: Author's Survey.

The function which best discriminates among the group is:

$T = 0.2512 + 0.5076X_1$ where

T = Taxes

X_1 = Investment

The major reason accounting for the deletion of seven variables from the function is the large range of values (for the seven variables) within each group. In fact, when the cases were classified into groups, 5 out of 7 cases in the group of firms with no ranking for tax structure were classified into group A--the group which ranked tax structure as important. The best interpretation that could be given to this occurrence is that there are no special attributes which characterize a firm favoring the state's tax structure. It might be assumed, therefore, that firms which ranked taxes as an important locational factor did so for reasons which cannot be explained by determining their type of operations.

Summary

Four locational factors influential in the locational decision have been investigated in this chapter. Unlike the analysis of labor factors, no specific orientation could be ascribed to firms as a whole ranking energy, transportation, raw materials or taxes as important locational factors.

This is so because the analysis of labor factors represented an integrated picture of one factor input while operating cost factors deal with an array of factors, or costs thereof, which vary from firm to firm according to specific needs. For each individual factor, however, the following picture emerged:

a. Energy.

The nature of firms finding Oklahoma's "energy picture" satisfactory was dominated by high usage of energy. This, apparently, stems from the fact that these firms were highly mechanized and/or were engaged in extractive activities which necessitate large quantities of energy, especially electricity.

b. Transportation.

The analysis of this factor revealed a definite transport orientation. Firms which specified the importance of transportation for their operations were classified as producers of industrial goods selling their product in national markets.

Two qualifications should be noted. First, cost of transportation did not play a major role for these firms. In fact, the randomly selected group of firms (group B) spend a higher percentage of total cost on transportation. Secondly, it might be suspected that Oklahoma's central location was influential in the locational decision when transportation needs were examined. This notion arises from the fact that this group of firms sold primarily in national markets where transportation facilities and rates are independent of those of Oklahoma.

It seems, therefore, that firms specifying the importance of transportation had in mind fast and

convenient delivery and service. These attributes were found to be satisfactorily achieved by locating in Oklahoma.

c. Raw Materials.

Firms which found their proximity to raw materials a satisfactory factor in Oklahoma can be divided into two groups. The first group is classified as an assembly type operation where component parts are procured from a variety of suppliers and then assembled at the point of production. For this group of firms Oklahoma offered a convenient central location.

The second group of firms were engaged in extractive operations. In most cases the final product is lighter in weight than the input. Firms of this nature tend to gravitate toward the source of raw materials in order to minimize transport cost. The availability of raw material is the prime reason accounting for the choice of site.

d. Taxes.

The findings of this and other studies support the argument that taxes represent only a minor factor in the locational choice. However, it should be acknowledged that a firm attempts to minimize its total cost. Hence, it will welcome any reduction in expenses. The question that communities try to answer is whether lower

tax rates or tax concessions can "bait" industry.

It is the belief of this and other writers that taxes are an influential factor in two circumstances. First, when two alternative sites are equal in all respects, lower tax rates or the provision of tax concessions might tilt the locational choice in favor of the location offering the "better" tax package. Secondly, based on businessmen's expressed opinion, taxes in most cases represent only a minor expense when compared to total cost of operations. However, tax inducements are indicative of good will and eagerness on the part of the community to have the firm settle in it boundaries. Being such, businessmen value this attitude more than they appreciate the minor reduction in money outlay.

Chapter V

MARKET FACTORS

Personal interviews with corporate officers revealed that in most cases the expansion decision of the firm is aimed towards a specific region of the country, with one or a combination of the following goals in mind:

1. To capture a share of existing markets in the region.
2. To better serve existing local and near markets.
3. To prepare for future potential markets.

Setting such goals presupposes the existence of a demand for the firm's product in a certain area, and/or a demand for the product is anticipated to materialize some time in the future.

The simplest case where markets are the decisive factor in the locational decision is manifested in the second goal where the firm is "pulled" to a certain location in order to better serve local and near markets. In this study, the best examples citing such reasons were firms which established manufacturing units in the area in order to serve existing customers. Specifically, firms producing packaging materials (containers, cans) and those whose prime customers

are large military installations have stated that this was the unequivocal reason for selecting their respective sites.

The problem becomes more complex when the first and the third goals cited above are the firm's reasons for moving into a certain area. Given such goals, the broad answer which has to be answered is: When does demand become an important locational factor? In order to provide an answer to this question the study will evaluate markets within the framework of three locational factors:

a. Nearness to market

b. Competition

c. Future markets

Before each of these locational factors is discussed in detail, some general observation should be noted. It has been stated by Greenhut that ". . . the concept of market area and variability of consumer demand per seller's location require a broader approach to location theory than a pure cost analysis."[1] In essence, this statement implies a deviation from classical location theory where markets were assumed to be given and variation in location of manufacturing depended entirely on cost differentials among locations. (In the simplest cases, cost variations meant variations in transportation charges.)

Modern location theory, then, relaxes the assumption of given or central markets and the introduction of scattered buyers is taken into consideration when the selection of

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[1]Greenhut, Plant Location, p. 140.

plant sites is being analyzed. Based upon the aforementioned observations Greenhut concluded ". . . what is involved in location under the influence of the demand factor in an attempt to gain monopolistic controls over customers by location."[2]

These monopolistic controls over a market area are achieved by pursuing the following strategies:

a. The firm will be in a better position (better than its rivals) to dominate a segment of the market if, ceteris paribus, its transportation charges of delivery of finished goods are lower than those incurred by its competitors. This implies being located closer to the market than competitors. If this is the case, the firm will be able to offer its product to the final consumer at a lower price.

b. The second strategy will be pursued if the nature of the product (or the market) is such that closeness to and fast contact with customers is an essential prerequisite for successful operations.

The basic assumption here is that this prerequisite is shared by all firms producing that type product. Thus, the firm which will establish itself in a position best conducive to the fulfillment of such requirements will enhance its opportunity to dominate the market.

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[2]Greenhut, p. 168.

The two examples mentioned above can be termed as cost reducing or revenue increasing factors with respect to markets. In this sense, then, the firm will reduce its total costs by reducing its transportation cost on delivery of finished product. In the second example, the firm might increase its revenue by offering an additional "service" not offered by competitors, namely, close contacts. In both cases, the firm will gain some dominance over a segment of the market.

I. Proximity to Markets as a Locational Factor

The total product sold by the firms in the survey was distributed as follows:

1. Sales in Oklahoma accounted for 24 percent of total sales.
2. Sales in the region accounted for 40 percent of total sales.
3. The remainder, 36 percent of total sales, was distributed in national markets. A more detailed breakdown of sales shows that within the region total sales distribution was as follows:

   Oklahoma - 59 percent
   Texas - 24 percent
   Kansas - 9 percent
   Missouri - 5 percent
   Arkansas - 3 percent

A fundamental question which should be posed is:

What markets did interviewees refer to when indicating that nearness to markets was an attractive locational factor in Oklahoma?

Two figures should offer some clues in answering this question. First, the average firms favoring nearness to markets as a locational factor sold 56 percent of their product in Oklahoma markets. Secondly, the average distribution index for such firms was 412. As indicated before, the value of 0 was assigned to firms selling all of their product in Oklahoma and 1500 to firms selling in East and West coast markets. The average value arrived at for firms selling in the region was between four to five hundred (percentage of total sales in a market multiplied by distance to that market). Thus, this average distribution index and percentage sold in Oklahoma indicates that the market area for firms attracted to their sites, partially, due to its closeness to markets, included Oklahoma and the surrounding states.

Another question which should be answered is: What types of products are sold by these firms? The importance of this question has been stated above when the strategies of firms with respect to markets were analyzed. The assumption is that the product of such firms is characterized by either high transportation charges, or it requires close and fast service (or a combination of both).

Referring again to the average profile of these firms shows that out of a total of 20 firms in that group (favoring nearness to markets), 14 are producers of industrial goods and 6 produce consumer goods. It might be conjectured that industrial goods share these features of high transportation charges and the need for close contact with buyers. However, the study cannot furnish data to prove this hypothesis other than to point out that this group incurred an average of 7.6 percent expenditure of total cost of transporting finished product versus 4 percent incurred by the group which classified nearness to market as an unimportant locational factor (no ranking).

Based upon the assumption that "near markets" include local and regional markets, Tables 23 to 26 present some of the characteristics of this market. The main purpose of these tables is to partially depict the existing markets in the region, especially in terms of population and income. These markets had to be taken into consideration when firms made their locational decision. It is not the intention of this presentation to compare markets, but rather to show the type of market information needed when alternative plant sites are evaluated.

TABLE 23

TOTAL POPULATION, METROPOLITAN AREA POPULATION, MEDIAN AGE AND NUMBER OF HOUSEHOLDS, BY STATE, FIVE STATE AREA, 1968

State	Population Characteristics				
	Total (1000)	Metropolitan Area (1000)	Metropolitan Area Population as Percent of Total	Median Age (Years)	Number of Households (1000)
Missouri	4,625	2,779	60.0	31.6	1,433
Kansas	2,293	914	39.8	29.9	712
Arkansas	1,986	552	27.7	29.0	580
Oklahoma	2,520	1,170	46.4	30.0	803
Texas	10,977	7,353	66.9	27.0	2,154

Source: Statistical Abstract of the United States, 1969, pp. 12, 24.

TABLE 24

PERSONAL, PER CAPITA AND MEDIAN FAMILY INCOME
BY STATE, FIVE STATE AREA - 1968

State	Income Characteristics		
	Personal Income (1,000,000 $)	Per Capita Personal Income ($)	Family Median Income ($)
Missouri	13,775	3,003	5,127
Kansas	6,961	3,052	5.295
Arkansas	4,130	2,095	3,184
Oklahoma	6,594	2,621	4,620
Texas	29,822	2,747	4,884

Source: Statistical Abstract of the United States, 1969, pp. 320, 324.

TABLE 25a

TOTAL, PER CAPITA AND PER HOUSEHOLD NET EFFECTIVE BUYING INCOME BY STATE, FIVE STATE AREA - 1968

State	Net Effective Buying Income (1,000 $)	Per Capita N.B.I.[a] ($)	Per Household N.B.I. ($)
Missouri	12,828	2,787	8,679
Kansas	6,520	2,820	8,878
Arkansas	4,023	2,026	6,707
Oklahoma	6,220	2,478	7,662
Texas	28,496	2,567	8,618

Source: Sales Management, June, 1969, p. B-3.

[a]Net Buying Income.

TABLE 25b

CASH INCOME BREAKDOWN, BY STATE
FIVE STATE AREA - 1968
(Percents)

Cash Income Breakdown	Missouri	Kansas	Arkansas	Oklahoma	Texas
0-2,999					
H.H.[a]	23.5	20.6	34.1	28.2	23.8
Income	4.3	3.7	8.1	5.8	4.4
3,000-4,999					
H.H.	14.4	14.4	19.5	16.9	15.9
Income	7.3	7.3	12.6	9.8	8.1
5,000-7,999					
H.H.	24.8	26.9	21.8	25.3	24.0
Income	20.4	21.7	22.9	23.5	19.8
8,000-9,999					
H.H.	13.9	14.6	9.7	11.9	13.0
Income	15.7	16.1	14.2	11.5	14.7
10,000-15,000					
H.H.	14.8	14.9	9.9	11.0	14.4
Income	22.3	21.9	19.4	18.9	21.8
15,000-25,000					
H.H.	6.2	6.3	3.7	4.8	6.4
Income	14.7	14.7	11.6	13.0	15.2
Over 25,000					
H.H.	2.4	2.3	1.3	1.9	2.5
Income	15.3	14.6	11.2	13.7	16.0

Source: Sales Management, June 1969, p. B-3.

[a]Household.

TABLE 26

PER HOUSEHOLD AND PER CAPITA ESTIMATE OF SALES BY STATE - FIVE STATE AREA - 1968 (1,000 DOLLARS)

	Total Retail Sales		Food		General Merchandise		Apparel		Furniture, Household Appliance		Lumber, Building, Hardware	
	P.H.H.[a]	P.C.[b]	P.H.H.	P.C.	P.H.H.	P.C.	P.H.H.	P.C.	P.H.H.	P.C.	P.H.H.	P.C.
Missouri	5,616	1,803	1,116	358	1,064	341	270	87	1,042	75	378	122
Kansas	5,261	1,671	1,065	338	654	208	228	73	241	77	499	147
Arkansas	4,443	1,342	889	269	563	170	220	67	195	59	500	151
Oklahoma	4,685	1,515	978	316	688	222	263	85	217	70	349	113
Texas	5,445	1,622	1,163	346	875	261	303	90	234	70	336	100

Source: Sales Management, June 10, 1969, p. B-4.

[a]Per Household

[b]Per Capita

The average profile of firms, group A with high ranking for nearness to markets as a locational factor and group B with no ranking, is shown in Table 27.

TABLE 27

AVERAGE PROFILE OF FIRMS RANKING PROXIMITY TO MARKET AS IMPORTANT AND UNIMPORTANT LOCATIONAL FACTOR

	Group A Ranking 1 to 3	Group B No Ranking
Sales ($)	3,700,000	2,900,000
Cost of finished product transport (percentage of total cost)	7.57	4.16
Sales in Oklahoma (percentage of total sales)	56.7	29.4
Distribution Index	412	871
Sales per production worker ($)	59,000	55,000
Investment per production worker ($)	38,000	16,000
Ratio of sales to investment ($)	7.12	4.55
Product Index	0.3	0.5

Source: Author's Survey.

The function which best discriminates among the group is:

$$N.M. = -1.3233 + 0.0447\ X_{12} + 0.3636\ X_{19}$$

where

N.M. = Near Markets

X_{12} = Percentage sales in Oklahoma

X_{19} = Product Index

The basic features distinguishing firms which found Oklahoma to be a good location with respect to their markets from firms with no preference to this factor is the percentage of sales in Oklahoma and the type of product they produce (consumer or industrial). Firms which sell most of their product in local and regional markets, especially when the product is an industrial good, found it advantageous to locate within the state.

To round up this discussion, it should be mentioned that the statistical analysis of firms indicating that Oklahoma's geographical location was a strong factor in their locational decision displayed great similarities with those firms ranking high closeness to market. Especially it has been noticed in the distribution index. In both cases, the market area was within the region's boundaries.

II. Competition as a Locational Factor

Twenty-four percent of the firms in the survey indicated that lack of competition was a strong factor in their

locational decision. Very few generalizations can be made with respect to this locational factor since market structures and concentration or dispersion of firms differ among industries and products. Therefore, a thorough analysis of the state of competition in an area should encompass a detailed investigation of individual industries and specific products. Some points of "agreement" can be detected, however; for example, the consensus among these firms was that "we came here because competition was anticipated to be very light" and, in some cases it was expressed that "this product was not produced in the area at all." This can be interpreted as a conscious decision by firms to exploit a market area underexploited, or unexploited by competitors. A check of these firms shows that most of them are producers of consumer goods and their market territory does not extend behind the region. The average profile of such firms is presented in Table 28.

When the discriminant function was formed, five of the eight initial variables were deleted. The variables which remained are expressed in this function:

$$C = -1.6815 + 0.0005X_{18} + 0.0412X_{4} + 1.9875X_{19}$$

where

C = Competition

X_{18} = Distribution Index

X_{4} = Sales per production worker

X_{19} = Product Index

TABLE 28

AVERAGE PROFILE OF FIRMS RANKING LACK OF COMPETITION AS AN IMPORTANT AND UNIMPORTANT LOCATIONAL FACTOR

	Group A Ranking 1 to 3	Group B No Ranking
1. Investment ($)	788,000	1,600,000
2. Sales ($)	1,760,000	4,390,000
3. Sales in Oklahoma (Percent of total sales)	38.2	35.5
4. Distribution Index	331	888
5. Sales per Production Worker ($)	48,000	56,000
6. Investment per Production Worker ($)	16,800	22,900
7. Ratio of Sales to Investment ($)	4.11	16.14
8. Type of Product	0.6	0.3

Source: Author's Survey.

The low figure for the distribution index (331) indicates that the average firm, partially attracted to Oklahoma due to lack of competition, sold its product well within the region. The tendency towards unity in the product index points to the fact that most of the firms in this category are producers of consumer goods (in many cases, food products). It is also interesting to note that, on the average, the firm conscious of competition is smaller in size than the firm "indifferent" to this factor. This fact is primarily indicated in the figures of investment and sales.

This section should be concluded with a word of caution. The practical usefulness of the discriminant function described above is somewhat limited. Given the nature of the three groups of firms in the analysis it was revealed that three major characteristics distinguish the group of firms which was attracted to Oklahoma primarily by lack of competition. To conclude, however, that any firm sharing these three attributes might be attracted to this state will be misleading. A complete analysis of a potential firm will have to take into account the product that it produces and also investigate the state of the market with respect to such product(s).

III. Market Potential as a Locational Factor

Forty-four percent of the firms in the survey have indicated that future market potential was a significant locational factor offered by Oklahoma. A further breakdown shows that 30 percent of the firms valued this factor as very important and the remaining 14 percent as less important. No clear indication has been given by the firms as to the boundaries of this potential market. However, observing the average profile of such firms may offer an answer to this question. Particularly, two figures are very revealing: The average firm in group A (the group with high ranking for this factor) sold 48 percent of its product in Oklahoma markets. The distribution index for such firm was 465, pointing to the fact that its market area was confined to the region. On the other hand, group B, the randomly selected group of firms with no ranking for this factor, sold only 22 percent of its product in local markets and its distribution index was 1016, indicating that its market area was well beyond the region's boundaries.

The term "future market potential" in this study refers specifically to anticipated change in demand for a product over time. Markets, therefore, are looked upon as a dynamic phenomenon, subject to change as time passes. The major components of a changing market are the following:

1. Change in population and population composition.
2. Change in income.

3. Change in industry and industry composition. The first two components deal with the ultimate consumer. Anticipated change, in the size of population, its composition, level of employment and income are, therefore, the basic information needed in order to assess future potential demand for a product.[4]

The third component, change in industry and industry composition, deals with both industry as a buyer of factor inputs (parts, machinery, and raw materials) and industry as a seller where the expansion within an industry might cut into the market share of existing firms.

The overall evaluation of an anticipated market, then, tries to answer questions with respect to individual consumers, industrial consumers and the probability of entrance of new firms, producing the same product, into the market. This evaluation of markets, or forecasting market opportunities, as referred to by marketing experts, is conducted on three levels:

a. Regional Economy forecasts

b. Industrial sales forecasts

c. Company sales forecasts[5]

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[4]Other ingredients such as change in tastes and preferences are excluded from the analysis because of the difficulty associated with forecasting such changes.

[5]These terms are used by Jerome McCarthy, Marketing a Managerial Approach, Richard D. Irwin, Inc., Homewood, Illinois, 1968, pp. 82-99.

On the regional level, the most widely used method of investigation is the trend-extension approach where regional growth is projected into the future on the basis of past performance. This method is supplemented by general macroeconomic models based upon factors such as consumer, business and government expenditures and utilizing data from surveys of consumers' intentions to buy, business expansion plans and budgets of local, state and federal governments.

Table 29 presents a partial population trend in the five state area. Table 30 shows personal income and its change for the five state area between 1955 and 1967.

Undoubtedly, the potential growth of a region, manifested primarily in the growth of per capita income depends to a great extent on economic activities outside of the region (notwithstanding the movement of capital into Southern markets), and the prime movers of a region's economic growth is the increase in availability of inputs or an increase in the productivity of the inputs.

The increased use and the more sophisticated approach to input-output analysis has made industry forecasting much more accurate. Industry potential forecasts are closely related to general economic activities. For example, an increase in per capita income might increase meat consumption

TABLE 29

COMPONENTS OF CHANGE IN POPULATION BETWEEN 1960 AND AND 1967 AND POPULATION PROJECTION FOR 1975 AND 1985, BY STATE, FIVE STATE AREA
(In 1,000, EXCEPT PERCENT)

	Net Increase		Births	Deaths	Net Total Migration	Population Projection	
	Number	Percent				1975	1985
Missouri	267	6.2	646	358	-21	4,870	5,515
Kansas	103	4.7	320	156	-60	2,397	2,608
Arkansas	186	10.4	303	136	19	2,184	2,442
Oklahoma	188	8.1	345	173	16	2,655	2,934
Texas	1,278	13.5	1,709	593	162	12,482	14,733

Source: Statistical Abstract of the United States, 1969, pp. 6, 13.

TABLE 30

PERSONAL INCOME, WAGE AND SALARY DISBURSEMENTS AND PERCENTAGE CHANGE FOR 1957 AND 1967 BY STATE, FIVE STATE AREA (In 1,000 $, EXCEPT PERCENT)

	Personal Income		Percent Change	Wage and Salary Disbursement		Percent Change
	1957	1967		1957	1967	
Missouri	8.2	13.8	59.4	5.4	8.8	61.3
Kansas	3.8	7.0	54.2	2.3	4.1	56.0
Arkansas	2.0	4.1	49.7	1.2	2.4	50.0
Oklahoma	3.6	6.6	54.5	2.3	4.0	57.5
Texas	16.3	29.8	54.6	10.7	19.6	54.5

Source: Statistical Abstract of the United States, 1959, pp. 311, 312; Statistical Abstract of the United States, 1969, pp. 318, 320.

and increased federal budgets might increase operations in the aerospace industry. On the state and local level, increased allocation of funds for education might result in an increased demand for textbooks and educational facilities and higher allocation for highway construction and repairs will increase the demand for cement, asphalt and related industries.

In addition to input-output analysis, the firm might be aided by observing the locational quotients of manufacturing. Observe, for example, the location quotients for selected industries in the Southwest region of the country (Oklahoma, Arkansas, Louisiana and Texas). This is shown in Table 31. The locational quotient for a region is obtained by dividing the ratio of employment in industry i to total employment in region j by the ratio of total employment in industry i to national employment.[6]

The main significance of the location quotient is the information that it reveals with respect to concentration of industries. Thus, it might be expected that a firm producing auxiliary products for the petroleum industry will consider expanding into the Southwest region (assuming all other things being equal). And the low quotient for the fabricated metal industry, indicating imports of such products, might point out open opportunities for firms

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[6] For a detailed discussion of the locational quotient see Hugh O. Nourse, Regional Economics (New York: McGraw Hill Co., 1968), p. 151.

TABLE 31

LOCATION QUOTIENTS FOR SELECTED INDUSTRIES IN THE SOUTHWEST - 1962

Industry	Locational Quotient
All manufacturing	0.71
Food and kindred products	0.93
Lumber and wood products	1.01
Chemicals and allied products	1.58
Petroleum and coal	4.87
Fabricated metal products	0.53
Stone, clay and glass products	0.95

Source: Hugh O. Nourse, Regional Economics (New York: McGraw-Hill, 1965), p. 153.

engaged in this type of production.[7]

Trend-extension and time-series analysis are useful methods in forecasting company and specific product sales. It is obvious that as the analysis is narrowed down to the company and product level forecasting becomes more difficult and hazardous. Industrial trends do not necessarily coincide with specific products, and general trend, for a product are not always an assurance that a certain brand name will be accepted in the market. But this is the point where value judgment and speculation enters the picture.

As a conclusion to this section it might be stated that no accurate method to estimate a potential market has been devised yet. However, the methods described above, in addition to other methods, are some of the tools utilized in making an intelligent estimate of a potential market. A frequent statement made by firms indicating that future potential markets brought them to the region was that they "felt" that the opportunities were here. They viewed the region as a growing one, and they believed that they should take advantage of these opportunities.

The average profile of these firms and the group of firms with no ranking for this locational factor is shown in Table 32.

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[7]This should be evaluated cautiously since the low quotient might be attributed to lack of appropriate factor inputs and low profitability of such industries in the region.

TABLE 32

AVERAGE PROFILE OF FIRMS RANKING FUTURE MARKETS AS AN IMPORTANT AND UNIMPORTANT LOCATIONAL FACTOR

	Group A Ranking 1 to 3	Group B No Ranking
Investment $	1,135,000	605,000
Sales $	4,260,000	2,000,000
Employment	256	100
Sales per production worker $	44,000	38,000
Investment per production worker $	13,000	12,000
Ratio of sales to investment $	9.69	3.77
Percentage sales in Oklahoma	48.4	22.6
Distribution index	465	1016
Product index	0.3	0.7

Source: Author's Survey.

It seems that the average firm concerned with future markets is larger in size than the average firm which placed no importance on this factor (compare size of investment, sales and employment). Also, the market area of such firms is limited to the region while the average firm in the second group sells its product behind the region's limits. This fact might partially explain why the second group is less interested in the potential growth of the region's markets.

The variables which best discriminate among the groups are investment, sales and distribution index. Said another way, the relatively larger sized firms selling their product in regional markets viewed their location as attractive as far as potential markets are concerned. The linear function is:

$$f.M = -0.7074 + 0.0017X_1 + 0.2765X_2 + 0.0005X_{18}$$

where

f.M = Future Markets

X_1 = Investment

X_2 = Sales

X_{18} = Distribution Index

The reader is referred to the concluding remarks of the previous section. Here, too, the practical usefulness of the discriminant function as a predictive tool is limited. The major characteristics of a firm attracted to Oklahoma because of future market expectations are very

general. The function describes only the sense in which the group of firms differed from the other two groups. To assess whether a firm might be attracted to Oklahoma by future market expectation will necessitate knowledge of the product to be produced and an assessment of future demand for such a product.

Summary

In the locational decision, market considerations are of major importance. The "vote" given to this factor by more than fifty percent of the firms in the survey support this statement. The common denominator to markets, as a locational factor, is the existence of an effective demand for the firm's product. However, the best opportunity to sell the product successfully was offered when one or a combination of the following circumstances existed:

a. Locating near markets.

Two prime reasons account for a firm's decision to locate near its market. First, the reduction of delivery costs might enable the firm to successfully participate in price competition. Secondly, for some products, the importance of prompt delivery and fast service is of a major magnitude.

An analysis of firms which had these considerations in mind reveals that such firms sell their product almost exclusively in local and regional markets. Since

most of these firms are producers of industrial goods, it might be assumed that both, reduction in transportation charges and prompt service, accounted for choosing a location in the center of markets.

b. Lack of competition.

Other firms viewed the market as being conducive to successful operations when competition was minor or nonexistent. The comment "no such product was produced in the area" was stated by many interviewees. Interestingly enough, whereas firms which favored proximity to markets were engaged in production of industrial goods, firms which sought locations which offered no competition were producers of consumer goods. Both groups sold their product in local and regional markets. Another feature which should be pointed out is that most of the firms seeking noncompetitive areas are relatively small in size (as indicated by figures of investment and jobs).

c. Another reason for locating in an area, when markets are primarily considered, is anticipated future markets. The precise estimation of a future market potential is a risky undertaking. It should be assumed that firms which anticipated a market for their product, and therefore located in the area, based their judgment on changing trends in population, income and economic growth. It might also be assumed that these firms

anticipated the area to develop industrially since most were producers of industrial goods. The average firm anticipating future markets was relatively large in size as indicated by the volume of investment, sales and employment. Its sales efforts concentrated on the region.

Chapter VI

SUMMARY AND CONCLUSIONS

The objective of this study was to provide a methodology by which an array of firms can be evaluated as to their probable adaptability to a specific state or community. The need for such a methodology has arisen, in the writer's opinion, because of the inadequacy of the two major methods of analysis commonly used. It has been pointed out that the investigation of all manufacturing in which firms are asked to rank locational factors in order of importance is insufficient and too broad a method in scope for practical purposes. On the other hand it was noted that the method of analysis by which individual industries are investigated provides a narrow and costly answer.

The methodology pursued in the present study capitalized on parts of the two methods and added a statistical technique, thus arriving at a new tool of analysis.

This study, or method of investigation, rests upon two basic premises: first, the best source of information concerning the question of why a firm located at a certain site is the businessman himself. Based upon this premise,

approximately two hundred firms were approached and asked to provide the relevant information.

The second premise was that there exists a set of common features characterizing a group of firms pointing out any one locational factor as being influential in the locational decision.

Based on these two premises, the study set out to devise a method by which an investigator can find out what is the basic nature of firms favoring a specific locational factor. This method centers on a statistical technique known as discriminant analysis. Essentially, this analysis isolates the variables which describe the differences among two or more groups. For the study's problem three groups of firms were compiled. For each locational factor, group one consisted of firms ranking the factor as being important in their locational choice, group two ranking the factor as less important and group three consisted of a randomly selected group of firms which did not mention the factor at all. (Thus, assuming that the specific locational factor did not play any role in their locational decision.)

Using a sophisticated version of discriminant analysis known as step-wise discriminant analysis, the basic nature or characteristics of the group of firms ranking a locational factor as important was determined. The result of pursuing this method for ten major locational factors is a complete model, or picture, describing what is the nature of the

average firm attracted to Oklahoma by the existence of markets, labor supply, low wage rates and so forth.

What are the advantages of this method? First, it reveals what are the most attractive locational factors of an area as viewed by firms which build and operate their plants in the area. Specifically, with respect to Oklahoma, the study shows that the most influential factors attracting out-of-state firms to locate here were labor supply, markets (local and regional), labor and community attitude and expected future markets. This information was obtained by asking firms to rank, in order of importance, the six locational factors which influenced their decision to locate in the state. A complete list is provided in Table 33.

Secondly, relying upon the information concerning the nature of firms, with respect to each locational factor, potential investors can be analyzed and the probable adaptability of their type operation to locations in the state evaluated. This is accomplished by first determining the nature of the firm's operation and then, for each locational factor in the model inserting the pertinent information into the function which describes the major features of a firm attracted by that factor. By evaluating the scores obtained for each factor it can be approximated whether, based on the experience of similar firms operating in the state, the new firm will favor the specific factor or be indifferent to it.

Thus, the method is broad enough to encompass an

TABLE 33

FIRMS' RANKING OF TEN MAJOR LOCATIONAL FACTORS

	Rank 1 to 3 Percent of Firms	Rank 4 to 6 Percent of Firms	Total Percent of Firms
1. Labor supply	38	17	55
2. Proximity to markets	41	13	54
3. Labor and community attitude	20	34	54
4. Future markets	30	14	44
5. Proximity to raw materials	29	6	35
6. Wage rates	20	7	27
7. Competition	15	9	24
8. Transportation facilities	10	13	23
9. Taxes	7	11	18
10. Energy	10	6	16

Source: Author's Survey.

array of industries and sufficiently specific to investigate a specific firm.

The major justification for this approach is the idea that it is not the product or industrial affiliation that characterizes a firm but its nature of operation as indicated by the firm's orientation (labor, markets...). And this basic orientation is not restricted to a specific industry or product; rather, it may be common to firms belonging to different industries and producing different products.

The specific findings of the present study supports both theory and empirical studies. Firms which were attracted to a location because of its labor supply were found to be labor intensive type operations.

Those firms which were attracted by proximity to markets were distinguished by high transport expenditures and a high percentage of sales in local and regional markets or, in short, were market oriented. The same affiliation between the firm's orientation and desired locational factors was revealed for the rest of the factors analyzed. The following presentation summarizes the ten major locational attributes and the nature of firms attracted by each:

1. Labor supply--firms attracted by Oklahoma's labor supply were characterized by a relatively large labor force, low investment per production worker and high ratio of sales to investment (which is indicative of labor intensiveness). Such firms

were dominated by the need for unskilled labor which was found satisfactorily in relatively small size communities.

2. Proximity to markets--the average firm indicating the attractiveness of Oklahoma as a location with respect to markets sells its product--mostly industrial goods--in local and regional markets. Such a firm found it advantageous to locate near its markets because of the relatively high expenditures that it incurs in delivering its finished product.

3. Labor and community attitude--the general labor atmosphere in Oklahoma, labor's willingness to be trained and the favorable labor-management relations as manifested in a low level of work stoppages were found to be among the most attractive factors that this state has to offer. When analyzing the community as a factor in the locational decision, favorable attitude and eagerness to help financially[1] and otherwise, was cited by 54 percent of the firms in the survey. The average profile of such firms showed a medium size firm (as manifested by figures of investment, sales and employment) with low investment per production worker (labor intensive).

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[1]The role of financial aid is discussed in this summary under taxes.

4. Future markets--expectations with respect to future regional markets were a strong motive behind the decision of firms to locate in Oklahoma. Those firms which specifically indicated the importance of this factor were large establishments in terms of investment, sales and employment. Their current sales territory was confined to the region's boundaries. Most of these firms were subsidiaries or branch plants of nation-wide corporations.

5. Proximity to raw materials--raw materials orientation is the prime feature of firms indicating the attractiveness of this factor. These firms were characterized by either being extractive operations, food processors or assembly type operations. In either case, the relatively high expenditures on transporting raw materials or component parts motivated these firms to locate at the center of supply.

6. Wage rates--the fact that only twenty percent of the firms in the survey indicated the importance of wage levels in their locational decision proves the hypothesis that wage considerations are secondary to labor supply, its productivity and its attitude.[2] The average firm that did attach importance to the wage rates offered by Oklahoma was dominated primarily by large employment and

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[2]De Vyver, op. cit., p. 205.

high labor expenditure as a percentage of total cost. The fact that Oklahoma's unionized labor, as a percent of total labor, is the lowest in the region might very well be one of the reasons attracting those firms to the state. If this notion is accepted, lower wage bills, rather than wage rates, attracted those firms to their respective sites.[3]

7. Competition--to take advantage of the existence of underexploited markets in the region was one of the reasons why some firms located their plants in this state. These firms were dominated by producers of consumer goods--about forty percent of the products produced by such firms were sold in local markets. The rest were distributed well within the region.

8. Transportation facilities--it seems that Oklahoma's geographical location played a significant role in the decision of some firms to locate in the state. The convenient access to major national arteries and the fact that these firms sell their product in national market explains adequately why Oklahoma was favored over other states as plant sites. It should be mentioned

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[4]Although wage rates might be equal among locations, lower workers' benefits will result with a lower wage bill.

that these facts were especially important to producers of industrial products.

9. Taxes--it has been pointed out in the body of this study that the importance of tax incentives and tax subsidies as an inducement to attract industry is being disputed by most studies. The fact that only seven percent of the firms in the survey saw taxes as an attractive locational factor support this hypothesis. A major qualification that should be made, however, is the non pecuniary role of tax incentives. It was the consensus of the majority of interviewees that most community aid programs are valued by firms not in monetary terms but as an indication of the community's good will. This being so, tax incentives may tilt the decision to locate in the community offering them when all other factors are equal among alternative sites.

   With regard to the profile of firms indicating the attractiveness of taxes in Oklahoma, no major characteristic could be determined due to the large degree of heterogeneity of firms within each group (with respect to structure, size and nature of operations).

10. Energy--the relatively low rates for utilities offered by Oklahoma served as a point of attraction to firms characterized by large usage of power

generating energy. The fundamental features of such firms were processes of production where a large amount of electricity is consumed or with an extensive use of machinery. These features were manifested in high expenditures in utilities (approximately fifteen percent for the average firm in this category versus 1.5 percent for other firms and a low ration of output to investment (capital intensive).

These general conclusions require a word of caution. To assume that each of the ten locational factors was by itself responsible for attracting a firm to locate in Oklahoma would be contrary to the findings of this study. Today's complicated market structures and the complexity of production processes are such that more than one factor has to be considered when a plant site is selected. Thus, when choosing among alternative locations the firm will favor the site which fulfills the firm's basic orientation and at the same time answers its other needs. An optimal location, therefore, is the site which offers an optimum mix of locational factors.

The use of the model provides an approximation of the probable adaptability of a firm to the state in so much as the firm's basic orientation is concerned. A comprehensive answer could be arrived at, therefore, only when the model is supplemented by a judicious evaluation of the firm's other needs.

This study and model are specific to Oklahoma since it is based upon information provided by firms which deliberately chose this state as a location for their plants. However, pursuing the same methodology in studies of other states or communities can provide the needed information which will assist industrial developers in their efforts to determine which firms are most likely to settle in their communities.

APPENDIX I

PLANT LOCATION QUESTIONNAIRE

Part I

This information will be held in strict confidence.

General description of company:

1. Name of Company_____
2. Year plant began operations in Oklahoma_____
3. Is your plant a branch or subsidiary of another company? ___Yes ___No
4. If yes, what is the name of the company?_____
   Location:_____
5. Has your plant relocated to Oklahoma from another state? ___Yes ___No
6. If yes, from what state?_____
7. Approximate total investment in plant and equipment:_____
8. Approximate annual sales:_____
9. Number of employees:_____
10. Number of production workers:_____
11. For the company's type of operation, do you hire mostly: a. skilled workers___ b. unskilled workers__
12. Did your company recruit employees from outside the state? ___Yes ___No
13. If yes, what type (by skill)?_____
14. Do you have a formal training program? ___Yes ___No
15. If yes, is the program financially assisted by:
    State_____ Federal Government___
16. Are employees unionized? ___Yes ___No

PLANT LOCATION QUESTIONNAIRE

Part II

This information will be held in strict confidence.

Production:

1. What are the major products that your company produces?

2. What are the major raw materials used in your operation?

3. What is the major power source used in the process of production?

   a. Electricity_____ b. Gas_____

   c. Water_____ d. Other_____

4. Who is the supplier of energy?_____

5. What means of transportation are used in delivering raw materials to your plant?

6. What means of transportation are used in distributing your product?

7. Please list by the locations of primary sources of raw materials (by state).

8. Please list your major production workers by function (machine operators, assemblers, etc.):

PLANT LOCATION QUESTIONNAIRE

Part III

This information will be held in strict confidence.

Cost and Marketing Ratios:

1. Please fill in below the approximate various costs as a percentage of total cost of production:

   a. Energy_____%

   b. Transportation of raw materials_____%

   c. Transportation of finished product_____%

   d. Labor_____%

2. Where is the product sold and what is the approximate percentage sold in each state?

STATE	PERCENTAGE OF TOTAL SALES

PLANT LOCATION QUESTIONNAIRE

Part IV

This information will be held in strict confidence. If more space is needed for replies, please use reverse side.

Plant Site Selection:

1. The decision to consider Oklahoma as a possible location for your plant was initiated by: (please check)

( ) management consultant firm
( ) company staff
( ) transportation company
( ) utility company
( ) state industrial development department
( ) other (please specify)_____

2. Who made the final decision to locate in Oklahoma?

Name_____

Position (or Title in case of Committee)_____

3. Below, you will find a list of factors which commonly influence the decision to locate in a particular site. Please rank, in order of importance, the six factors which were most influential in determining your decision to locate in your specific site.

( ) nearness to markets
( ) low cost of utilities
( ) tax structure rate
( ) tax exemptions
( ) labor supply
( ) good transportation facilities
( ) recreation facilities
( ) low wages
( ) future market potential
( ) other (specify)
( ) nearness to raw materials
( ) state financial aid
( ) labor and community climate
( ) land cost
( ) schooling system and churches
( ) Oklahoma labor laws
( ) transportation rates
( ) personal factors (specify)
( ) non-existence of similar firms in the area
( ) Oklahoma's geographical location in the southwest region

4. In the space below, please explain briefly why the factors ranked highly by you were particularly significant in inducing your decision to locate in your specific site.

5. What costs did you especially seek to minimize in choosing a plant site? (Please rank in order of importance)

( ) labor costs
( ) transportation cost of finished product
( ) land cost
( ) other (please specify)
( ) transportation cost of raw materials
( ) cost of utilities and power
( ) taxes

6. In the space below, please explain briefly why the minimization of the specific costs is essential in your type of operation.

7. Did your company consider other locations?

___Yes ___No

8. If yes, which ones?

9. Please list the unsatisfactory factors which induced you to eliminate these locations as probable sites for your plant.

10. If your plant has relocated to Oklahoma from another state, please briefly explain why.

11. If your company were selecting a new plant site which consideration would be of importance to you in selecting the specific site? (Please rank in order of importance)

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