THEODOR BRINKMANN'S
ECONOMICS OF THE FARM BUSINESS

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ENGLISH EDITION

WITH INTRODUCTION AND NOTES BY

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PREFACE

THE WRITINGS OF TWO MEN, Friedrich Aereboe and Theodor Brinkmann, have been especially representative of the best modern German thinking concerning the problems of agricultural economics, especially the problems of farm management. They represent an approach and point of view with which American students have not been widely familiar. Aereboe's treatment of this subject is best set forth in his *Allgemeine landwirtschaftliche Betriebslehre.* A briefer treatment covering much of the same ground is presented by Theodor Brinkmann in *Grundriss der Sozialökonomik,* VII Abteilung, under the title "Die Oekonomik des landwirtschaftlichen Betriebes." As yet conditions and sale possibilities have not seemed to warrant publishing a translation of so extensive a work as Aereboe's *Betriebslehre.* As a means of bringing the German point of view more generally to the attention of American students of farm economics, a translation of the briefer treatment by Brinkmann has, however, seemed a more practical undertaking.

Through the interest and encouragement given by a former student of Professor Brinkmann's, Dr. Kurt Schneider, Mrs. Benedict in 1929 undertook this translation chiefly as a pastime. Its completion was prevented by her death early in 1930. Even before that time it had become evident that accurate handling of parts of the subject-matter would necessitate consultation with someone intimately acquainted with German agricultural practices and sufficiently familiar with German scientific literature to deal with some of the unusual terms and expressions used in the original. Moreover, it appeared that this very difficulty of making a clear and accurate translation would enhance its usefulness. It was also felt that, inasmuch as the majority of American students of farm management have not been very familiar with German writings on the subject, the bringing of the German point of view more definitely to their attention might stimulate a more effective exchange of ideas between students in the two countries.

Director H. R. Tolley, of the Giannini Foundation of Agricultural Economics, became interested in the project and made arrangements whereby Mr. Heinrich Stippler, formerly a student

under Friedrich Aereboe, could assist in completing the translation. Mr. Stippler's intimate knowledge of German conditions and of the language has made possible the clarification of many passages which would otherwise have been obscure or inaccurate.

In offering this edition to English-speaking students of farm management, the translators are acutely aware of the inability of any translation to convey all the shades of meaning which the original possesses. It is our hope, however, that the meaning as worked out after careful discussion and numerous revisions will be clearer than the original would be to persons who do not read German very freely.

The aim has been to keep as close to the text of the original as could be done practically, but in many passages entirely literal translations would distort the meaning. Careful students of the subject will no doubt wish to turn to the original, particularly in connection with such phases as the treatment of the Law of the Minimum and the Law of Diminishing Increments.

Special acknowledgment is due for the encouragement and assistance given by Director Tolley. Besides making the necessary arrangements for Mr. Stippler's services, he has assisted in a careful final reading and revision of the copy, contributing many helpful suggestions for better wording and clearer statement.

Professor J. D. Black, as chairman of the Social Science Research Council's Advisory Committee on Social and Economic Research in Agriculture, has aided greatly in making the arrangements with Professor Brinkmann and his publishers for the authorization to print the English edition. The Social Science Research Council's subcommittee on translations has also been helpful. This committee consists of Dr. L. C. Gray, Dr. C. J. Galpin, and Miss Mary G. Lacy. We wish also to acknowledge the generous service performed by Professor Joseph Schumpeter in facilitating the arrangements with Professor Brinkmann and his publishers. Also, we wish to commend the spirit of coöperation shown by Professor Brinkmann and by his publisher, J. C. B. Mohr, in authorizing a limited edition of this translation without royalty. Without the ready coöperation of these various people, it would not have been possible to bring out this edition.

M. R. B.

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EDITOR'S INTRODUCTION

SIGMUND VON FRAUENDORFER in 1928 presented to agricultural economists an able and understanding discussion of the "Development, Methods, and Results of Agricultural Economics Research in the United States."[1] This treatment, which on the whole is a very accurate one, indicates the very limited extent to which American students of farm management have drawn from either the general field of economic theory or foreign works on farm management. In fact, the influence of the German discussions of this subject, which have been the most extensive of any outside the United States, is practically nil. On the other hand, a study of the writings by German students of farm management, up to very recent years, will indicate a similar lack of contact with the procedures which were being developed in the United States. The strikingly different approaches to very similar problems suggest that considerable advantage may come from a freer interchange of views between the two countries.

The following comments by Frauendorfer point to interesting differences in point of view:

> A characteristic of American research activity is respect for the accomplished fact and a predilection for its expression by means of figures. The American cannot easily be surpassed in untiring accumulation of data and in their skillful, clear presentation. That is shown particularly in the surveys and cost of production studies of the earlier days, which often carried too far the zeal for descriptive statistical material, and neglected the solution of the question of causes....
>
> The American, on the other hand, does little deductive work. There is not one of the agricultural economic works that can be compared in any way with Aereboe's *Betriebslehre*. That is no depreciation of analogous American works. It only directs attention to the difference in the intellectual attitude; on the German side an intuitive grasp of truth and never-failing sense for systematic arrangement; on the American side a collection of constructive details, all keenly observed and well described, which, nevertheless, does not present a very convincing picture. The German observer of American work is, therefore, more impressed by the detailed studies of an analytical nature than by handbooks and textbooks, of which there are many. The latter have a too pronounced

[1] Written for and published in *Berichte über Landwirtschaft* (Berlin, 1928), vol. 7. (Also published in English in the *Journal of Farm Economics*, July, 1928.)

didactic character—at least to the German taste—and that may bias judgment, perhaps unjustly, against American works.[2]

The method of approach followed by both Aereboe and Brinkmann, like that of Alfred Weber, is a development and refinement in the use of those analytical tools which are most generally associated with the name of Thünen.[3]

These methods represent a refinement of Thünen similar to that which Marshall made of Mill and Ricardo, or the more detailed analysis of monetary and credit theory which R. G. Hawtrey built on Marshall's treatment of the same subject. In no textbook in the English language do we find as careful separation and identification of the elements that affect the combination of enterprises and the levels of farming intensity as are to be found in some of the German writings on the subject. The nearest approaches to this in the English language are J. D. Black's *Introduction to Production Economics* and C. L. Holmes's *Economics of Farm Organization and Management.*

The deficiencies of such theories as Justus von Liebig's "Law of the Minimum," for example, have been recognized by many American economists but have seldom been discussed in print. Brinkmann deals with this in a vigorous and understanding way, bringing out its limitations in the light of the relationships expressed in the "Law of Diminishing Increments." In nearly all the American writing on the subject, intensity of farming has been considered in an extremely abstract form.[4] Brinkmann's treatment still is in

[2] A. M. Hanney's translation of Sigmund von Frauendorfer, "Development, Methods, and Results of Agricultural Economic Research in the United States," *Journal of Farm Economics,* July, 1928, pp. 308–309.

[3] Some aspects of Aereboe's point of view and approach to farm management problems are well discussed in the article by Heinrich Stippler, "Philosophy of Aereboe as Related to Scope and Method of Research in Farm Management," *Journal of Farm Economics,* October, 1931, pp. 597–604. See also G. P. Minnemann's translation appearing under the title, "Graphic Presentation of Thünen's Theory of Intensity," of an article by Richard Krzymowski, *ibid.,* October, 1928, pp. 461–482; "German Approach to Farm Economic Investigations," by Immanuel Fauser, *ibid.,* July, 1926, pp. 289–297; "Farm Budgeting in Germany," by Walter J. Roth, *ibid.,* October, 1929, pp. 623–632.

[4] See, for example, T. N. Carver, *The Distribution of Wealth* (New York, Macmillan, 1926), Chap. II; J. D. Black, *Introduction to Production Economics* (New York, Henry Holt & Co., 1926), Chaps. XI and XII; and H. C. Taylor, *Agricultural Economics* (New York, Macmillan, 1919), Chap. XIII.

abstract form but it brings the discussion much closer to reality than do most of the American writings. One of the most interesting phases of Brinkmann's analysis is his treatment of the nature of the competitive relationships among farm enterprises. In few writings has this had the careful and almost quantitative treatment which he gives to it. He has dealt with the elusive problem of opportunities sacrificed in a way that should meet with little criticism and which is at the same time lucid and stimulating. Not[5] only the principles of opportunity cost but those of comparative advantage are used without the wearying process of attempts at abstract definition, and, further, without resort either to Davenport's way of presenting them or to Marshall's use of the substitution method.

Type-of-farming studies have made some little progress in the United States, but as yet are almost wholly in the descriptive stage. Brinkmann's treatment of this phase of farm management is suggestive and stimulating, and points the way to a possible inductive development of the dynamics of comparative advantage. Such studies thus far have shown relatively little attempt to explain either the reasons for the existing farm types or to indicate the probable direction of future change. An explanation cannot, of course, be worked out on the relatively simple bases indicated in Brinkmann's analysis, at least not through the use of actual mileages in considering the effects of location. It is possible, however, that fuller treatment of these relationships may be possible through the use of transportation costs rather than of distances and through more careful analysis of the physical similarities and differences of competing areas.

Serious attempts to apply the methods of analyzing farm types outlined by Brinkmann will inevitably raise some very interesting points in respect to policies affecting agricultural production. These methods seem to imply, however, the possibility of a scientific basis for study of certain phases of agricultural policy—a basis which has been much lacking in that new and rapidly developing

[5] A different approach to these problems and one which may be of interest for comparison is to be found in the two articles by M. R. Benedict, "The Opportunity Cost Basis of the Substitution Method in Farm Management," *Journal of Farm Economics*, July and October, 1932.

field of agricultural economics. The principles discussed in this brief theoretical treatment must, of course, be carried considerably farther if they are to provide the working tools for analysis of the complex relationships encountered in agricultural production. Nevertheless, such a background of theory is a much needed foundation for a well balanced use of the various specific research procedures which have been developed.

Like the methods of analysis which Alfred Weber has developed in his *Theory of the Location of Industries*,[6] this will not be found an easy approach to apply to the locational relationships of agricultural production in the United States where other factors than economic distances play so large a rôle; where racial differences, climatic variations, soil conditions, and sizes of the business unit, are such significant elements in the problem, and where freight-rate structures have developed along lines very different from those which have been characteristic of Germany as well as of many other European countries.

One of the surprising features of Aereboe's and Brinkmann's treatment of these problems, as compared with the writings of many other German students, is the relatively small recognition of the effects of historical development on existing types of agriculture. This is, to be sure, recognized in the latter part of Brinkmann's treatment where he deals with dynamic aspects of the problem, but even there it is not fully developed. How much of the present form of agricultural production and of the present type of business unit are the result of the particular way in which the land of the United States was taken up or to the peculiar racial relationships which grew out of the era of slavery is an interesting phase of the background of farming types, and has so far had relatively little careful analysis. In Brinkmann's analysis, as in most American writings, this is not much considered. A higher degree of mobility and flexibility in agricultural relationships than actually exists is assumed. In this respect the treatment suggests much more the assumed mobility and atomic nature of economics, which are characteristic of the English classical and neo-classical writers,

[6] English edition, with Introduction and Notes, by Carl J. Friedrich (University of Chicago Press, 1929).

than the American ways of dealing with these problems where, except in the strictly abstract discussions, the possibility of systematizing existing conditions along rather rigid lines is probably given too much weight. That the German writers have a contribution to make to American thinking in these respects seems evident.

Professor Brinkmann's treatise is not a new work, nor does it now accord wholly with his present views. It is some twenty years old. (The manuscript was delivered in 1912 to Professor Max Weber of Heidelberg, and was published in 1914 as a special publication. Not until 1922 did it appear in *Grundriss der Sozialökonomik.*) The author states that, although his desire to help in bringing together American and German agricultural knowledge overcame any prejudice he might have had against a translation, he nevertheless regards the treatment as a "beginner's work," of which no one is a sterner critic than himself. American readers will be interested to know, however, that the *Oekonomik* has appeared also in the Russian and Japanese languages.

Professor Brinkmann makes the following comment: "No one can be more firmly convinced than I that a synthesis of American and German thought is very well suited to promote knowledge of the nature of agriculture." If the present small venture in making more available to American readers this source of ideas and methodology serves to stimulate them to further study of the German writers, its purpose will have been served.

MURRAY R. BENEDICT

LITERATURE

THE VERY EXTENSIVE LITERATURE dealing with farm management consists mainly of presentations which not only are largely descriptive but often are obsolete as well (descriptions of farming systems, etc.). Little attention has been given to theoretical analysis and explanation of cause and effect relationships. The *Isolierte Staat*, by Joh. H. von Thünen (III edition, 1875), is basic from the standpoint of theory. In addition to this, so far as older scientists are concerned, the works of Ad. Krämer are of great value, especially the "Grundlagen und die Einrichtung des landwirtschaftlichen Betriebes," published in Goltz's *Handbuch der gesamten Landwirtschaft* (Tübingen, 1890). Fr. Aereboe has recently furthered the theoretical knowledge of the subject in a pioneering way. Especially worth mentioning among his books are: *Beiträge zur Wirtschaftslehre des Landbaues* (Berlin, 1905); an article in Volume I of the *Thünen—Archives* on "Ursachen und Formen Wechselnder Betriebsintensität in der Landwirtschaft;" and *Die Taxation von Landgütern und Grundstücken* (Berlin, 1912). Fr. Waterstradt and G. Laur have also tried to do justice to the theory of the subject, the former in his *Wirtschaftslehre des Landbaues* (Stuttgart, 1912), the latter in a very extensive work, *Grundlagen und Methoden der Bewertung, Buchhaltung, und Kalkulation in der Landwirtschaft* (Berlin, 1911). The discussion in the following pages draws upon Thünen and Aereboe. The author has also acquired valuable ideas from the work of Alfred Weber, *Über den Standort der Industrien* (Tübingen, 1909).

CHAPTER I

GENERAL CONSIDERATION OF THE TYPES OF FARMING

IN A GENERAL CONSIDERATION of the various types of farming, the differentiation as between extensive and intensive methods is of fundamental importance. This differentiation has to do with the relationship between the factors of production; namely, on the one hand, the land, on the other, labor and capital. The most casual observation shows that this relation varies greatly from place to place and from time to time. In some cases nature plays the most significant rôle while the agricultural *entrepreneur* applies only an insignificant amount of labor and capital for the purpose of increasing the productivity of the soil, or satisfies himself with the mere appropriation of that which nature has already produced without his coöperation. In other cases the entrepreneur applies large quantities of labor and capital in order to increase the returns per unit of land. In the first case we speak of it as an extensive, in the second, as an intensive, method of agricultural production. The degree of intensity with which a farm is operated (Betriebsintensität) means, then, the amount of labor and capital used per unit of land. The terms "extensive" and "intensive" have, of course, only a relative meaning. Depending upon the measures used in judging it, a certain method of farming may be termed in one case extensive, in another intensive.

Since the relation of labor to capital is capable of the same manifold variation as the relation of these to land, we may distinguish further between "labor-intensive" farms, if mainly human labor is applied in order to increase production, or "capital-intensive" farms, if the direct use of human labor is minimized while the use of machinery and materials predominates. The labor-intensive farm is then capital-extensive; the capital-intensive farm is labor-extensive.

The terms "intensive" and "rational" should not, without further explanation, be used interchangeably. Every degree of intens-

ity can be "rational," under certain conditions; that is, can yield the highest continuing profit. The extent to which labor and capital can be applied rationally in the farm business depends, as will be shown in detail, entirely upon the economic, natural, and personal conditions. There is therefore a "rational-extensive" as well as a "rational-intensive" mode of farming.

Nevertheless, the practical farmer is inclined to look upon the intensive farm business as the most profitable type. This accords with the commonly observed fact that the increasing intensity of operation made necessary by progressive development of the social structure does not take place with equal rapidity on all farms. Instead it comes about now more quickly, now more slowly, depending on the personal abilities of the individual entrepreneurs. Under similar natural and economic conditions (Verkehrsverhältnisse) those farmers who keep pace with economic progress usually operate not only more profitably but also more intensively than do those who follow but slowly the progress of the times. This latter group, as we know from observation, includes the great majority of farmers. Thus the intensively operated farms are often at the same time the more profitable farms. To be sure, the more limited the range of observation the more this appears to be true.

It is not easy to find a suitable expression for the degree of intensity in a given case; that is, a numerical measure usable for purposes of comparison. To be sure, labor and capital and the different forms of capital have in their money value a common denominator. But the amount of labor and capital expenditure per acre expressed in money or, in other words, the total farm expense (Wirtschaftsaufwand), is not a satisfactory measure of the intensity of operation. Even with a given expenditure (in terms of money) the amount of labor accomplishment and of capital input may fluctuate considerably. In comparing one farm with another, therefore, one cannot call the one "labor-intensive" merely because its wage expenditures are relatively high. This term is proper only if high wage payments are accompanied by a correspondingly high labor accomplishment. High wage payments may result from high wage rates or from low capacity for accomplishment on the part of the laborers. This is true also of expenditures for teams and other

capital goods. Nevertheless, the money value of labor and capital used per unit of land affords a comparatively safe measure for appraising the intensity of farming, at any rate a better one than various other criteria which have been used. To judge intensity on the basis of the extent of the one or the other type of input, perhaps by the number of teams or even by the amount of the gross return, as is not infrequently done, is not feasible because one cannot be certain that there is any correlation whatever either among the individual types of input or between gross return and the total input per unit of land. And even if one plans to use the total money input, he must consider that he will obtain usable figures for comparison only if he combines, for a given production period, the inputs of wages, of capital consumed, and of interest on the investment. It is not feasible to limit the comparison to the "current" operating expenses as obtained by bookkeeping methods; that is, to the expenditures for labor used and capital consumed, even taking into account the amounts needed for depreciation. Farms with large long-term investments, which have on the one hand comparatively low costs for labor and for production goods used, but on the other hand high interest charges, would then appear more extensive than they really are. As has been said, the unit upon which money expenditure thus reckoned is based, is the unit of operated area and not its money value, because the latter is itself a variable which is influenced by the same factors and in the same manner as the total amount of expenditure per land unit.

If, in accordance with the foregoing, we indicate by I the degree of intensity of farming, by L the labor input, by C the capital used, by M the interest on invested capital, and by A the extent of the operated area, then we shall have the following formula:

$$I = \frac{L + C + M}{A}$$

Next in importance to degree of intensity as a means of differentiating types of business organization in agriculture is the system of farming. This concept links up with the lines of production; that is, with the division of the farm business according to enterprises or branches. Only in very exceptional circumstances is a

farm given over exclusively to the production of a single product. For reasons with which we shall be intensely concerned, several, or even whole groups of, products are, as a rule, produced side by side on the same farm. The land is used partly as meadow and pasture which supply hay and grass, partly as forest for the production of wood, and partly as cultivated land and garden which furnish the various crops. Each kind of use constitutes then a special type of land use. The primary or plant products of the farm need in many cases refinement or conversion into other products before they can leave the farm as marketable goods or can be made to serve other useful purposes. Thus hay and straw and other feeds are transformed, through the keeping of live stock, into animal products. Others again, as potatoes and sugar beets, are refined by technical processes. With the types of land use, therefore, are linked certain kinds of farm activities concerned with the processing or refining of plant products; namely, live-stock enterprises, home industries, and technical side lines. These constitute special farm enterprises called the refining or processing enterprises. We can also, in both groups, speak of "main" or "sub" branches or enterprises, as can be seen more clearly from the summary on page 5.

Sometimes a larger, sometimes a smaller number of types of land use, of kinds of processing, and of main and sub-branches, may be combined in a single business unit. This depends, of course, upon the economic, natural, and personal conditions on the farm. Also the proportions in which the individual enterprises may be combined can be infinitely varied. Indeed, the number of possible combinations is scarcely conceivable; so, in order to get a general view of the types of farming, we usually combine as a single group or type those farms which derive a characteristic aspect from the existence or predominance of a specific enterprise or group of enterprises combined in a similar way. These typical farm organizations are designated as farming systems.

Of chief importance in grouping farms according to farming systems is, of course, the way in which the branches of land use are combined. Farming systems are therefore classified primarily according to the relationships of types of land use and kinds of field crops grown. We may speak of field-crop systems and pasture sys-

tems, these terms having reference to types of land use. We may also speak of grain farms, feed-crop farms, beet farms, etc., or of three-year rotation systems, arable-pastoral systems,[1] etc., if we

A. TYPES OF LAND USE

"Main branches"	"Sub-branches" of the first rank	"Sub-branches" of the second rank
Field-crop production	Production of grain	Rye, wheat, etc.
	Hoe crops	Potatoes, sugar beets, etc.
	Feed crops	
	Commercial crops	
Production of garden crops	Vegetable growing	
	Fruit growing, etc.	
Meadows		
Pastures, etc.		

B. BRANCHES OF PROCESSING OR REFINEMENT

"Main branches"	"Sub-branches" of the first rank	"Sub-branches" of the second rank
The keeping of productive live stock	The keeping of:	The keeping of:
	Cattle	Milk cows
		Breeding cows
		Beef cattle
	Sheep	For wool
		For meat, etc.
	Hogs	
	Horses	
	Etc.	
Technical side lines	Distilling	
	Starch making	
	Sugar manufacture	
	Potato drying	
	Manufacture of dairy products	Butter making
		Cheese making
	etc.	

[1] TRANSLATOR'S NOTE: The "Feldgrassystem" and "Feldgraswirtschaft" are respectively a farming system and a farm wherein the land is divided into cultivated and pasture lands. The cultivated land is allowed to go to grass as soon as it is exhausted, and the pasture is then plowed up in its stead.

have in mind the field-crop systems and their characteristics. We can also, where it is feasible, combine both the distinctions between the types of land use and the distinctions between the individual crops within these types, and may, for example, designate a system as crop-rotation farming with permanent pasture. Not infrequently, however, one or another branch of processing, together with a type of land use, also provides a main characteristic by which to define the farming system. So, for example, one may speak of a grain farm with wool production, a crop-rotation farm with distillery, a feed-crop farm with market-milk production (Abmelkbetrieb), or a pasture and fattening-farm (Weidemastwirtschaft), etc. One always indicates, if possible, that which is typical for the combination of enterprises and therefore an appropriate designation of the farm in respect to its fundamental operations. The term "system" is used of course if one wishes to indicate only one aspect of the type of farming, that is, the kind of land use or the processing set-up, and we speak accordingly of systems of land use and of processing or conversion systems, respectively.

Since the individual enterprises require greatly varying amounts of capital and labor, the grouping of farms according to systems is at the same time, taken as a whole at least, a grouping according to degrees of intensity. Grazing lands, for example, make comparatively small demands upon capital and labor, far less than do hoe crops or even forage crops or the arable-pastoral system which is characterized by the predominance of tame pasture. A grazing system must therefore be termed an extensive system in comparison with one in which grain crops are rotated with sugar beets. Of course, inclusion in a certain system does not mean definite determination of the degree of intensity, nor can the combination of farming enterprises be accurately described thus. A particular system, as the ranching system, may have an extraordinarily wide range of possibilities in respect to gradation according to degrees of intensity. In designating types in such cases, it is well therefore to refer both to the degree of intensity and to the farming system; for example, extensive ranching system or intensive ranching system.

Chapter II

THE LEVELS OF INTENSITY IN AGRICULTURAL PRODUCTION AND THE ORIENTATION OF ITS LOCATION

1. MARGINS OF PROFITABLENESS AND FACTORS OF INTENSITY

THE AIM OF AN AGRICULTURAL ENTERPRISE is to achieve an individual economic profit which is as high and as lasting as possible. In his efforts directed to this end the agricultural entrepreneur adds his capital and labor to his farm area. He may indeed increase both (intensify the business) until the money values of the last inputs (Einwendungen) plus the customary rate of interest on these (the money costs in a broader sense) are just returned through the resulting gross receipts from such final units. He must stop increasing the intensity when the gross return no longer suffices for this purpose. He may then invest additional amounts of labor and capital only if he continues to receive for them equivalent values in the form of gross returns. The question therefore arises of identifying the general factors determining the degree of intensity which, for rational operation, may, and in fact must, prevail in agricultural production.

The fact that, in the agricultural use of the soil, additional amounts of capital and labor cannot be invested indefinitely becomes clear if we keep in mind the law of diminishing rate of increase in return (Ertragzuwachs), commonly called the law of diminishing returns of the soil.[1] This natural law states that the gross return in agriculture does not increase proportionally with increase of inputs; that, on the contrary, the increase in return which accompanies the successive units of input becomes less and less beyond a certain limit and finally completely disappears. Indeed, this law of diminution holds true without exception for every kind of input. From the point of view of the individual, using money values for inputs and outputs as the farmer is compelled to reckon, it means that the differences between the money costs of

[1] A designation which is less in accord with the sense of the word.

the units of input and the money values of the corresponding units of output gradually decrease and of necessity become negative before the limit of increase in [total] returns is reached. It is evident, therefore, that it cannot be advantageous to strive for the absolute maximum of gross return, much less to increase intensity indefinitely. In respect of individual gains, the highest permissible limit for the total input lies where the value of the marginal [unit of] output and the value of the marginal [unit of] input just equal each other; that is, where the last unit of input is just paid for by the corresponding gross return, including of course interest on the capital used. If this limit is overstepped, then, to be sure, an increase in gross receipts in terms of money is sometimes gained, but an increase which is too small to cover the money costs appertaining to it. The entrepreneur must then take a loss first in interest and soon in capital.

This upper limit is at the same time the margin of profitableness for the application of inputs. Not only must this limit be reached, but, if the goal of agricultural entrepreneurship is to be attained, the application of inputs must be maintained at this level. Not only is the profit lessened by exceeding this upper limit but also by failing to reach it—not, to be sure, through direct money loss but through failure to make complete use of the possibilities of gain. This is apparent without further explanation, as a consequence of the law of diminishing returns. If the marginal input yields the customary rate of interest, then of course every preceding unit of input must yield a more than customary return. A lessening of the inputs must therefore lower the profit. Only at a quite definite degree of intensity can the highest profit from the farm business be attained. An intensity carried too far results in an actual loss. An over-extensity results, on the other hand, in the failure to make a possible gain. This concept forms the main basis for the derivation of all further laws of farming intensity. Since it is based upon the law of diminishing returns, and since all questions of profitableness in farming are fundamentally only questions of intensity, we may properly designate this as the fundamental law of farm management. However much one may debate whether this "law of the soil" at present increases the burden of providing civilized peoples

with organic products over that of past times, its practical significance in the sphere of private economics cannot be questioned.

We can now define more exactly what the highest and most lasting possible profit, which has just been designated as the goal of agricultural entrepreneurship, consists of in the final analysis. The application of capital and labor must be carried to the point where, reckoned upon the individual units of input, the net return (Reinertrag) has decreased so far that it just pays interest for the last unit of input at the customary rate. The highest possible net profit over and above expenses and interest is to be striven for, or, in other words, the highest possible land rent. This is the "goal of all farm operations"[2] and not net profit in the customary sense; that is, the surplus including interest on capital investment. It is conceivable that, with increasing intensity, net profit still increases even when ground rent again decreases. This results, however, from imputing insufficient interest on the last additions of capital. That this possibility has more than mere academic significance appears from the fact that many expenditures in agriculture, if made at all, can only be made by investing relatively large amounts of capital. To illustrate this, one may assume the operation of a large farm to be intensified by the purchase of a steam-plow set whereby, considering the replaced teams, there results a capital investment of 25,000 M, and an increase of the net return of 250 M,[3] equaling 1 per cent of the additional investment. If the prevailing rate of interest were 4 per cent the entrepreneur would have to bear a loss in interest of 750 M.[4] The ground rent would be lessened by this amount.

If we have recognized the limits of profitableness as determined by the fundamental law governing the application of labor and capital to land, a further question now arises as to the factors which can shift these limits; namely, the forces of orientation which determine the locations of the different intensities of farm-

[2] Lambl, *Die Grundrente als Zweck aller Landwirtschaft und Viehzucht* (Prag, 1888).

[3] TRANSLATOR'S NOTE: The German text shows these interest items as 1000 M and 3000 M respectively, an error to which Professor Brinkmann has since directed attention.

[4] Lambl, *op. cit.*

ing. The limits of profitableness may be shifted in the following ways: either, with equal inputs, the amounts of output (money or physical output) may vary or, with equal outputs, the inputs (in quantity or value) may vary. The higher the gross return with a given input and the lower the input with a given gross return, the farther away is the point where marginal return and marginal expense balance, and the larger the additional expenditure which can profitably be made. The gross returns and expenses in agriculture are affected chiefly by four factors, which may therefore be termed the general factors of differentiation and orientation of farming intensities, or, briefly, the "factors of intensity" (Intensitätsfactoren).

These four factors are: (1) the economic location of the farm, (2) the natural conditions (physical productivity) of the farm, (3) the stage of development of the social organization (Volkswirtschaft), and (4) the personal qualities of the entrepreneur. To put it differently and more precisely, of the many separate influences which, through their joint action, play significant rôles in the differentiation of farming intensities sometimes reënforcing one another, at other times counterbalancing one another and thus creating the endless variety of individual combinations observed—all may be classified under these four headings. They fall under one or another of the concepts—economic location, natural conditions, stage of development, or personal qualities of the entrepreneur. All these factors are fundamentally of equal importance, though, in reality, the effect of one or another of them manifests itself more predominantly depending on the point of view taken; that is, whether one is considering, historically, a longer or shorter period of time or, geographically, a larger or smaller area. The two first-named factors and the last explain the greater number of the observed differences in a cross-section analysis as of a given time. The third is of importance mainly in considering successive periods; in other words, for historical analysis. In order to make clear the effects of the individual factors it is necessary to isolate them deductively; that is, to investigate each individual factor under the assumption that the effects of the other factors remain unchanged. First, let us take up the influence of economic location.

2. THE ECONOMIC LOCATION OF FARMS AS A FACTOR OF INTENSITY

THE ECONOMIC LOCATION of a farm includes all its relations to the outside world, active as well as passive. We have, on the one hand, the marketing location, on the other, the purchasing location. The favorableness of a farm's location can be measured by the level of the local prices (farm prices) for products of the land and by the local price level for the goods and services purchased by farmers. The higher the prices of agricultural products and the lower the prices of purchased goods in a given place, the more favorable is its economic location.

The differences which the local prices show within the economic structure at a given time can best be made clear by an abstraction such as Von Thünen has given us in his "isolated state." We assume an isolated economic area which has in its center a single selling and purchasing place or market, and which is equally developed in all parts with respect to means of communication. In such a hypothetical economic structure the local prices of the agricultural products are determined, first, by the level of prices at the market place, second, by the amount of expense (freight, commission charges, risk, etc.) which is incurred in marketing. The market price is a standard price for goods of definite kinds and qualities. The local price is calculated on the basis of the market price after deducting the marketing costs. The farm price reaches its maximum in the vicinity of the market where transportation expenses disappear, its minimum at the periphery of the trade area where the difficulties of marketing are greatest, and its gradations are located concentrically around the market. So it is in the "isolated state." The reality departs from this only so far as the regularity of the pattern is broken by the fact that the amount of marketing costs is not only a function of distance in space but also of kind of transportation. Distance in space and economic distance do not, without some qualification, correspond to each other. This is because of the manifold kinds of transportation facilities to be taken into consideration (highways, railroads, waterways, etc.). Further, there is not merely one market; there are many markets, the

spheres of influence of which touch and cross one another. But all this is too self-evident to need to be carried farther here.

Not quite so simple are the causes of differentiation in the prices of goods used in agricultural production. Market price and transportation costs (in the broadest sense) are here also the factors which we must consider. It should be added however that the different production goods[5] have quite different origins. Some are "obtained" from the market as industrially produced goods; others are obtained from the farm itself as agricultural products; others again occupy an intermediate position. Depending upon the origin of the production goods, we have therefore, as we proceed away from the market, sometimes an increasing sometimes a decreasing tendency in the local prices.

The industrially produced goods, purchased from the market, show a rising tendency as a rule (tools, machines, fertilizers, many concentrated feeds, etc.). The farmer who purchases them has to pay the standard market price and besides has to bear the additional expenses which vary with the distance and the means of communication. Such industrially produced goods therefore behave in a way opposite to that of agricultural products, and, for these goods, the local price level reaches its minimum in the vicinity of the market, its maximum where trade with the market stops.

Production goods of purely agricultural origin cannot behave differently in price gradation from agricultural products in general. They become not cheaper but more expensive as the market is approached. Draft animals, cattle, and similar production goods of purely agricultural origin increase in price with more favorable economic location.

Even the most important production good, human labor, undergoes a rise in price with approach to the market. This increase in labor expense is not so rapid however as the increase in prices of agricultural products. This is characteristic in the differentiation of labor expense under the influence of variations in economic location. Labor expense increases only absolutely with more favorable economic location. Relatively—that is, in relation to the prices of

[5] TRANSLATOR'S NOTE: *Bodennutzungsmittel;* that is, instrumentalities of production. See the following paragraph.

agricultural products—it decreases. This behavior of labor expense, lying as it does between two extremes, is explained by the fact that labor expense consists of two cost elements, both of which differ according to the economic location, but in opposite directions.

In order to see this more clearly, we must distinguish between real wages and money wages. The real wage is the amount of the means of subsistence which is placed at the disposal of the laborer in return for the labor he puts in for the entrepreneur. Real wage may be in goods or in the form of money. Money wage is the real wage calculated in money value. The latter we may think of, as we have already said, as consisting of two components: one part consisting of the means of subsistence which are of agricultural origin, which we may designate as Thünen does the "grain part," and a second part consisting of the industrially produced goods needed by the laborer; the latter being obtained from the market may therefore be designated as the "market part" of the real wage. Grain part and market part follow in their price gradations the rules already stated. With approach to the market the former rises in price while the price of the latter declines. The curve representing the net effect of these movements, in other words the curve of money wages, must therefore lie between these extremes, though with an upward inclination. Since the grain part constitutes, for obvious reasons, the larger share of the total wage the curve of money wages must show, in comparison with the curve for prices of agricultural products, a declining tendency, but, taken absolutely, a rising tendency.

This result of course occurs only if we assume that the real wages are not influenced in respect to their level by the economic location. Such an assumption is justified since it corresponds to the hypothesis on which this whole consideration is based, the hypothesis of a stationary or, as Thünen says, a "static" condition of national economy. If there were differences in the level of real wages this balance would no longer exist, since these differences must bring about a leveling tendency. In reality then, differences in real wages, even if they exist side by side, have, as will be shown later, causes which are connected with changes in economic relationships.

They are phenomena of a "dynamic" economy, but not a result of varying favorableness of economic location at a given stage of development.

Let us review. Through savings in transportation costs proximity to the market leads to a growing price spread between the agricultural products and the production goods needed. This spread is greatest for those goods industrially produced and purchased from the market and is lower for the labor expense. For some of the production goods it disappears entirely. Taken as a whole the farm expenses, measured in terms of agricultural products, decrease with the shortening of the distance between the place of production and the market.

The price spread between product and expense, or the relative price level of the production goods, is then a determining factor in the optimum degree of farming intensity because the greater this spread the higher is the degree of intensity at which, according to the law of diminishing yield increase, the money values of marginal output and marginal input balance. Districts near the market—that is, districts with favorable economic locations—are therefore districts of intensive methods of farming. Districts far from the market—that is, districts with unfavorable economic locations—are the areas of extensive methods of farming. In the "isolated state" the optimum degree of farming intensity reaches its maximum in the immediate vicinity of the market, its minimum where communication with the market disappears entirely and agriculture becomes a purely self-sufficing economy.

Of interest for clarification of the laws of intensity in farming is the fundamental difference between the economic problem of a farmer imagined as entirely isolated and that of the agricultural entrepreneur who is within the sphere of influence of the market. For the farmer located outside the area which is in communication with the market the land would have only the significance of a free good which one may utilize in any amount desired. For this farmer only labor and capital would have an economic value. His consideration must be directed to obtaining, with the help of his limited amount of labor and capital, the highest possible gross income without any regard to the area required. He would have to

operate in such a way that capital and labor would yield the optimum of physical goods, and if the amounts of those means of production which were at his disposal were increased he would have to extend his business by taking into cultivation new land. He should not, however, intensify the method of farming because in his situation the maximum return of physical goods reckoned in relation to capital and labor would not thus be obtained. Under a purely self-sufficing condition therefore, economically considered, capital and labor are the factors to be utilized in production; the means of utilization for both is the land. The extent of input at which labor and capital show the greatest productivity constitutes the lowest permissible limit of intensity.

Fundamentally different is the situation in the exchange or money economy. Here the means of extending the area is lacking because free land is no longer available. Labor and capital have now become, because of their capacity to increase, the means for utilizing to the greatest advantage the land which is limited in area; a means of which so much the greater use must be made as the land gains in scarcity value with approach to the market. It is unimportant that the maximum return in physical goods per unit of labor and capital is not obtained in this situation. The question now is how to get from a given area a maximum of money return per unit of land (höchste Grundwert).

Nevertheless, it would be confusing cause and effect if we were to agree with the oft repeated opinion that in the final analysis the value of land, which increases with increasing favorableness of economic location, is the causal factor in the gradation of intensity. The land value is to be regarded entirely as a result. It owes its origin to the land's inherent possibility of producing a ground-rent. It is ground rent capitalized at the "customary" rate of interest and goes up and down with the level of this rent. The level of economic rent is related to the permissible degree of intensity through its dependence upon the price relationship between product and expense. With approach to the market economic rent increases for two reasons, as the previous explanation has made clear and as Ricardo and Thünen have shown, first, because a certain expenditure—one may take the amount of expenditure in the

purely self-sufficing economy as a starting point—yields a steadily increasing net amount in terms of money, second, because, more and more, additions to expenditure become profitable. These, with the exception of the marginal amount, yield contributions to the economic rent. In the chain of interrelationships between land value and the degree of intensity, land value is therefore not the logical initial link but the final link.

It is true, to be sure, that the land value thus originated and thus graduated now forces the maintenance of that intensity of farming which corresponds to its level if the capital value which the land represents is to pay the usual rate of interest. Therefore, when we emphasized above that an incorrect extensity may result only in a falling off of profit but not in a direct loss, we were speaking only in a general way and not in strictly accurate terms. This statement holds true only so long as no actual interest obligations arise from the possession of the land, but not, however, for buyers and tenants who must pay interest on a capitalized value of land resulting from the normal intensity of a given economic location. Through an incorrect extensity they suffer not merely imaginary but actual interest losses such as otherwise would occur only in overstepping the limits of profitable intensity and only in relation to the operating capital. Of course this differentiation, considering the practical range it may have, has only an individual or private significance. Considered objectively and from a purely capitalistic point of view it is entirely irrelevant. But what is of importance here, land value and the necessity for maintaining a normal intensity both go back to the same source; namely, the relative advantage of the economic location. If, for some reason, these advantages disappear—we shall discuss this later—the fact that the entrepreneur has paid a certain price for the land can no longer justify an intensity corresponding to this price. Only as long as the causes which have brought the land values into existence remain effective can these values exert an influence for maintaining a certain intensity of farming. If they disappear no other course is open but to write down the land valuation and, by extensifying the method of farming, avoid the second type of loss; namely, loss in interest on operating capital and in the capital itself. Elsewhere

we must consider more in detail this question which is closely interrelated with the problem of agrarian crises.

Considered as a whole the adjustment of farming intensity to accord with the economic location is, in the main, a purely quantitative phenomenon—greater total expenditures and greater gross returns with increasing favorableness of location. Extensive and intensive methods of farming differ also in more qualitative ways. With the shifting by locational gradations goes another no less important parallel relationship. This relationship applies to the most significant features and to the direction of the intensification; that is, the differentiation in forms of intensity, the main characteristics of which we have yet to investigate.

We must first point out that increasing favorableness of location does not increase the rational rate of expenditure for all factors of production equally, but does make a difference in the relationships of capital and labor and of the various forms of capital. For obvious reasons those factors of production are most affected for which the price curves show the greatest spread with respect to the curves representing prices of products; thus the operating capital is affected more than labor, and of the operating capital chiefly that which represents industrially produced goods that are purchased from the market. Variations in intensity with differences in favorableness of economic location are in the first place differences in capital intensity, in the second place, differences in labor intensity. Tools and machines, fertilizers, purchased feeds, and other purchasable capital goods are the chief elements which aid in getting a higher gross return in the zones of intensity nearer to the market.

With this shifting of the constitution of the farming expenditure there goes hand in hand a change in its direction of application. One may in general distinguish two main groups of measures of agricultural activity: one which relates more to the passive part of the total activity, that is, harvesting and utilizing the products of the land, and a second which includes those activities by which the agricultural producer promoting (förderend)—actively—undertakes to interfere in the organic processes of plant growth, that is, works on the soil: cultivation, fertilization, and the care of

plants in the broadest sense. These two categories, which one may term the group of crop utilization expenditures (Verwertungsaufwand) and the group of cultivation expenditures [proper], behave quite differently in relation to increase of intensity. The second group is far more capable of being intensified than the first. With the same quantity to be harvested one can, to be sure, if the price spread permits it, increase the amount of labor per land unit used in harvesting (as well as the other crop-utilizing labor). With increasing favorableness of economic location this occurs, for example, through harvesting with greater care the less valuable parts of plants (straw, leaves, chaff, etc.). The increase in output which is obtained in this way is comparatively small, however, and is much less significant than the additional output which results from intensification of cultivation expense proper. Or, if we keep in mind the law of diminishing returns, the rate of yield increase falls off far more quickly for the crop-utilizing expenditures than for the cultivation expenditures proper and, with relatively increasing prices of products, the limit of profitableness in the latter case is pushed out correspondingly farther than in the former. Increased intensity as determined by economic location shifts the emphasis (Schwerpunkt) in operating expenditures more and more toward those expenditures which are associated with land cultivation proper. The association of land cultivation (cultivation, fertilization, plant care, etc.) with the appropriation of the products of the land has been the means of bringing about a higher form of agriculture as contrasted to primitive land use (mere appropriation of the products). And, furthermore, the whole process of increase in intensity in agriculture is closely connected with increase in expenditure for land cultivation (fertilization, land cultivation, and plant care).

With this we come to a further problem which is of major interest in this connection; namely, the differentiation between extensive and intensive types of land use or of crops. The shift in relationship between the two forms of expense above indicated applies fundamentally to every kind of crop and type of land use—not, however, in the same degree for all of them. There are crops and types of land use which, no matter where located, occupy land

but use relatively little labor and capital and others which, no matter where located, have a more intensive cultural character. Pasture, meadow, and forest, for which cultivation and also in part fertilization play always a secondary rôle, are specifically extensive types of land use. Field and garden, which receive their characteristic impress through cultivation, are specifically intensive types of land use. Similar differences are to be noticed if we compare the individual crops of field and garden; for example, in the field, a sequence perhaps of forage, of grain, of commercial crops, and of hoe crops. Extensive and intensive types of land use differ from each other in that the first permits a relatively small expenditure per unit of surface area, though its intensification reaches a limit at an early stage, while the latter behaves in the opposite way; that is, requires a high minimum expenditure and permits of considerable increase in intensity. One can express the antithesis thus: the one category is in relatively high measure capable of being extensified, the other is in relatively high measure capable of being intensified. Or, in terms of the law of diminishing returns, the maximum physical output calculated per unit of expenditure is obtained for extensive types of land use through a relatively low per acre expenditure, for intensive types through a relatively high per acre expenditure. Pasture and tilled land are in this respect especially typical opposites. In a pure ranch economy, for example, a very small amount of herdsman's labor, calculated per land unit, is sufficient under certain circumstances, while on tilled land there must be at least plowing, cultivating, and harvesting if a return is to be obtained.

One recognizes the fact that a varying favorableness of economic location not only reacts upon the most profitable degree of intensity with which kind of crop or cultivation is conducted, but that it must at the same time be an influence in determining the most profitable location for the production of the crop. If one imagines in the "isolated state" an extensive and an intensive type of land use—pasture and tilled land—successively displaced "from the periphery to the center," both will, for reasons we already know, gain in profitableness or, more accurately, in economic rent per unit of area. However, under otherwise equal circumstances, that

kind of land use will gain most which requires the highest expenditure per unit of land because that type will profit most from a cheapening of the expenditures which are one element in the determination of land rent; the other element, which consists of the increase in local price for products, is assumed to remain constant. Therefore, under otherwise equal conditions, intensive types of land use and crops will show more and more superiority over the extensive as we approach the market. The former are more attracted by the market than the latter and will force these away from the market. Zones near to the market are locations of specifically intensive types of land use. Zones at a distance from the market are locations of specifically extensive types of land use. Increasing intensity of land cultivation therefore means not only increased expenditure in cultivating the given crops but at the same time a change to specifically intensive crops.

One can easily perceive further details of this picture. Thus one can distinguish between specifically capital intensive and specifically labor intensive types of land use. Crops which require a relatively high expenditure for purchasable input goods are, for example, more strongly attracted than those for which hand labor or even animal labor is more important as a means of production. Tilled land and pasture are also in this respect typical opposites. It seems unnecessary, however, to go more into detail in these self-explanatory matters. One further factor should be mentioned, however: "under otherwise equal conditions" must be sharply emphasized in this connection. It will be shown later that the specific degree of intensity of a type of land use is not the only and not even the most important force in determining the locations in which it will be used.

Thus we have learned two forms that an increased intensity may take: the one of which we think first is an increase of expenditure for the same crop; the other is a transition from extensive to intensive crops. There is finally still a third form which, however, is similar to the second in many respects and relates mainly to the most important kind of land use; namely, tilled land. Nevertheless it deserves to be treated as a separate phenomenon. It is this: the shortening of the fallow periods, or, in other words, the increase in

the number of harvests which are obtained from the area under cultivation.

The processes of plant growth and the maturing of crops, as is well known, are dependent on the periodicity of the seasonal changes in weather. The farmer too must adapt his production activities to this dependence on the seasons. He must seed at given times and harvest at given times. Only a few activities, namely, those of soil cultivation, allow him greater latitude as to timing. Although these activities are not independent of the seeding and harvesting times the farmer may choose either to concentrate them within a short period or to distribute them over a longer period of time within the year or even over a number of years. He must concentrate them if he wishes to produce one or more crops each year on the area at his disposal. If he is satisfied with a lesser number of harvests and crops only a part of his total area, keeping the remainder fallow, he can distribute them.

It is apparent that in these two procedures a definite amount of labor and the same amounts of expenditure for capital and labor are not required for the production of a given amount of product. The factors of production, whether labor or capital, cannot be acquired and discarded by the agricultural entrepreneur (Unternehmung) at desired times and in desired quantities, but must, for the most part at least, be kept available in the quantities necessary at the times of greatest demand. There are needed therefore relatively, that is, in comparison to the quantity harvested, more units of the factors of production as the farming activities are more concentrated in time and as the number of crops produced on a given area is greater. If upon a given area a large quantity is to be produced in a short time a greater amount of labor and capital is needed than would be necessary if the same quantity were to be obtained over several harvest periods. Concentrating the farming activities in time causes an increase in gross receipts but only by relatively increasing expenditures. Here again, therefore, the relationship of prices of products to money costs of the factors of production determines the procedure which must be used. If we consider an extreme situation: in the purely self-sufficing economy where the main problem is to produce large quantities of product

with the smallest possible amounts of capital and labor—although at the expense of a large use of land—extensive use is made of labor-saving and capital-saving methods, such as fallowing of the land. In the vicinity of the market, where the problem is to develop the highest possible productivity of the land, the time of fallowing or land rest is limited to a minimum even though there may be periods when the other factors of production are idle. Or, to describe the tendency, the farmer must choose between two methods: (1) the temporary rest period for the land accompanied by the highest productivity of the agencies of land use; and (2) temporary idleness of these agencies accompanied by the highest productivity of the land. The first method means foregoing part of the gross receipts, the second, an increase of farming expense. The more unfavorable the economic location the more will the first result be the lesser evil of the two; the more favorable the economic location the more will the second result be the less undesirable.

With increasing favorableness of economic location, the fallow land therefore gradually disappears, first the "Schwarzbrache" and then the "Halbbrache."[6] The intervening periods between those required for the production of the main crops are more and more used to grow the so-called secondary or intermediate crops (Unterfrüchte) and stubble crops.[7] Under very favorable conditions it may even be possible to grow two main crops successively in one year on the same field. All these are ways of increasing the total farm area on which crops are grown during the year; that is,

[6] TRANSLATOR'S NOTE: "Schwarzbrache" (literally, black summer fallow) is land frequently plowed, or cultivated alternately, or in three-year rotation, with crops. It is not seeded to any crop for a whole season. "Halbbrache" (literally, half-summer fallow) is like "Schwarzbrache" except that half [of the land lying fallow] is seeded to a forage crop, thus increasing the nitrogen content of the soil and keeping the weeds down by the thick stand of such a crop, for example, as clover. Another form of the original summer fallow is the "besömmerte Brache" where on the former fallow land a crop is grown—for example, corn or a hoe crop—in rows wide enough apart to allow cultivation between them in order to keep the land clean. This third method has developed into the modern rotation system.

[7] TRANSLATOR'S NOTE: Secondary crops (Unterfrüchte) are seeded in the spring into growing crops—for example, clover into winter wheat—their main growing period timed to come after the harvest of the grain crop. Stubble crops are seeded into the stubble after the harvest of early crops in the same season, mostly lupines or legumes following in the same year the grain crops.

ways of increasing intensity. The significance of land rest or fallow is increased still further in unfavorable economic locations by the fact that it not only makes possible a given gross receipt with a relatively small input of the means of land use, but also lessens absolutely the required expense for cultivation. This latter result is caused by the favorable effect of fallowing in, renewing the fertility of the soil through its accumulation of available plant food. What in fallowing is done by nature must, in the absence of fallowing, be accomplished through the application of labor and capital. This direct saving of expenditure is apparent in another form of land rest still more than in fallowing; namely, the so-called land change (Umlage). This is the arrangement whereby the field crops are from time to time interchanged with pasture. Besides making the plant food soluble it leaves largely to the free action of nature the freeing of the soil from weeds and plant pests. One may therefore regard the farming methods that are based on periodic conversion of arable land to pasture, with which at the same time fallowing may be combined, as the most extensive form of farming. In this is found the clearest expression of the principle above discussed; namely, the production of a maximum of product with little labor and capital through utilization of large areas.

Periodic conversion of tilled land to pasture and fallow disappears, therefore, with increasing favorableness of location. With this change there is a tendency to choose the crops that replace pasture and fallow so as to conserve as much as possible the advantages of the latter. One chooses, therefore, as substitutes for fallowing and periodic conversion, those forms of cultivation, first, which need very little farming expenditure, and, second, of which the periods of cultivation coincide with the time of fallowing and therefore come to be situated between the chief peaks of labor demand, thus contributing comparatively little to increase of total requirement for factors of production, and, finally, those forms which economize as much as possible the fertility of the soil. The rôle of the fallow and periodically converted land is more and more taken over by pastures, by other forms of field crop cultivation, by legumes, etc. These specifically extensive so-called "fallow crops" (Brachkulturen) share to a varying extent with the inten-

sive crops and with the remainder of the fallow or periodically converted land, the total cultivated area. The transition from extensive to intensive cultivation under the influence of the economic location does not therefore take place by definite and pronounced steps. Instead, it occurs as a gradual shift in the relation between the extensive fertility and production-factor-saving forms of cultivation and the intensive forms. Thus in all the zones the main importance naturally lies in the moderately intensive types of crops, namely, the grain crops, which in favorable economic locations find their main supplementation in intensive hoe crop production, and, in unfavorable economic locations, in extensive feed crops and fallow.

There is no kind of expenditure in agriculture which is not governed by the law of decreasing yield increase (law of diminishing returns); therefore no kind of expenditure which is more than relatively important to the economic interest of the individual. For each particular kind of expenditure the economically permissible amount is that determined or reached in the balance of marginal values. The fertilizing of the soil is no exception to this rule.

In contrast to this certain writers, mainly Justus von Liebig and his more extreme followers, have attempted to show by reasoning purely from a natural science standpoint that a certain standard of expenditure for fertilization is a necessity from both a national and a private point of view. To support these ideas they erected their own scientific structure in the theory of statics, and even today in certain quarters their ideas still persist. Their conclusion was as follows: The cultivated soil does not contain unlimited supplies of plant food. It therefore requires a replacement of the quantities taken out by crops if it is not to be gradually, and in the course of decades and centuries, even completely impoverished, thereby placing in jeopardy the continuity of agricultural production and even the economic structure in general. A natural balance, that is, a balance between the quantities of plant food taken out in the crops and those contained in the fertilizers applied, was therefore proclaimed as the standard to be striven for and was looked upon as an important criterion in judging the suitability of any given type of farming. Only in this way was it possible to

avoid the eventuality mentioned above—which might, indeed, occur so much the earlier if the rate of population increase became more rapid.

The untenableness of this replacement theory, in the sense used by Liebig, and the impossibility of carrying out this policy in an economic order which is built upon the principle of self-interest, are shown by the following considerations: The requirement for unconditional restoration of the plant food taken from the soil would be consistent with private interest only if, with the fertilizing intensity which it requires, the limit of profitableness would nowhere, not even in the most unfavorable economic locations, be exceeded, and if this degree of intensity coincided with the point where the maximum gross return to capital and labor would be obtained. In reality, however, that is not at all the case. Fertilization is an operation which requires relatively much labor and capital—one may think for example of the expensive method of keeping live stock which it presumes (stabling, etc.). Because of this the individual will find it profitable under unfavorable economic conditions, or under purely self-sufficing conditions, to desist from fertilization, at least from a complete replacement, and to cultivate instead a correspondingly larger area more extensively. And this is true even if the entrepreneur considers not only his present advantage but wishes to give his business a lasting continuity. The danger of soil exhaustion becomes less important practically as the yields produced from the soil become lower.

The same proof can be shown in another and perhaps still more convincing way. We know that the price of agricultural products is determined by the supply costs (production and transportation costs) of that quantity which is just required to supply the market demand. This quantity is, however, produced most advantageously with an entirely extensive method of farming which is, from the technical viewpoint, "mining." In fact it must be so produced as long as there is available uncultivated land worth cultivating and as long as the production area can be enlarged. We are concerned here again with the alternatives, in agricultural production, of utilizing more labor and capital, on the one side, or more land, on the other. If we want to save labor and capital we can do so only at

the expense of the land, and inversely the land can be brought to its highest utilization only by the application of much labor and capital. Private interest forces the individual to take sometimes the one, sometimes the other course, depending on the circumstances. If a farmer for whom price conditions indicated the most extensive method of farming operated on the basis of replacing fully the fertility removed, that is, if he avoided the mining of plant food, he would be mining his labor and capital. He must use labor and capital in order to get something which he does not regard as profit. Of course the interest of the individual demands a continuing profit, but this requirement should not become an obsession. It is not feasible to sacrifice entirely, or in large part, for continuing gross returns, the net return for periods over which individual farmers and even generations of farmers are accustomed to reckon. If this seems an unfortunate circumstance one must remember that in other phases of economic life, especially in mining, exploitation is resorted to far more widely.

In contrast to Liebig's replacement theory with its demand for a standard of intensity of fertilization independent of economic laws, fertilization in accordance with the point of view here presented behaves in the same way as every other kind of farming expenditure. Its most profitable intensity increases gradually with increasing favorableness of the economic location. The most extensive agriculture usually does not involve any fertilization at all; through extensive use of fallowing one must endeavor to retard the lowering of returns which are already small. Fertilization begins only if the economic conditions call for higher yields, obtained mainly through greater frequency of cropping. Only gradually, with increasing favorableness of location, does its degree of intensity reach (though for some kinds of plant food earlier than for others) the point where a complete replacement of the elements taken from the soil occurs. In fact it need not stop here. A storing up of fertility may be desirable in some cases. Extensive agriculture is therefore the removal of plant foods, intensive agriculture the using of them. This contrast is so marked that fertilizing materials of mineral origin, procured in regions distant from markets, are chiefly utilized not in the vicinity of the places

where they are found, but often thousands of miles away on lands which are cultivated intensively. Guano and Chile saltpeter, for example, are brought from South America, while raw phosphates are exported in great quantities from Algiers and Florida to central and western Europe.

3. THE NATURAL LOCATION OF FARMS AS A FACTOR OF INTENSITY

IN CONSIDERING THE "NATURAL LOCATION" of a farm we have in mind the conditions of soil and climate and all those characteristic qualities which are significant in the successful cultivation of agricultural plants—the amount and distribution of heat and precipitation associated with a piece of ground, its topography, content of fertility, ground-water conditions, physical condition of the soil, etc.

The practical farmer bases his judgment of the fertility or productivity of a piece of land on the degree to which the natural conditions will favor plant growth and facilitate the cultivation of plants. One might therefore be tempted to parallel favorableness of economic location with "favorableness of natural location" and to try to ascertain whether the latter exerts as unequivocally as the former a decisive influence upon the level of intensity which will result in optimum use of the factors of production. The question arises: Is there a universally applicable law in the sense of a functional relationship between soil productivity and farming intensity?

Establishment of such a conformity to law is frustrated by the fact that we do not have a suitable, that is, a generally usable, measure for the determination of soil productivity such as is provided for the appraisal of economic location by the level of local prices. Such a measure is lacking here because no constant ideas concerning certain soil qualities are associated with the concept of soil productivity. Agriculture produces not one but many cultivated plants; in fact, plants which do not grow equally well on a soil of a certain quality and which do not have everywhere equal relative values. In the eyes of the farmer that land always appears fertile

which has a specific yield capacity for the cultivated plant which is most highly valued at a given time. If farmers tended to produce rye alone, all kinds of soil might be brought into a single scale of productivity, the degrees of which might then be graduated according to the amount of return (in form of rye) which could be obtained from them with a given expenditure; or, with a given return, the amount of expenditure required. Similarly, if agriculture consisted exclusively of the production of pasture grasses, all the various soils could be arranged according to a fertility scale in terms of pasture grasses, which would of course present an entirely different gradation from that provided by the appraisal of soil fertility in terms of the yields of rye. As a matter of practical application, however, it is the relative fitness of a soil for a given use that determines for the farmer its degree of productivity, since a soil is sometimes more favorable for one crop, sometimes for another. In every economic location—the reasons will occupy our attention later—the judgment of value will be different and will be associated with different natural soil qualities. For this reason we must deny the functional relationship that was mentioned above. A conformity to law, in the sense of a functional relationship between soil fertility and farming intensity which would have the same general significance as the dependence of farming intensity on the favorableness of economic location, does not exist.

This of course does not preclude recognition of the fact that natural conditions do influence greatly the degree of farming intensity. We have just noted that each particular type of soil may have specific adaptability for producing sometimes this type of product, sometimes that. Each soil tends to exhibit a specific suitableness for intensive or extensive kinds of crop production. Our attention will be occupied in still more detail with questions relating to the locations of different farming systems (Produktionsrichtungen). Here we may only mention the fact that the regularity of the zones of intensity which group themselves around the market centers may undergo far-reaching modifications as a result of the influence of natural conditions of the individual farms and areas. Extensive, even the most extensive, forms of cultivation may under some circumstances appear in the most favorable economic

locations because soil and climate are unsuited to an intensive cultivation, or at least make it unprofitable. So in pronounced coastal climates or in lowlands, because of favorable conditions for the growth of grass, utilization of the land for pasture is often more profitable than its utilization as intensively cultivated land. Even in the most favorable economic locations, as in the immediate vicinity of the city of Hamburg, pasturage is able to maintain supremacy. The advantage of pasture use lies in the fact that it enables one to produce with relatively small expenditure gross returns that are almost as high as, or possibly even higher than, those which would be obtained through its utilization for producing crops, which nevertheless would be a possible form of utilization. In other locations again, as, for example, steep slopes, or in the flooded areas of rivers, pieces of land are assigned to extensive pasture uses because their use as arable lands would be linked with disproportionately high costs while their use as pasturage pays very well because of the low expenditure involved. Even in the cultivation of arable lands the optimum degree of intensity is dependent to a great extent upon quality of soil and the climate. An intensive form of cultivation, for example sugar-beet production, tends not only to seek locations of relatively low expenditure for labor and capital but also makes rather definite demands on the natural conditions of its location. It must not be undertaken where these are not provided, or at least not provided to an extent such that the cultivation of sugar beets is more profitable than more extensive types of land use. Again, in respect of arable land particularly, the relationship between times of fallowing and of plant growth is strongly influenced by natural conditions. In climatic regions like those in many parts of northern Europe where, because of the shortness of the summer period the time for seeding winter crops conflicts with the harvesting of spring crops, an extensive fallow system is necessary under any circumstances, even though economic location be very favorable. In the most favorable locations two harvests are produced in three years. Somewhat similar are conditions in regions of so-called dry farming. There, however, it is not the shortness of the warm season but the shortage of precipitation which necessitates fallowing, the main purpose of

which is then the storage of water. With us in Germany fallowing is of major significance only in those places where annual production, either from climatic reasons or because of unfavorable physical condition of the soil, would require a disproportionately large amount of labor. On lighter soils where the climate is mild arable land, with us, can yield a harvest every year. Conditions are still more favorable in subtropical regions; in the Nile Delta, for example, where winter does not interrupt the growth of vegetation three harvests in two years are usually produced (cotton, wheat or barley, corn or rice).

Theoretically, therefore, it is conceivable that in the most favorable economic locations, under the influence of natural conditions, the same succession of degrees of intensity may appear as that which, if we assume a soil of varying possibilities of utilization, was found to result from the influence of the market. A radial differentiation corresponds to the concentric differentiation (based on differences in economic location). To be sure, even here the changing quality of soil can only weaken or strengthen the influence of the market upon the arrangement of degrees of intensity, but cannot remove it entirely. Even on the best beet land there must sooner or later appear, with increasing unfavorableness of economic location, a limit where such an intensive crop as beets becomes unprofitable and must be displaced by a more extensive crop. Generally speaking, the more unfavorable the economic location becomes the more the possibility of a differentiation caused by natural influences is limited and the more uniform the agriculture becomes because, as a result of economic influences, intensive forms of cultivation are successively excluded from competition. Zones near the market are therefore not only locations of intensive agriculture, but may at the same time show the greatest variety in gradations of intensity. Where the range of natural conditions is greatest, the possibility of differentiation is also greatest. Greater uniformity of course favors those crops which do not have special requirements in respect to quality of soil and climate and are therefore extensive in type. Such types of land utilization are pastures and forests and, of the tilled land crops, grain. So far as these occupy all land not suitable for other crops—land, that is,

not sufficiently fertile—one can speak of a relationship between productivity and intensity. However, as set forth above, a generally applicable law does not exist. Greater productivity can under some conditions cause a high as well as a low intensity, because the determining factor is always the particular type of productivity.

Even if we consider the differentiation which cultivation of a given crop may show and examine its relation to the quality of the soil, we cannot state as of general applicability that the intensity increases with the degree of soil productivity. Of course one must grant that a soil which because of its favorable quality yields a high return, needs proportionately more labor and capital even for harvesting and utilizing these higher yields. It is often true also that good land is more responsive to careful preparation, fertilization, care in cultivation, etc., and thus it permits a higher intensity in the way of cultivation expenditures (always having in mind a given crop). This becomes clear without further explanation, from the coöperation of the various factors in the growing process, that is, from the law of the minimum.[8] If for a given soil the factors which are entirely or mainly beyond the control of man are provided in good measure—we are here concerned with a good soil—relatively much labor and capital is required in order to bring about an optimum relation between the various factors affecting production. A medium loam soil with a good water supply repays in grain production a greater expenditure than will a light sandy soil. One thinks usually of such types of soils if the matter under consideration is the interrelationship between productive capacity of the soil and intensity of farming. Conditions may, however, be quite different. There are many soils which, if they are to repay cultivation at all, must be farmed very intensively, yet we cannot speak of them as being especially productive. The wet clayey soils (Tonböden), for example, are less productive than many medium heavy soils but must nevertheless be farmed as intensively as these, or even more intensively. One can

[8] TRANSLATOR'S NOTE: The German text reads "the law of the minimum" (Gesetz vom Minimum), but the context indicates that the author had in mind the law of diminishing yield increase.

therefore, in a sense, speak of specifically extensive and specifically intensive soils, of which as a rule the first are of higher productivity. Certain kinds of farming practices are often the means by which a particular and thorough correction of growth conditions is sought, so-called ameliorations, which result in a specific intensity. We may imagine that the two types of soil above mentioned require for the attainment of a certain yield the same amount of current labor for cultivation, but that the clayey soil must, in addition, be drained. This circumstance then makes its cultivation specifically intensive. Nevertheless, conditions may be fundamentally the same for expenditures which cannot be described as ameliorations. For example, in the matter of fertilization, pastures on moor and sandy soils are more responsive to intensive fertilization with potash and phosphate fertilizer than are rich pastures in the marshes, upon which such fertilizer may often be quite without effect.

Theoretically we can establish a limit up to which the forced intensity may go in comparison to a soil having the highest gross output and lowest cost; that is, to the best soil. A soil remains worth cultivating as long as the total costs (labor, use of capital, interest) required to obtain the return do not exceed the gross return of the best soil. Earlier explanation has shown that soils with specifically high farming intensities are worth cultivating only in favorable economic locations. This requires no further proof.

The optimum farming intensity at a given time with a given development of technique is determined by the natural and economic factors of intensity. One might raise a question as to which of these two factors has the greater practical significance or influence. Does the differentiation appear in reality more marked with respect to differences in location or is the quality of soil a more significant factor?

The influence of natural locational factors is no doubt more significant than that of economic factors. In a particular localized area differences in economic location are slight while soil conditions may show the greatest extremes. For a more generalized comparison, however, it is the climatic variations which are of

greatest significance. One need only think of the great contrasts which exist between forms of cultivation in the polar, the temperate, the subtropical, and the tropical zones: from reindeer pastures to sugar-cane plantations. These differences overshadow any influence which the economic location is able to exert.

4. CHANGES IN THE INTENSITY OF FARMING UNDER THE INFLUENCE OF A PROGRESSING ECONOMIC DEVELOPMENT

IN A NATIONAL ECONOMY thought of as being in equilibrium, that is, with a given market price for the products and for the means of production, accompanied by a certain agricultural technique in universal use, the economic and natural locations explain for us the different gradations of intensity existing side by side. We may call these the factors of intensity in a "static" national economy, to apply a term much used recently.

Actually, however, a "static" national economy is not possible. Economic life is in continuous movement, is in process of "development." We must now therefore drop the previous supposition while we turn to a comparison of past and present, to the phenomena of the succession of events. How do the different stages in the development of national economy influence the degrees and the forms of intensity in agriculture; how does progress in economic life affect both?

It is impossible to describe exactly the development or the progress of a national economy or even to give it a unified expression because we are concerned with the summation of the effects of manifold and entangled groups of causes (Ursachenreihen). Because it has this complicated character economic progress does not exercise a unified influence as a factor of intensity. On the contrary it brings about different and variously directed tendencies, intensifying as well as extensifying. One may therefore speak of a group of factors which are to be designated as "dynamic" in contrast to the "static" factors because they explain the changes over time of the degrees and forms of intensity and thus in a certain sense its phenomena.

We begin with the following summary: If we go back a little and consider only the progressing, not the possible backward movements in a given locality, the following factors are found to exert a changing influence upon the optimum expenditure of labor and capital in a given locality: (1) the strengthening of the demand for agricultural products, which may result from (*a*) a growing population and (*b*) increasing consumption per capita; (2) improvements in technique: (*a*) technique in general and (*b*) the technique of agricultural production. These factors stand of course in a causal relation to one another, which is not further discussed here.

Strengthening of demand brings about increasing intensity of agricultural production by raising market and local prices. If the population of a country increases or if the consumption of agricultural products per capita rises the marginal increment which determines market price must, other things being equal, be drawn from a greater distance if the demand is to be covered. The result is an increase in the supply cost in two directions: (1) transportation of the product itself to the market; (2) transportation of that portion of the production goods which must be obtained from the market. As a result of this twofold cost increase the prices at the market rise and with them the local prices in all zones. If we turn again to the "isolated state," strengthened demand operates in such a way that the diameter of the market area increases and a new curve of local prices appears running parallel to and above the previous one.

The spread between gross value and production costs, which determines the degree of intensity, is not expanded however by the full amount of the increase in price of the product. The costs also undergo an upward movement because the money cost of the agrarian or farm share (Korn-Anteil) of the production expense—namely, the business capital of agricultural origin and the grain share of real wages—rises with the increase in market price. A mathematical example may illustrate this relationship.

Assuming that production expenses of growing 10 Zentner (500 kg.) of rye, requiring an area of one Morgen (a quarter-hectare), are, when applying a normal intensity at a distance X from the

market, 250 kg. of rye (farm share) and 20 M + ½ x M (market share) while the transportation costs per Zentner of rye for this distance amount to ⅕ x M,[9] we can then set up the general formula for the market price per Zentner of rye (R) as follows:

$$R = 5\frac{R + (20 + \frac{1}{2}x)\,M + \frac{5}{5}x\,M}{10}$$

Thus we get the value R=7 M or R=10 M depending upon whether the marginal unit is located at the distance 10 (for a weak demand) or 20 (for a strong demand). Local prices, gross proceeds, and costs vary then with changing distance as follows:

MARKET PRICE 7 M

Distance	Local price per Zentner	Gross proceeds per Morgen	Costs per Morgen		
			Farm share	Market share	Total cost
	M	M	M	M	M
0	7	70	35	20	55
5	6	60	30	22.5	52.5
10	5	50	25	25	50
15	....	....	....	....	....
20	....	....	....	....	....

MARKET PRICE 10 M

Distance	Local price per Zentner	Gross proceeds per Morgen	Costs per Morgen		
			Farm share	Market share	Total cost
	M	M	M	M	M
0	10	100	50	20	70
5	9	90	45	22.5	67.5
10	8	80	40	25	65
15	7	70	35	27.5	62.5
20	6	60	30	30	60

The purpose of this mathematical example is to illustrate the following principles: Expansion of the territory supplying a market increases the production and transportation costs of the

[9] To be exact one should again separate the transportation costs into the farm and market shares as Thünen has done.

marginal price-determining quantity and raises the price at the market, the local prices, and the gross proceeds for all locations by the same amount. It also raises, though to a less degree, the cash expenses. In proportion to the thus expanded spread between the gross proceeds and the cash expenses, it is then possible to increase the farming intensity.

The series of stages of development which is thus brought about—that is, entirely in consequence of progressive strengthening of the demand for agricultural products—shows, in relation to the intensity, exactly the same behavior as the differentiation of the zones at a given stage of development. The vertical differentiation, or the nonsynchronous succession of the degrees of intensity, corresponds to the horizontal arrangement or the synchronous juxtaposition of the zones of intensity. This applies not only to the degrees of intensity but also to the differentiation as to the forms of intensity. We would have to repeat all the earlier explanation if we were to show in detail that an increase in the prices of products caused by increased demand in itself raises the intensity, shifts the emphasis of the intensity more toward the use of capital, and lessens the importance of fallow while emphasizing the specifically intensive forms of cultivation. We may assume without more ado that all the degrees and forms of intensity which we have recognized heretofore as resulting from an orientation according to economic location may appear successively in a given location.

The great revolutionary forces in economic life are the progressive changes in methods applied in the production and supplying of economic goods; that is, changes in technique.

The status of technique indicates the extent of the domination over the forces of nature which man has attained, and its stage of development is the decisive factor in determining the location and quantity of goods which can be obtained for the sustenance of the nation. Further, it is decisive in respect to the methods of providing goods in general and the methods of agricultural production in particular.[10]

[10] Cf. Philippovich, *Grundriss der politischen Oekonomie*, 1 Bd., 7 Aufl., 1908, S. 109.

The influence of technical progress upon agriculture proceeds both indirectly and directly; indirectly in that agriculture participates in the improvements that originate in other fields of the national economy, especially in the production of industrial goods; directly, in that agriculture itself develops better techniques. Furthermore, these improvements may have quite different characters. Without attempting to be exhaustive, one may indicate some fundamental differences:

1. Improvements in the methods of producing mechanical and other inanimate agencies of agricultural production; for example, machines, buildings, fertilizers, commercial feeds, etc.

2. Improvements through betterments in the external growth conditions and of the internal growth qualities of the cultivated plants and domestic animals; for example, improvements in plant and animal breeding, etc.

3. Improvements in the processing or conversion of agricultural raw products of vegetable or animal origin, as in the production of alcohol, starch, butter, etc.

4. Improvements in the organization of the personal and material means of production; that is, the "technique" of farming which, like the technique proper indicated above, is an historical product and capable of development.

Every improvement in farming technique exerts a direct influence, either by increasing gross output or by decreasing production costs. In both cases, after the introduction of the improvement, a given expenditure brings forth a higher gross output than before; that is, each cost unit then results in a higher gross output. If with a defective technique the expenditures have been carried to the margin, that is, to the point where the last input just produces an equivalent amount of income, then with a perfected technique and the same amount of expenditure, and the same prices for the products, this balance will no longer exist, for the marginal expense (as above determined) will now bring more than an equivalent return. In order to reach the margin of profitableness additional expense units must be added. Technical progress in agriculture therefore, other things being equal, not only saves expense but also increases the intensity of farming operations.

The following consideration, which is associated with the law of the minimum, reveals the interrelation between the respective phases of technical development and intensity better than the short series of ideas indicated above has done: The agricultural production process consists of many and various single activities which must coöperate in order to assure success. It is not expenditure in itself that produces income, but rather the manner of spending, together with the relationships between the different kinds of expenditure. Cultivating, fertilizing, seeding, and harvesting can bring a return only when they work together, and they will bring the highest return only if they are in a certain relationship to one another. Also in cultivation there are various specific operations, and in fertilizing there are various elements of plant food, which must be interrelated. The same is true for all the other activities and arrangements of the farm business. There is a theoretical optimum interrelationship of all the production factors for which one must strive in order to obtain the maximum net income. So long as this optimum is not reached the net income depends upon that factor which, in relation to its demand, is at a minimum. If a single factor is less adequate than the others these others cannot come into full effect and must be limited in their extent if they are not to be partly unutilized. For a field which suffers from excessive moisture intensive fertilizing, as well as intensive cultivating, is out of place. Where in the first place nitrogen is lacking, potassium or phosphoric acid can have either but a limited effect or none at all. The more imperfect the coördination of all inputs the sooner the limit of profitableness is reached for each individual type of input. Only if the field suffering from excessive moisture is drained, and the unfavorable relationship is thus corrected, is it possible to increase profitably the extent in which the other factors are used.

Every technical improvement, considered fundamentally, represents a correction of this relationship and therefore increases the amount of expenditure that can profitably be made not only for that type of input to which it is directly related but also for all the others which stand in organic relation to it. Development of a better balance among the fertilizing elements not only increases

the amount of fertilizer which can profitably be applied; it also makes profitable a greater amount of cultivation and greater care in seeding and in harvesting. Replacement of extensive grazing by field cultivation would have been impossible on many soils except for the invention of tile drainage. This is fundamentally true for every technical improvement: the more favorable the coördination of the inputs, or, in other words, the higher the stage of development of technique, the more intensively the farm can be operated, other things being equal.

In this connection it makes no difference whether the technical improvement is achieved by means of an invention and the application of new and improved methods or only by a lowering of the costs of methods and operations already known and used. If we should succeed at the present time in offering to agriculture the nitrogenous fertilizers at a much lower price than that at which they have been selling, the fundamental effect upon the coöperation of inputs and upon their degrees of intensity would be the same as that of the improvement which lay in the development of such fertilizers in the first place.

This general rule in respect to the intensifying effect of technical improvement needs, nevertheless, a not unimportant qualification. It has already been stated that not all inputs behave the same with regard to the possibility of an increase in intensity. An expenditure which has to do with the operations involved in active furtherance of the growth processes of cultivated plants and of domestic animals is capable of considerable intensification, while a utilizing or processing expenditure which has a more passive character is far less susceptible of intensification. Improvements that affect the first type of expenditure result in a greater intensification; while in the last-mentioned type they usually result in a mere cost-saving which at best is reflected only indirectly in the intensity with which the soil is cultivated, the effect being to increase the utilization value of the products. When scythe and flail are replaced by machines the purpose is not, or at least not at first, to increase yields but rather to lower costs. The situation is similar for many other operations connected with the harvesting and processing of farm crops. Another result of this difference in be-

havior is that, under the influence of increasing favorableness of economic location brought about through progressive technical development, the emphasis in intensity is shifted more and more toward actual expenditure for cultivation. This tendency is still further increased through the fact that, as a result of the division of labor, the processing of products is more and more withdrawn from the farm. This will be discussed more fully in a later section.

Technical progress, in its influence upon the direction which intensification takes, corresponds to an increasing favorableness of economic location at a given stage of development in that it emphasizes the importance of capital. Undeveloped agriculture is labor-intensive; developed agriculture is capital-intensive.

This statement is no doubt really a tautology, because, as is well known, technical progress consists simply in the fact that human labor is continuously made more productive through a more complete supply of aids to labor, which may be summed up in the one word, capital. Even on an isolated farm every technical improvement would shift the direction of intensification toward the larger use of capital. Early man moved in this direction when he increased the power of his arms by some primitive tool or when he used the power of animals for his benefit. In a society based upon the exchange of goods this tendency is strengthened by the division of labor between agriculture and the other fields of profit-making activity. This results from the fact that these other activities place more and more effective tools at the disposal of agriculture and are able also to cheapen the production of those tools as society advances from stage to stage. If we consider the general tendency of the price movements which the implements of agricultural production display during the progress of economic development, we find that the directions taken by the prices of industrially produced means of production and the prices of human labor are diametrically opposite to each other. Industrial costs decrease greatly, while wages do not decrease as development progresses but rather tend to increase. The explanation of the cheapening of the purchasable industrially produced means of production lies in the great advantages which are associated with the progressing division of labor and the concentration of labor within the field

of industrial production. These very advantages were the principal reasons for the separation of the manufacturing operations from the primary production of agricultural products, and for their being concentrated and made independent of the farming operations. If, in the course of further development, industrial production processes become cheaper and cheaper, this will be therefore merely a continuation of this original tendency.

In order to recognize why human labor does not participate in the cheapening process at constant prices for agricultural products (these are always assumed in this discussion) we must remember that the main part of real wages consists of agricultural products and thus that the share of cash wages which is made up of these products stands in a constant relationship to the prices of the products. Only the so-called market share of the real wage participates in the decreasing cost of the industrial products, and, as a whole, there could be only a relatively small reduction of the total wages. But it does not take place at all. This may be explained by the fact that the real wage increases in the course of development, and can increase because labor, being supplied with better equipment, becomes more productive. While the problem of the "natural wage" (Von Thünen) may be regarded as unsolvable, one may assume as a certainty that the absolute amount of real wage increases with the productivity of labor in general. At least all the experience of modern development points in this direction. If an increasing real wage which consists mainly of agricultural products is converted into money, at constant prices of agricultural products, it means also an absolute increase in the money wage. This must increase, especially if, as is really true in progressive development, the prices of agricultural products increase at the same time because of increased demand.

However that may be, labor costs do become relatively higher in the course of economic development; in comparison, that is, to prices of the industrially produced means of agricultural production. The successive shifts of the emphasis in intensity toward the use of more capital or, as one often but less sensibly expresses it, the progressive substitution of capital for labor, must be the consequence of this changed price relationship.

Special mention must be made of the fact that we are to understand the cheapening of capital to mean not only an absolute and relative lowering of the purchase price but also a reduction of the imputed interest which the capital-using entrepreneur must charge against the business. The so-called common rate of interest, although fluctuating usually not insignificantly, shows, in general, in the course of economic development a falling tendency. This factor plays an important rôle in long-term investments. For current capital which will be reproduced in one year, the difference between 4 per cent and 6 per cent interest is, for the limited extent in which it is used, not very important. Such a difference in the interest rate is important if the matter under consideration is the erection of a building, the construction of a drainage system, or the purchase of a steam plow. The capital invested in such improvements is consumed over a period of several years, often over several decades, and appears again in the production, but interest must be charged up to the time of such reappearance. The lower the customary interest rate the greater will be the importance of long-term investments for the purpose of saving labor and operating-capital in agriculture.

Thus far, we have seen that, with prices of products constant, technical progress extends the limit of profitable expenditure. We have not yet covered, however, all the interrelationships between the phases of technical development and intensity. In order to dig more deeply into the problem, we must in addition take account of the fact that the prices of the products are dependent upon the current stage of technical development and that these, consequently, may influence indirectly the optimum degrees of intensity.

It is easy to recognize the nature of this influence. Every improvement in technique means a lowering of production costs. The higher the stage to which the technique is developed the cheaper can a certain quantity of agricultural products be produced. The price-determining marginal quantity will likewise be more cheaply produced and, therefore, if the market demand is constant, the market price will be lower. The indirect effect of technical progress upon intensity is therefore exactly opposite to the direct effect.

We have on the one side a tendency toward intensification, on the other a tendency toward extensification, and it is only if some other factors are operating at the same time to prevent a price decline that an intensification will appear as a final result.

Consider again the situation in the "isolated state." Let us assume that, at a given moment, the static balance is destroyed; that a technical improvement, suddenly appearing and generally applied, increases the productivity of agricultural labor tremendously while all other conditions, especially the demand for agricultural products and the conditions of transportation, remain unchanged. The first consequence of this technical improvement will be a drop in the market price. Production expenditures must therefore be cut down; in other words, farmers must operate more extensively, at least the group as a whole, because otherwise more products would be raised than the market would be able to absorb.

Of special interest in connection with this tendency is the fact that the different economic locations may be affected in very different amounts depending upon the nature of the technical improvement that is occurring. If it consists of improvements in the methods of cultivation which are directed toward lowering costs and at the same time toward greater yields per unit of land, it strengthens the position of the favored locations at the expense of the less favored locations. The latter may even be entirely excluded from supplying the market. This follows from the fact that the less favored locations are included in supplying the demand only so far as the transportation costs which they must meet are lower than the additional expenditures required in providing for the demand through more intensive utilization of the ones close to the market. This is all the more true where the productivity of the land is low and cannot be significantly changed by improvement in technique. If one succeeds in increasing the yield by means of technical improvements it will be profitable to save in transportation expenditures through spatial limitation of the supply area. The stronger the "pressure" of the law of diminishing return upon production, the more will a spatial expansion of production take place in spite of increasing cost for transportation.

If, on the other hand, technical improvements result exclusively

or even predominantly in a saving of human or animal labor, as, for example, construction of new harvesting or threshing machinery or the use of tractor-drawn plows, etc., and have therefore no organic-technical but a decidedly mechanistic-technical character, the consequences are entirely different. The mere mechanization of the operations associated with the organic processes of plant and animal production does not increase the competitive strength of zones close to the market but rather that of zones at a distance from the market. That such types of progress are at least neutral in their effect follows from the fact that they do not make transportation costs unnecessary in providing for the demands of the market, because they do not increase the yields as the organic-technical improvements do. In fact, they benefit the more distant zones and therefore directly favor extensive utilization of large areas at the expense of intensively cultivated small areas. The reason for this lies in the fact that the total production expenditures distribute themselves unequally between the organic and the mechanical types of labor, according to the degree of intensity of cultivation. Under extensive conditions the main expenditure goes, as we have already seen, to mechanical labor, while under intensive conditions the labor associated with organic processes comes more and more into the foreground. Therefore an advance in the mechanization of labor means a strengthening of certain phases of the activities on the extensively operated farms.

Quite certainly, therefore, the reason the competition in grain production which came from the oversea countries toward the end of the nineteenth century was felt so pressingly in western Europe was mainly that the improvements in agricultural machinery in those countries made it possible for them to lower their production costs tremendously. If, after all, the tendencies here presented in the abstract seldom appear clearly, the explanation lies in the fact that, in practice, technical improvements are never suddenly adopted by farmers, but always slowly. Thus they exercise their price-depressing influence only very gradually so that it is usually offset by the effect of the absolute and relative increases in consumption. In reality what mainly obscures these tendencies is the reaction upon the intensity of farming, which—in contrast to the

changes in agricultural technique—appears as a consequence of the progressive and more suddenly occurring improvements in transportation. For theoretical and practical reasons this question deserves special attention.

Economically every improvement in transportation means a lowering of the expenses and losses incurred in marketing agricultural products. Improvements may come about either through reduction in the rates charged for the same means of transportation, through substitution of a cheaper for a more expensive means of conveyance, through acceleration of transportation, or through better organization of the intermediate handling and similar improvements. These influence the market price as well as the local price; the market price, in that the marginal quantity can be obtained more cheaply, the local price, in that the difference between local and market price is lessened. Also the differences between the local prices are lessened. This can be shown in more detail by the following example in which it is assumed that, through improvements in transportation, the marketing costs fall by 50 per cent.

	Before:	After:
	Improvement of transportation	
Transportation costs per km. and 100 kg...	0.10 M	0.05 M
Distance of marginal zone from market....	100 km.	100 km.
Production costs of the marginal quantity per 100 kg.....	10.00 M	10.00 M*
Market price (production plus transportation costs of the marginal quantity)....	10+100×0.10 =20 M	10+100×0.05 =15 M
Local price at a distance from the market of:		
0 km.....	20.00 M	15.00 M
50 km.....	15.00 M	12.50 M
100 km.....	10.00 M	10.00 M

* For the sake of simplicity, costs are assumed to be constant; in reality the production cost also change as a result of improvements in transportation.

The market price is reduced from 20 M to 15 M, that is, by the amount which is saved, as a result of the improvement in trans-

portation, through lessened transportation costs in obtaining the marginal quantity. Local prices are also affected but not equally, being affected less in the zones of more unfavorable economic location. In more distant zones the reduction in market price is more and more offset by the advantage of the saving in transportation costs, in the marginal zone to such an extent that the local price remains unchanged. In other words, an improvement in transportation, that is, a cheapening of transportation, affects the local prices by leveling them out. If transportation and handling costs (Absatzkosten) could be entirely wiped out, prices would be the same everywhere.

With the leveling out of local prices, one of the most characteristic manifestations of a progressing economic development, namely, differences in intensity between the various economic locations, will be lessened accordingly so that, within a given area, the nature of the soil and the climate will be more and more the determinants which will explain the existing differences in intensity. Actually the leveling process does not usually take the form presented in the foregoing scheme; that is, the intensity in the most unfavorable locations remaining constant and in the more favorable locations a backward movement gradually increasing (toward a less intensive agriculture). Rather, as a rule, under the influence of compensating forces in the zones near the market, the existing degree of intensity tends, more or less, to hold its own while in the farther zones the degree of intensity increases and thereby the whole trade territory is extended. Remote districts are "opened up" by means of communication, and thus are operated more intensively. We may assume that, in our example, the market-price reduction is offset entirely or partly by increased demand so that one gets the following gradation of local prices.

Distance, km.	M
0	17.5
50	15.0
100	12.5
150	10.0

In zones close to market there is now only a slight reduction in price; in the more remote ones, on the other hand, there is an increase in local prices and at the same time an extension of the entire supply area. This situation will be in reality the usual one for this reason: an extensification of farming in the zones near the market would be associated with a reduction of the market supply which could only be offset by an expansion in more distant zones. Furthermore, this will be especially true if an increase in consumption occurs, the cause of which is to be found in the reduction of the market price itself.

Let us review. Society as a whole, like the individual economic unit, follows the principle of conserving power. It tends to obtain the amount of goods required with the least expenditure of effort and has a choice between the intensive utilization of a small territory or the extensive utilization of a large one. There is a tendency for a leveling in two ways: the one through yield-increasing improvements in cultural methods, the other through mechanical improvements that economize labor and remove transport difficulties. From the social standpoint, all improvements in technique have the same objective: they counteract the necessity for obtaining, at an increasing expenditure, a growing volume of the products required. They all increase the productivity of the labor of society. In considering these influences, when comparing the various kinds of progress and their effects on one another, we observe, however, the following differences. The yield-increasing improvements in cultivation make a direct saving in production expenditure, and an indirect saving in transportation expense, by limiting the production area. The application of machinery saves, primarily, production expense. Finally, improvements in transportation make a direct saving in transportation expense and an indirect saving in production expense through limitation of the less productive intensive effort. In supplying market requirements, the first-mentioned type of technical improvement strengthens the competitive position of the areas close to market; the two latter ones strengthen the competitive position of the areas far from market. If, in recent decades, in spite of all the improvements in agricultural production technique, the last-mentioned tendency has

been predominant within the whole field of economic life, the reason lies in the fact that transportation and traffic represent just that field of human activity which, because of its mechanical nature, is most susceptible to improvement. This does not mean that the relationship might not be reversed after the improvements in transportation have passed their peak.

One may speak of a normal procedure in the development of agriculture and of crises which disturb it temporarily. From the individual point of view, development is normal when the intensifying tendencies which occur here and there make themselves felt only as a negative force tending to slow down a movement which has a different direction; but let these forces be triumphant and the disconcerted agricultural entrepreneurs suffer a financial injury which constitutes, for them, a genuine crisis. Such a development occurred, for example, in the last third of the nineteenth century in many districts of western and central Europe, because of the abrupt expansion of world traffic which outdistanced all other improvements. Such a crisis results from the fact that, because of the decreasing prices of the products, land rent, and with it the value of land, is decreasing. The entrepreneurs' income and property are thus injured in a way that may lead to economic ruin for those who have to pay contract rents and interest on mortgages, if these are computed on the basis of the former level of land rents. There is, in addition, a further injury in that the degree of intensity which has been reached no longer corresponds to the price relationships, and the last "additional" expenditures no longer pay. Although the entrepreneur may prevent an injury of this kind from becoming permanent in its effects by developing a more extensive method of operation, to do so usually means great loss because expenditures once made cannot be readily withdrawn. The entrepreneurs mostly prefer, therefore, to continue, come what may, with the old operating methods, writing off a part of the expenditure as loss. They depend upon the coming of better times and, for the rest, try by the greatest possible utilization of technical improvements to change the irrationally intensive operating method to a rational one. The farmer is never more receptive to improvement in his business than in times of crisis when the saving

of his present property is involved. Although for the "economic man" (*homo œconomicus*) accustomed to accurate analysis it makes no difference whether by utilizing an improvement direct damage is avoided or new profit obtained, this is not true for the imperfect practical man. For him the urge is far stronger to turn to the first alternative. The means which governments apply as their part in helping to overcome agricultural crises are not within our present purview.

Competitive clashes between areas of extensive and of intensive production occur both on a large and on a small scale: on a large scale in the supplying of the world's grain markets; on a small scale, often in recent years, in supplying fresh milk to cities and industrial centers, in meat markets, etc.[11]

While improvements in transportation and in agricultural mechanization, as we have seen, affect the degrees of intensity in relation to distance from market by leveling them out, in doing so they indirectly strengthen the effects of the natural differences. The organic-technical improvements, on the other hand, tend to lessen the effects of natural differences. This phenomenon, namely, the gradual leveling of the differences in intensity caused by nature, is a striking trend in the modern development of agriculture. It is not contended, of course, that, in the course of time the extremes of natural difference come closer together. On the contrary, as development goes on they become more widely separated as long as there remain soils which are close to the present limit of suitability for cultivation. In the higher degrees of intensity, however, the differences disappear more and more. Improvements in methods of cultivation cause all cultivated soils to rise in the scale of intensity. And the more extensively a given type of soil was formerly operated the faster this change takes place, while below these levels of land quality the less productive types of land heretofore uncultivated come into production. This can be expressed still more schematically as follows: All soils, cultivated and not cultivated, tend with slowly decreasing rapidity toward a level of intensity which theoretically is different for each type of soil.

[11] Cf. Brinkmann, "Die Stellung des Abmelkbetriebes in der neuzeitlichen Landwirtschaft," *Fühlings landw. Zeitung*, Jahrg. 1914, Heft 13.

Differences in intensity will thus grow increasingly smaller as this goal is approached. In this process sooner or later the less productive soils will pass the better ones, in intensity of operation, so that the above-conceded law of higher intensification of the more productive soils, which we have mentioned with many limitations, reverses itself and remains true only for certain stages of development. This much must be admitted, though as yet we know very little about when and where such changes occur in reality. That today we have already many illustrations of the reversal of this law we can prove by pointing out the ameliorated soils which absorb, or better demand, usually under the same cultivation methods, more labor and capital than other naturally more fertile soils which do not need to be ameliorated. This becomes quite clear if one considers that technique, after all, is meant only to help where the natural fertility fails. Improved technique, and labor and capital as well, are directed first to those areas where corrections are easiest to make and most profitable, that is, to the better soils; after that, gradually and in the extent permitted when these better soils have been fully supplied, to the less productive soils where the necessary corrections demand greater expenditures. One can imagine that sometime in the future the farmer will try not only to correct the soil content as the home of cultivated plants, but also will try to produce artificially on a large scale the most beneficial "climate" for plants (greenhouses) where nature has not provided it. At such a stage of development one may perhaps say, generally speaking, that the intensity of the cultural method and the natural fertility of the soil would stand in inverse ratio to each other.

5. THE PERSONAL QUALITIES OF THE AGRICULTURAL ENTREPRENEUR AS A FACTOR OF INTENSITY

LOCATION IN RELATION TO THE MARKET and the character of the soil offer all entrepreneurs the same opportunities. They may therefore be termed the objective factors of intensity. Thus far we have also given to the stage of technical development this same objective quality by basing our discussion upon certain assumptions; that is, we have assumed that at a given time all entrepreneurs apply

capital and labor with equal efficiency. We have thought of an improvement as, in a way, a change in the level of technique which affects all the farms at the same time so far as no objective hindrances interfere.

In reality technical improvement is a change of an entirely different kind. The originator of the technique is a human being, and as different as are the mental and physical capacities of human beings are the farm-to-farm results obtained in setting up and managing the various agricultural establishments. When we speak of the stages of development in technique we refer in reality only to the average levels of technical ability attained. As a matter of fact, however, every stage has far-reaching individual differences. Changes in the level of technical improvement occur in the following manner: At first a few individuals as pioneers or leaders improve the technique of their operations; but the great mass follows slowly. The average farmer today works more effectively than he did a half-century ago, therefore we speak of our higher stage of technical development. Nevertheless, there are farmers today whose technique has reached a stage of development which will be considered "common" ten or twenty years hence, and there are still others whose plants are equipped and operated as those of our grandfathers were. We can observe, therefore, a differentiation in intensity according to the stage of technical development, not only if we compare for a given area the past and the present, but also if we compare at a given time the different areas with one another.

Also the concurrent (one-beside-another) variations in development are to a great extent explained by the same reasons as those which account for the consecutive (one-after-another) gradations. It is one of the most familiar experiences of practical life that the influence of the personal qualities of the entrepreneur, or management, upon the degree and direction of intensity often far surpasses the influence of soil and of economic location. The farmer, when he speaks of extensive and intensive types of farming, often has in mind only these differences. This is natural because they appear first in his range of vision. Moreover, he likes to identify the concepts rational and intensive (see pp. 1 f.) A method of farming which, because of the ability of the entrepreneur, has an inten-

sity above the average is properly called rational in comparing it with the average, because it gives more than the average absolute return and at the same time is the reason for a relatively high profitableness of the invested capital.

This fact deserves our special attention here since it provides the motive for technical progress in agriculture. Soil fertility and location considered alone cause differences in the absolute amount of land rent but do not change the return on invested capital because this varies with the rise and fall of the land rent which it is possible to get by the usual methods of operation in the different economic locations and on the different qualities of soil. Only through the subjective factor, that is, through the operating ability of the individual entrepreneur, is it possible to influence the profitableness of, that is, the rate of interest on, the invested capital. This factor changes only one condition of profitableness, namely, the amount of return; the other factor, the amount of land capital, is left unchanged. Only an individual farm which is above the average stage of technical development produces in net return more than a usual rate of interest on the equipment and on the land capital. This difference in interest is called the profit of the entrepreneur because it represents the compensation for his special ability. Opportunity for profit to the entrepreneur is therefore the motive for betterment of methods of operation—as we have said above, the motive power in technical progress.

This motive never weakens; it permits no rest but drives on without cessation. Let us assume that, in the "isolated state," at a given time, the majority of farmers are operating with a given technique and only very few have carried their operations to a higher stage. These farmers will receive entrepreneurial profit as long as they maintain this lead over the others. But if the majority of farmers succeed in catching up with them the difference in profit disappears, because now land values have adjusted themselves to the improved technique. Under some circumstances these farmers might even have to reckon with an absolute decline in net return; for example, when a situation such as that mentioned above occurs, wherein the market price of the product falls because of lowered production costs. Only through new improvements can

these better farmers maintain their position and gain an advantage again. On the other hand, the rest of the farmers also are forced, whether they wish it or not, to make use of the improved technique and intensity if their invested capital is to be kept profitable. The initiative of individuals starts the progressive movement which then, because of the example it sets, extends in wider and wider circles and finally draws everything relentlessly into the sphere of its influence.

We have already mentioned that the personal qualities of the entrepreneurs, as we can readily see, often cause marked contrasts in the gradations of intensity even within a small area. It is also well known that territorial differences in methods of agricultural operation are not infrequently wholly or partly due to the same cause. Agriculture in the western states of America is extensive in spite of the relatively high development of agricultural technique; agriculture in Russia is extensive largely because of its undeveloped technique. In America further intensification of agriculture is in the main a transportational, in Russia an educational problem; in so far, that is, as education is necessary to overcome the inertia of the peasants. Denmark owes her intensive agriculture not primarily to favorable natural and transportation conditions, but chiefly to the outstanding ability of the farming class. In sharp contrast to Danish agriculture is the agriculture of Ireland, which is extensive in spite of the fact that the best market in the world lies right at its door.

Even though we further emphasize the fact that the personal influence of the entrepreneur may, not infrequently, exceed in significance the objective factors, yet this influence is, of course, not to be understood as having everywhere the same scope for its development. Nature and economic location force upon the most able farmer limiting conditions which he can modify but cannot eliminate. The more restrictive these conditions are, that is, the more intensive the farming has to be for objective reasons, the wider is the scope for the use of individual initiative. In favorable locations and on fertile soils opportunities for individual initiative are greater than in unfavorable locations and on less productive soils. In an extensive type of farming, such as ranching, with its

few and simple operations, these are less than in intensive farming with its great variety of operations. Under objectively favorable conditions a whole scale of degrees of intensity may appear, while under objectively unfavorable conditions only a few steps, or only one, may appear with slight modifications. Naturally, the farther the whole development has progressed the more leeway there is for a subjectively based differentiation of intensity. Thaer has already said that the entrepreneur's ability is the factor of first importance in determining success. That is no doubt especially true at the present time.

It may be seen from this that the techniques of intensive and extensive agriculture cannot possibly be compared at the same time. The more intensively the agriculture must be carried on for objective reasons, the higher the stage of technical development it assumes and the greater the demands on the personal ability of the entrepreneur. The management of a ranch in Argentina demands, besides a high degree of physical ability and cleverness in business matters, only a limited knowledge of breeding methods; as a whole far less knowledge, at any rate, than is required in the operation of a large farm given over to the production of crops. Furthermore, crop farms make greatly varying demands according to their degrees of intensity; an American wheat farm is more moderate in its requirements than a Central European beet farm. Technical requirements increase correspondingly as trading conditions favor a higher gross return per acre. Where trading conditions are favorable there is, therefore, a greater interest in yield-increasing improvements than where trading conditions are unfavorable. In the latter case technical improvements that are primarily cost saving are important, a contrast which we have already pointed out in another connection. If the term "rational" is related only to technique, it is necessary to call the more intensive business the more rational. It is not a mere coincidence that modern agricultural chemistry and plant breeding were born in the Central European grain-import countries and not in the grain-exporting "agrarian countries."

In order to value at its full importance the influence of the personal factor upon the type of farming as measured by intensity, it

may be well to analyze this factor more closely. That not all agricultural entrepreneurs, to speak in the language of Thünen, obtain equal results from their operations is due to various individual reasons. It must first be noted that apparently all farmers do not strive in equal degree to make the highest possible profit. The spirit of the entrepreneurial class, the spirit of capitalism, the pronounced striving for wealth, or whatever one may call the basic motive of modern business, finds less receptive ground in the population engaged in agriculture than in other fields of business. This can be explained by the absence in agriculture of direct individual competition.[12] The farmer, far more easily than the man engaged in commerce or industry, can refuse to accept a purely arithmetical view of his calling without having to fear, at least for the immediate present, that he will be forced out by his competitor. Therefore large groups of rural people even today do not look upon their property as a mere return on capital invested (Rentenquelle), but are more or less satisfied to receive from it the means of maintaining a usual standard of living—the so-called maintenance "according to rank." The "concept of a dependable food supply" (Idee der Nahrung) has not been displaced everywhere by the "principles of the business office" (Sombart). Furthermore, pleasure in the ownership of ancestral property, in traditions and in sports and other noneconomic considerations, as well as obsolete ideas of profession and occupation not infrequently interfere with the purely businesslike calculations of those who are engaged in agricultural pursuits. This is so much the more true, of course, the more the traces of the past exercise their retarding influence in a country or district or upon a particular group. One could not maintain that the entailed property of a German family of rank and the share capital of an Australian sheep company, or the property of a Westphalian peasant and the rented farm of an English farmer, are all valued by their owners in the same way. Here a cold unsentimental business viewpoint, there a close connection of a personal kind between land and land operator.

Of still greater significance than the differences in basic eco-

[12] Which again is associated with the price-making process for agricultural products.

nomic conceptions are the varying professional abilities, resulting from differences in the intelligence and characters of the entrepreneurs. The characteristics required in farmers are well known: diligence and conscientiousness, energy, and resourcefulness in the use of expedients; knowledge of human nature and versatility in business, calculating talents, and economic courage; in short, all the capacities and attributes of character which make, as is commonly said, the knowledge and ability of the farmer, and which are decisive for his business success. It is unnecessary to explain further how much each single capacity and attribute may affect, under given circumstances, the rational degree of expenditure in agriculture.

Of greater interest to us, from the theoretical point of view, is the fact that the financial condition or capital strength of the individual entrepreneur at a given time also plays an important rôle in the question of intensity, so far as it influences his economic mobility, warns the one farmer to be cautious, or allows another to take great chances. Let us examine this more carefully. The agricultural plant is in any case subject to certain risks. The farmer can never be absolutely sure of receiving the return upon which he has based his calculations in making the expenditure, or to which he has adjusted the intensity. He knows that he can count certainly only on average returns, because yields as well as prices vary from year to year. But the most able farmer can estimate even these average returns only approximately, never exactly, at the time when he has to make the necessary expenditures for their production: a certain amount of uncertainty remains under all circumstances; so if the farmer can "insure" himself against some of these risks he has only lessened, not eliminated, this factor. But what we are concerned with here is the fact that, under given objective conditions of intensity, the risks, too, are greater the more the expenditures have been increased. The relatively intensive farm will produce high yields, but with comparatively high costs per unit; the relatively extensive farm is satisfied with lower yields in order to operate at comparatively low costs per unit (of land). If the expectations fail of fulfillment, the first has to suffer greater losses than the second. (See the example on p. 57.) The

farmer has, as the illustration herewith indicates, a choice between the possibility of a too intensive, and the probability of a too extensive, method of farming; that is, between the chance of a high but relatively uncertain return and the chance of a smaller but relatively certain return. If he is able to take the greater risk without endangering his economic existence, that is, if he can with his own

Expenditure	Normal return		50 per cent failure	
	Gross return	Land rent	Gross return	Land rent
100	150	50	75	−25
50	80	30	40	−10

resources stand possible losses, then he will be inclined to take the chance of a higher profit. If he cannot, that is, if he must operate with borrowed capital, he had better choose the other way and be careful in the application of capital and labor, even though his personal abilities may qualify him to operate more intensively. In the latter circumstance it will be advisable for him to change to a more intensive method only after his financial condition has improved. A direct loss might defeat him while the failure to make a profit only slows down his advancement. It is assumed, of course, that the farmer does not drop below the average intensity which is necessary to obtain a customary return on the investment in land. If his means are not sufficient to permit him to maintain this standard, the enterprise is doomed to failure from the beginning, except as the farmer has special ability which enables him to obtain an exceptionally favorable relationship between expenditures and returns; that is, to obtain, with an intensity below the average, returns which correspond to the usual land rent. That is a situation which in general should not be regarded as permanent but only as a passing stage, because such a farmer will naturally try to arrive as quickly as possible at the degree of intensity which corresponds with his ability.

Special consideration must be given to the fact that the "relative" intensity or extensity of a farm, whether caused by the mental or by the material resources, is reflected first in the choice of

crop combinations, that is, in the relations in which specifically intensive or specifically extensive kinds of crops combine with one another—in other words, in the intensity of the farm organization. To a less degree it is reflected in the intensity with which the cultivation of the individual crop is carried on within these limitations. The reason for this is that, with extensification of the individual line of production, the point is reached comparatively soon where the combination of factors for the farming operations begins to be more unfavorable. Relative costs of operation, therefore, do not decrease but increase. A farmer dependent upon a relatively extensive procedure would be unwise if he undertook to raise sugar beets on a large scale while planning to save by cutting down sharply the work of cultivation. In extensifying, such a farmer must limit or abandon this specifically intensive type of cultivation. The decision in respect to intensity as influenced by the personal factor is also modified in other ways, particularly by the farmer's financial situation. A farmer whose capital is limited must first of all be careful that he has fluid capital in hand and therefore must beware of long-term investments. For example, he will not purchase an expensive steam plow but will be satisfied with teams, which may make for a more expensive form of operation but which will lessen the present demands on his financial resources, thus releasing them for more important duties and for his "risk fund." In general, therefore, he will use relatively much circulating and relatively little fixed capital. Technical improvements often mean a substitution of fixed for circulating capital. This explains the fact that the farmer who is financially strong is able to keep pace with progressive developments better than the one who is financially weak. The fixed capital, of course, is relatively less prominent in a financially weak enterprise, because the risk of the investment generally increases with greater durability of the goods purchased. It is more difficult to coördinate expenditure for buildings with expected conditions of intensity than to make a correct adjustment in expenditure on short-lived chattels.

These differences are, of course, really only differences of degree. Everyone, even the financially strongest entrepreneur, must take into account the fact that all investments and activities do not

carry the same risk. Adjustment of intensity to changed conditions, which we may here assume to be in the direction of a progressive development, does not take place as a continuous and uniform process, that is, a series of unimportant changes. It occurs more abruptly in the form of sudden and drastic changes. The spread between conditions and the form and degree of intensity, which develops in the course of time, is done away with after it reaches a certain size. This is in large measure the reason that with every change in farm organization some of the capital which has been invested is wholly or partly deprived of value. In other cases returns are temporarily foregone. The expected increase in return must cover both kinds of expense in addition to interest and amortization of the newly invested capital if the change, in this case the intensification, is to be profitable. The agricultural entrepreneur must in a sense balance two opposing demands, stability and progress. Stability is necessary in the interest of the maintenance and amortization of capital; progress, in the interest of the highest utilization of varying economic resources. Therefore, in spite of sufficient capital and ability on the part of the entrepreneur, every farm business may appear temporarily to be relatively extensive because the time for change has not yet arrived.

It has already been mentioned that, in these abrupt adjustments, individual inputs behave differently and permit at one time a faster, at another time a slower correction. At first, as a rule, the degree of intensity within the individual crop combination is balanced if possible with the changed conditions, because this change can be made mostly through adjustments in short-term investments or the application of circulating capital. Only if this procedure is not sufficient to meet the need is the extensive crop combination replaced wholly or in part by an intensive one; for example, grazing by farming, or feed crops by hoe crops.

The foregoing explanation of the influence of the personal factor upon the optimum amount of expenditure is based upon the assumption that the intensifying effect of a higher managerial intelligence is always associated with an increase in the productivity of labor and capital. It is further assumed that the more

rational technique mitigates the pressure of the law of diminishing returns and, with a given price of products, shifts the point where the cost of the last unit of expenditure balances with the value of the resulting output. The price of the product was tacitly assumed to remain constant.

Finally, this assumption also must be corrected; it does not necessarily follow that an increase in the quantity of products occurs. An increase in intensity may also be justified by the fact that the entrepreneur succeeds in increasing the value of the product. This is the case if one farmer, because of special business skill, gets higher prices than the average farmer receives for the same quality of product, thus increasing the farm price which determines the degree of intensity. This aspect is of still more significance if the farmer is competent to produce products of high quality, for example, registered seed. Such products repay a higher expenditure per acre than that required for production of the usual market products not because the higher expenditure is balanced by an increase in quantity of output but only because of a higher value of the output. The quantity may even be comparatively low. The significance of this factor is made clearer if we consider the breeding of pure-bred animals, or the development of new plants for kitchen and pleasure gardens, etc. The possibilties of increased intensity are here almost unlimited, and it is therefore understandable that especially the most able farmers aim less at a mere increase in the quantity of product and more at the production of valuable products. As long as they produce average products their activities are limited, because the price of the product is determined by the output sold by competing producers. Only the production without competition, that of the so-called quality products, prices of which are determined by the purchaser's necessity in each individual case, offers free play to the abilities of these more able farmers. The more intelligent farmer tries first, by increasing productivity, to use as fully as possible the objective conditions of intensity and, if this is insufficient, even tries to break through these limits. But the work of those who succeed—there are only a few—can hardly be termed agricultural management. It is rather the employment of a rare inventive genius.

CHAPTER III

SYSTEMS OF FARMING OR THE ORIENTATION OF THE LOCATIONS OF THE LINES OF PRODUCTION

1. GENERAL CONSIDERATION OF THE ORIGIN OF FARMING SYSTEMS

THE DEGREE AND DIRECTION of intensity constitute one characteristic whereby the forms of farming can be differentiated from each other. The other is the organization of the farm according to lines of production, or the system under which the farm is operated. We are accustomed both in practice and in science to classify the modes of farming mainly according to systems, and rightly so, because through such grouping we are able to get a real insight into the great variety of agricultural phenomena. Whether one terms a mode of production intensive or extensive depends entirely upon the measure of comparison he uses, but if one knows that a farm is operated according to a certain system he has a real description of its operation.

Systems of farming can only originate through the fact that two antagonistic forces or groups of such forces work against each other. On the one hand, forces must be operating which make some one place more advantageous for a given type of production, another place superior for another type of production; namely, forces of differentiation (Differenzierung). On the other hand, the combining of different lines of production into a unit must offer advantages; that is, there must be forces working which offset to some extent the advantages of specialization, and thus exert a compulsion in the direction of versatility—namely, forces of integration. If there were none but forces of specialization the production of each individual farm would be compelled to take on a quite one-sided character. A consistently sustained division of labor among the farms which supply the market would necessarily result, so that one could no longer speak of a farming system. Only

if all the farms be taken as a whole could they be described as versatile. But on the other hand, if there were only forces of integration, each individual farm would have all the lines of production one can think of existing side by side and thus would present a picture of greatest versatility. The farms taken as a whole would be equal, or better uniform, because under these circumstances each one must of course be comparable to the others in its details. One would be spared the trouble of arranging farming methods according to systems.

If we consider again the coöperation of the factors of intensity we recognize there also two forces working in opposite directions. On the one hand stands the force of extensification; namely, the effort, in production, to overcome with the least cost the resistance of nature (the law of the soil). On the other hand, there is at work a force of intensification, which originates in the effort to overcome with least cost the resistance of transportation in supplying the market demand. The gradation in intensity arises from the fact that at times the one force, at other times the other, assumes greater importance.

The forces of differentiation and integration which bring about systems of farming have the same origin: for the purpose of saving as much as possible in production costs, supplementing lines of production are combined on a given farm. In order to save as much as possible in transportation costs for supplying the market, it appears necessary to favor for one kind of production this location, for another kind that location. In addition to these, there is again, modifying the general rule, the influence of changes in natural conditions of the locations; that is, changes in the specific fitness of them for the different lines of production as well as the influence of the personal ability of the entrepreneur.

2. THE INTERRELATIONSHIPS BETWEEN THE ENTERPRISES ON THE FARM OR THE NECESSITY FOR DIVERSIFICATION OF ITS PRODUCTION

THE NECESSITY FOR DIVERSIFICATION which as a rule underlies the entire production of a farm can be explained mainly by three different influences, which we therefore call the forces of integra-

tion. The first of these is the desire for the most continuous employment of labor and equipment; that is, the endeavor to obtain a competence with the smallest possible quantity of the means of production. This tendency makes it necessary for the farmer to allocate his area to a larger or smaller number of kinds of production so that the seeding, cultivating, and harvesting periods will differ as much as possible. The more specialized the crop combination, the shorter in general is the time in which the operations in a certain area must be performed and the more therefore must labor and equipment be supported permanently on the farm. Of course, cultivated plants do not behave alike in this respect. For some the cultivating and harvesting periods are distinctly fixed, while others permit a greater range in the timing of their care. Grain crops, for example, in contrast to hoe or feed crops, have a narrowly defined harvesting period. None of the crops permits a changing or shifting of the growing period at will. Most of them show severe reductions in yield with comparatively small departures from the optimum times for seeding, cultivating, or harvesting.

One may speak, in analogy to the recognized law of diminishing returns, of a law of increasing costs, which comes into effect if the farmer tries by expansion of one kind of production to give to the utilization of the land an increasingly specialized form. With successive expansion of one kind of production beyond a certain point, within the combination as a whole, the production costs per unit of area and per unit of product increase progressively, in most cases even disproportionately. It is profitable, therefore, for the farmer, instead of growing only one crop—even though it be a very valuable or high-yielding one—to grow different crops side by side, crops which have different seeding, cultivating, and harvesting periods and which therefore supplement one another in the utilization of labor and equipment. With a small expenditure it is thus possible to obtain a comparatively large although differently constituted quantity of gross output. The branches of a farm business, therefore, are associated through joint use of the means of production. The closer this community of use is made—that is, the more the demand for labor can be evened up—the lower in general are the expenses per land unit or per unit of product.

Most complete, and therefore most important, is the joint use of labor and equipment in the production of those crops for which the peaks of demand for labor in seeding and harvesting do not coincide at all. In favorable climates this is approximately true for spring and winter grains, which are sown side by side nearly everywhere that winter grain grows at all, and which may even be regarded as the framework of the tillage systems. Very important, too, is the supplementation between the hoe crops and the feed crops, on the one hand, and between the grain crops and the oil crops on the other; also the labor distribution which is obtained through the cultivation of tilled land and meadows. Less important are the differences between the various sorts of winter and summer grains or even between the varieties of a given kind of grain. This, of course, does not exclude the fact that these varieties or types may also in some cases be decisive in the selection of crops. It would lead us too far astray to explain the technical differences in detail. It may suffice to say that a given crop gives, within a systematic land utilization, a greater resistance to the competition of another the more its cultivation facilitates the distribution of labor on the farm. Through superiority in value or yield, winter wheat might be able under some conditions largely to force out winter rye, yet might influence but little the cultivation of summer grains.

The timing of the use of the factors of production is not the only decisive influence in the problem of balancing properly the labor inputs. Also, of course, the special demands which the individual crops make in respect to the quantity of labor input exert a determining influence. If a specifically intensive crop is more and more expanded, the costs of production increase more rapidly than if the same thing is done with a specifically extensive crop. The more intensive the culture which must be practiced, the more the crop loses in independence unless it is a crop which employs the factors of production almost continuously, as, for example, vine culture. The most independent form of cropping, so far as labor distribution is concerned, is grazing, partly because of its specifically extensive character but mainly because there is no periodic change between its growing and harvesting times. It is for other reasons

therefore that it seems profitable to combine other kinds of crop production with grazing to make up an organic whole.

There are other reasons why the cost-saving influence of labor distribution is not always of equal importance in the choice of type of land use. Soils which because of their natural conditions make large expenditures necessary, demand greater attention than soils which are easy to cultivate. As we have found in our earlier discussion, changes in the favorableness of the economic location also alter the importance of the distribution of labor. The smaller the price spread between products and the factors of production, that is, the more unfavorable the economic location, the more important the distribution of labor becomes. It cannot, of course, be concluded from this that now also the diversity of the farm business must increase or decrease accordingly. The working tie-up of the different forms of land use is one factor which facilitates the distribution of labor, but not the only one, nor the most influential one. On the contrary, the most effective means is the summer fallow, which therefore assumes first place where the crop combination is ineffective or at least is alone scarcely adequate; that is, under unfavorable natural conditions where either the soil, because of its "heaviness," demands an unusually large amount of cultivation, or where the climate is such that the growing season is much shortened. This is also true for the most unfavorable transportation conditions where labor and capital, measured in terms of the product, are very expensive and where for this reason, as well as by reason of the small number of crops which pay at all—we will speak of this point later—it is not possible to forego the extensifying effect of the summer fallow.

Diversity of land use for the purpose of distributing labor is brought about on the one hand by dividing the area among several types of land use which occupy the same area permanently, on the other hand by establishing a so-called crop rotation on the tilled land; that is, a certain number of fields is set apart on which, one after another, different crops are grown in such manner that an individual crop occupies continuously the same percentage of the total area. One might bring about an adequate distribution of labor simply by growing different crops side by side although it would

not be so complete as if a change in the sequence of crops were made at the same time.

The second reason which makes necessary a diversity in land use is the effort to get the best feasible utilization of all the fertility elements of the soil. One of the most familiar experiences in practical agriculture is that the yields of crops are increased if they are not grown continuously on the same land, but are interchanged with other crops of different types. The main reasons for this are the following: The demands on the chemical, physical, biological, and other primary and secondary attributes of the soil are not the same for all the cultivated crops but operate in different directions, and similarly there are differences in the conditions in which the plants leave the soil. Only a few of the most important differences of this kind may be mentioned. There are plants which take their water and nourishment chiefly from the surface layers, and others which extract both more largely from the deeper layers; plants which need easily soluble plant foods, and others which are satisfied with those which are less easily soluble. One plant has a relatively high demand for this plant food, another for that, and a third one even enriches the soil with plant foods, as, for example, the nitrogen collectors. Some plants like a high lime content in the soil, while others dislike soils with a lime content. One plant wants a loose, the other a more solid structure of the soil. And the condition in which the soil is left after the crop has been harvested varies according to the fertility demanded of it by the crop. But this is also true in another way. The one plant leaves the soil in a loose, fruitful, and clean condition, the other in a crusty, dead, and weedy condition. The one crop contributes much to enrichment of the soil by building up its humus content, thus making the plant foods more available by leaving great quantities of organic residues; the other contributes but little in this way. There are still other differences in the demands upon the conditions for growth and in the effects upon the condition of the soil. It will be seen from the examples given that an unbalanced crop combination must mean utilization of only a part of the capacity of the soil and letting the other part lie idle, and, further, an unbalanced deterioration of the conditions required for growth. On the other hand,

coöperation of crops which supplement one another in their demands, which spare now this part, now that part of the elements needed for growth, thus giving them a chance to make restitution through their own powers, and such that one crop repairs what the other has torn down, can bring forth a greater quantity from the soil than can a single crop. It is true that all crops do not depend equally upon this supplementation, which we might call coöperation in land utilization. Crops like rye, potatoes, and corn can be grown pretty well year after year, whereas others, like clover and sugar beets, decrease in yield very rapidly if they are grown at short intervals on the same field. Scarcely any of the European crops, however, represent fundamental exceptions to this rule. For all of them the change of crops in the rotation is significant to the cultivation; that is, it furthers the yield-increasing and cost-saving activities. The farmer, therefore, in choosing the crops for his rotation and in determining their relationships and sequences, tends to combine as much as possible the advantages of the coöperation of factors of production with those of coöperation in land utilization.

This is not possible, however, without some compromising. Although a crop rotation which takes into account only the principle of labor distribution is no doubt preferable to an unbalanced crop combination, in the sense of providing a varied utilization of the land, maximum results are in general obtained only by renunciation of the ideal of labor distribution. How the balance is obtained in such cases may best be illustrated through the following example.[1]

The crops—rye, potatoes, and lupines—permit of two different rotations without any change in their relative proportions of the area, namely:

I	II
1. Rye	1. Rye
2. Potatoes	2. Lupines
3. Lupines	3. Potatoes

[1] Cf. Aereboe, *Beiträge*, S. 63.

Favorable distribution of labor calls for the selection of the first rotation in which the fall jobs of potato harvesting and rye seeding are distributed over two fields. Against it is to be considered the incomplete utilization by rye of the nitrogen which is left in the soil by the lupines. In the second rotation the conditions are reversed. The potato crop assures a good utilization of the lupine nitrogen, while the timely seeding of the rye after potatoes causes difficulties. In order to benefit as much as possible by the advantage of a high nitrogen utilization and to lessen the disadvantage of an unfavorable labor distribution neither of the two rotations is selected but both are combined to make up a six-year rotation.

1. Rye	4. Rye
2. Potatoes	5. Lupines
3. Lupines	6. Potatoes

Or one may repeat one of the sequences in a nine-year rotation, which would mean an approach to one of the two extremes. The principle according to which one may proceed with such compromises is the multiplication of fields, so as to get a greater possibility of variation and adjustment.

How far the consideration of coöperation of crops in land utilization, the principle of crop rotation, can maintain itself against an unfavorable labor distribution depends again largely upon the physical and economic conditions of production. Crop rotation gains relatively in importance as nature and the economic location make possible the production of high yields, that is, work in favor of an intensive agriculture. This is true, first, because the competing consideration, labor distribution, loses in importance to this same extent. Then too, and this is still more important, the number of crops which it is possible to grow increases with increasing fertility. Furthermore, the number of crops which can be grown profitably also increases with increasing favorableness of the economic location. On sandy soils where only rye, potatoes, and lupines grow, or in severe climates where only potatoes and summer grains can be cultivated, the opportunity for carrying out a rotation is far more limited than on soils which produce all crops with

some degree of certainty. The type of farming is also far more limited in unfavorable economic locations, where only grain can profitably be sold, than in zones closer to market where a great number of products is salable. Under unfavorable natural and economic conditions, the diversity of land use is based chiefly upon the principle of labor distribution; under favorable conditions, upon the principle of rotation. In general, diversity increases with increasing favorableness of the conditions of production.

Important differences are also noted if one compares the individual crops one with another. In determining the crops to be admitted into a rotation group, the effect upon labor distribution may be for a certain crop the more decisive factor, while for another crop the beneficial fertilizing effect which it will have within the rotation is more important. Grain and hoe crops represent sharp contrasts of this kind, and the so-called main crops on the one hand, and the interim or fertilizing crops on the other, represent still sharper ones. The latter, as is well known, are grown only because of their "indirect" effects.

In this discussion we touch upon one phase of coöperation in land use which needs special explanation; namely, the regulation of the fertility economy of the farm. It has already been shown that fertilizing the soil is as much a conditional matter as every other operation, that economically the right procedure may be—depending upon the conditions—mining, maintenance, or storing up of fertility. The demand for fertilizer in farming can be met in two different ways: first, by producing fertilizer on the farms, the so-called farm fertilizer; or second, by putting fertilizing materials from outside into the circulation of the farm, as for example commercial fertilizer, fertilizing materials from commercial feeds, waste materials, etc. The first-mentioned method is of more general importance because, on every farm, materials, especially manure, are produced as unavoidable wastage but are suitable for fertilizing. It is apparent that the farmer will apply these first before he purchases fertilizer from the market. The purchase of fertilizer, the necessity of fertilizing being assumed, is profitable only when by this means a certain result can be obtained more cheaply than by making a corresponding increase in farm-produced fertilizer.

The importance of the purchase lies in its supplementation of the natural sources of fertilizer on the farm. This importance increases, as also in general does the demand for fertilizer, with increasing profitableness of the economic location. A full restoration, or still more a storage of fertility, assumes the purchase of fertilizer in any event, although the mainstay of fertilization is always the farm-produced fertilizer.

In the profitable production and application of farm fertilizer the mutual supplementation of the forms of land use on a given farm plays an extremely important rôle. The individual forms of land use and the different field crops act differently in respect to production of fertility as well as to demands for fertility. Some produce more fertility than they themselves can profitably consume, while for others these conditions are reversed. The first appear therefore in the total fertilizer economy as fertility producers, the latter as fertility consumers. Both are interdependent; the producers need the consumers in order that their surplus may be utilized, and the consumers again can satisfy their demands for fertility only through association with the producers. A rational fertility economy on the farm is obtainable only if the fertility-producing and fertility-consuming types of land use are associated in the right relations with each other. Improper balance in the one or the other direction must prejudice the return of the farm, be it through an irrational intensity or extensity of fertilization.

Meadows and pastures are fertility-producing types of production, especially the former because they produce stall feed. Field and garden crops are fertilizer-consuming types of cultivation. In field-crop production the cultivation of green-manure crops or feed crops produces great quantities of fertility but makes small demand on the soil, while the hoe crops represent the other extreme, and the grain crops take an intermediate place.

There is therefore a certain analogy between the relationships presented by the types of land use on a given farm, on the one hand, and the various economic locations on the other. On the individual farm the intensive types of crops are supplied with fertilizer at the expense of the extensive in much the same way as the plant foods flow from the extensive zones, which depend upon min-

ing fertility, toward the intensive zones where they serve for restoration or storage of fertility. In both cases the principle is that of concentrating fertility from relatively large areas and applying it on relatively small areas, or, viewed from the standpoint of the restoration theory, a robber economy in both cases. This again makes recognizable the inconsistency between the economic principles involved and the demand for a static balance between fertility extraction and fertility restoration.

One fact which may greatly lessen the importance of the static consideration of fertilizing one crop at the expense of another should, of course, not be overlooked: this is that the production of farm fertilizer is not solely, nor even primarily, an accumulation of those elements of plant food the extraction of which would constitute a permanent damage to the soil substance. Of first importance are the gains resulting from increase in nitrogen and from building up the organic matter which assists in crop production through its so-called indirect or decomposing effect in the soil. These gains are, indeed, outstandingly important in the whole fertilizer economy of the farm. Farm fertilizer production is then, in large measure, the accumulation of ingredients the elements of which are not taken from the soil but from the inexhaustible reservoir of the atmosphere. Of these two problems, that of nitrogen production has again the greater practical importance because, if it is solved, the supply of organic matter has at the same time been taken care of.

That the production of fertility on the farm is, from the economic point of view, mainly the production of nitrogen is explained by the isolated position of this element of plant food in the natural cycle, and this is the result of its peculiar chemical qualities. Nitrogen is not a mineral-forming element. Its real home is rather the atmosphere, of which it is an important ingredient. Nevertheless, most plants must absorb nitrogen in the same way as they obtain the other mineral substances, that is, in the form of water-soluble compounds drawn from the soil. Although fixed nitrogen is returned to the soil by various chemical and biological processes, this does not alter the facts that, in general, nitrogen is the element the supply of which is most limited in comparison to

the demands of the plants grown, and that the demand of farms for fertilizer is mainly a demand for nitrogen. That is one side of the nitrogen problem. The other is that the nitrogen-containing fertilizers (commercial fertilizer and the fertility contained in concentrated feeds) which can serve as substitutes for the farm-produced fertilizers are very expensive; this fact is of course related again to the peculiar chemical behavior of nitrogen. Although the chemical industry has recently learned to fix free nitrogen artificially and to transform it into usable fertilizers, this process, because of the slight affinity of nitrogen for oxygen, requires a large consumption of energy and therefore, at least for the present (1912), such fertilizers can be produced only at great cost. Agricultural enterprises therefore still rely mainly upon their own resources in obtaining the nitrogen they need.

Thus it happens that the pressure for diversification, which grows out of the fertilizer economy, is the principal reason for associating the cultivation of hoe crops, grain, and other nitrogen consumers with the cultivation of nitrogen producers. These may be feed crops or even crops which cannot be utilized in any other way than as fertilizer for the main crops (green manures). Also not the least part of the importance of meadows and pastures in the fertility economy lies in the nitrogen problem.

How closely the fertility economy is associated with the types of land use is shown clearly by those situations in which the marginality of some land depends entirely upon the existence of a suitable combination of fertility production and land use. Poor sandy soils often can be profitably cultivated only if they are associated on a given farm with productive meadows, especially irrigated meadows. In mountain districts the cultivation of land is not infrequently justified, in spite of most difficult operating conditions, merely because of the desirability of using the fertilizing material of the large grazing areas. In poor forest districts it is often the opportunity to use forest-bedding materials which makes the existence of small farms possible. In these and similar situations it is the very definite interrelationship among the types of land use which is decisive. The relationships existing between the individual kinds of crops are not sufficient in such cases to justify tillage.

If the farmer is dependent upon the latter alone, the fertility production is so expensive that the less productive soils can no longer pay for it.

Which course of action is advisable in regulating the fertility economy—whether the extensive types of land use, such as meadows and pastures, or the extensive types of crops, such as feed or fertilizer crops, are to be preferred for fertility production—depends, first, upon the natural conditions, second, upon the economic conditions prevailing at given times. This problem will be discussed later as a problem of differentiation. It may only be said that, especially with an increase in the tilled area of a farm, considerations connected with the fertility economy lead not only to the introduction of fertility-producing crops in the same rotation but also often, along with other reasons, to the establishment of several rotations. One of these, the extensive outer rotation, is intended more for fertility production, while the other, the intensive inner rotation, is intended more for fertility consumption.

Finally, the third factor which exerts an influence in the direction of diversification in land use is consideration of the supplies needed by the converting enterprises, especially by the live stock of the farm.

Live stock is an indispensable enterprise on most farms for two reasons: first, because of the rôle it plays in the fertility economy; second, because on every farm greater or smaller quantities of plant products are produced and cannot be utilized except as they are fed to farm animals or used in caring for them. Where the keeping of live stock is feasible, it must be supplied of course according to its requirements. This can be done only if, in choosing the types of land use, adequate consideration is given to it.

The live-stock enterprise cannot be based now on this feed, now on that, as one may choose, but as a rule on mixed "feed rations" only. If a given production is to be obtained from animals it is not sufficient merely to supply a certain quantity of nutritive material or starch value. This quantity of nourishment must also be contained in a certain volume of feed which on the one hand can be consumed and digested and which on the other hand does not fall below a certain minimum of bulk. An animal can neither absorb

any quantity of feed one chooses to give it nor thrive on a too concentrated feed. On the contrary, the highest return is obtained from a feed only if it has an optimum concentration, which varies, of course, according to the result sought. In other words, the relation of nutritive matter or starch value to the quantity of feed must be fitted to the performance desired of the animal. As the concentration of a given feed falls below this optimum or rises above it, the efficiency of feed utilization decreases more and more until finally no value results from its use. Feeds which do not fulfill these requirements, whether they contain too large or too small amounts of bulky material, must be supplemented by other feeds in such manner that the total feed ration represents the desired relation of volume to nutritive value. It must be added that some feeds, for other reasons mainly dietetic, also require supplementation by other feeds. For example, very succulent materials make a physiologically valuable food for most purposes only if used in connection with dry feeds, while, on the other hand, the utility of dry feeds is usually increased by adding succulent feeds to the ration. In other cases there are undesirable secondary effects which make it advisable to give only small amounts of a certain feed and to provide the lacking nutritive materials in some other form. Thus many factors work together in such a manner that rational feeding can, as a rule, be brought about only by feeding mixed rations, and the types of land use must provide for meeting this requirement.

The need for variety in the production of feeds is further greatly increased by the fact that, once live stock is on the farm, a feed supply for the whole year must as a rule be provided. This makes necessary a timely integration of the various kinds of feed production. Only in exceptional cases can a profitable live-stock enterprise be based upon summer feeding alone. On most farms summer feed can be sufficiently utilized only if at the same time provision is made for winter feed. Again, both summer and winter feeding may utilize different feeds which integrate with one another in timing. This factor plays an important rôle especially in summer stall-feeding. Here it is necessary to have continuously at disposal young green fodder in the best harvesting stage and this requires the growing of feed crops that have different harvesting seasons.

Besides this coöperation of the forms of land use and of the factors of production (labor and equipment), there is therefore a third interrelationship among the various forms of land use; namely, a complementary use of the products. Partly for physiological reasons and partly for reasons associated with the organization of the farm work, it is not possible to give over an unlimited part of the total area to a single kind of crop which depends on live stock for its utilization. This is true because the utilization of its product will be more and more adversely affected, and other supplementary types of cultivation will therefore become increasingly superior in spite of the fact that their cultivation may involve relatively high costs or other disadvantages. Let us suppose that there are, with respect to utilization of labor and of land, no reasons adverse to unlimited expansion of the grain crops. Even in such a situation, if we disregard exceptions, it would prove profitable, in addition to the grain crops, to grow to a greater or less extent other crops, especially those of which the products would supplement the straw for feeding; that is, to produce hay or clover, hoe crops, etc. Hardly any specifically agricultural mode of land use stands entirely outside of this complementary relationship between products, because nearly all of them are, either wholly or as secondary or waste products, feed producers. Only in exceptional cases is an individual crop a profitable feed basis for the live-stock enterprise. The production of oil and of certain commercial crops might be regarded as on the whole independent types of land use so far as utilization of such products is concerned, because they produce only small amounts of not very valuable feeding materials. Of the feed crops, pasturing may in exceptional circumstances maintain its independence when either a very mild climate permits the extension of pasturing over the whole year or the natural and economic conditions permit of an intermittent live-stock enterprise (Fettgraeserei). All other forms of land use and kinds of crops, as grain crops, meadows, clover, feed crops, hoe crops, etc., must be regarded in all cases as dependent, that is, as requiring supplementation for a rational utilization of the products.

Of great practical importance on farms consisting predominantly of tilled land, because of the greater extent of the grain

crops, is the establishment of a balance between the production of straw on the one hand and of hay or green fodder on the other. This can be accomplished either by means of meadows and pastures or by producing feed crops. It is also important to supplement winter dry feeds with tuber and root crops (winter green feeds), and for farms depending upon summer stall-feeding to produce fodder crops which bridge the intervals between the cuttings of the main feed crops. Aereboe designates the crops which serve this last-mentioned purpose as the supplementary feed crops, in contrast to the main feed crops which serve the first-mentioned purpose.

To summarize: A threefold tie holds together the different enterprises of a given farm, deprives them of independence, and makes them parts of an organic whole: (1) the relationship of the factors of production to one another, (2) the types of land use, and (3) the ways of utilizing the products. Regard for this threefold tie assigns to each individual enterprise within the farm business a certain sphere which may not be violated if the whole is not to suffer injury. If the farmer tries to loosen this tie by extending one particular enterprise at the expense of the rest of them, a threefold prejudice to the farm business will be the consequence. Production costs per unit of area and of product increase because of the unbalanced use of labor, yields per unit of area decrease because of the incomplete utilization of soil fertility, and finally the money value of the output declines because of the difficulties which stand in the way of a profitable utilization of the product. Only with a very definite relationship in respect to the spheres of the individual forms of land use, therefore, is it possible to obtain the highest net return for the farm as a whole. To discover this relationship, and the most profitable degree of intensity for each enterprise, is the farmer's main problem in land utilization. The farmer therefore need not decide upon the one or the other form of land use or kind of crop but must answer the question: "Where is the last acre of land which on the average over a period of years can be put to this form of land use or kind of crop with greater profit in terms of total net return for the farm than if put to any other use?"[2]

[2] Aereboe, *Beiträge*, S. 55.

The heart of the problem of most profitable degree of intensity is centered about the determination of the limit beyond which it does not pay to intensify. This is true also in the organization of kinds of land use. The only difference is that, in the second problem, we do not seek the point where a given enterprise will just pay for the last unit of area assigned to it but instead the point where it just makes better use of this last unit of area than do the competing enterprises.

As yet, however, nothing has been said of the relationship of enterprises to which solution of the question of profitableness must lead in the individual case. It, again, may lead to entirely different relationships. In approaching this question we turn our attention to the second group of forces the effect of which plays a rôle in the formulation of systems of land use, namely, the forces of differentiation. If a certain kind of land use finds conditions on a given farm better suited to it than conditions on another farm, it will therefore be enlarged to the degree of its profitableness, at the expense of the other enterprises and of the interrelationships of these enterprises; that is, the system of land use will undergo so extreme a modification that, under some circumstances, diversification may be done away with entirely. An entirely one-sided form of land use is of course not only a most extreme form but, in general experience among all the types of land use, it has been but rarely noted—that is, if one considers each individual crop as a separate enterprise. In the competition for the land area we can the more easily contract and finally displace entirely a given kind of land use the less the advantages offered by its admission into the supplementary relationship of the factors of production, of the types of land use, and of the ways of utilizing the product, as compared to those offered by competing uses. On the other hand, the looser the tie which connects a given use with the other enterprises, the more easily that use can be expanded. Usually, therefore, as has already been mentioned and explained, the basis is provided for the entire separation of pasture from the supplementary interrelationship of the kinds of land use, while of the cultivated crops only the grain crops can be thus separated, and these only in some cases—for example, wheat farms in the western

states of America. All the other kinds of land use show variations in respect to their most profitable extents and seldom free themselves entirely from these ties.

One can also see from this to what extent one enterprise displaces—that is, limits through its increasing superiority—the enterprises competing with it. The greater the similarity of two enterprises in their utilization of labor, capital, and land, as well as in supplying feed for live stock—that is, the more the one enterprise can be substituted for the other—the more easily can the one restrict and finally entirely eliminate the other. If the cultivation of winter wheat gains in competitive strength it must affect first the cultivation of the other winter crops, as rye, oil crops, etc., and much later the cultivation of spring grains, hoe crops, and fodder crops, because the latter differ from winter wheat in their requirements and returns far more than do the other winter crops. For the same reason, with increasing competitive strength, the cultivation of sugar beets affects, first, the cultivation of mangels and the other hoe crops, and second, the cultivation of fodder crops, while the grain crops are affected more in their relative amounts than in the total amount of all of them. Under the most favorable conditions (for us in Germany) experience indicates that the cultivation of sugar beets cannot occupy more than 50 per cent of the cultivated area, in which case the rest is usually planted to grain crops (mainly barley for brewing).

3. THE ADJUSTMENT OF PRODUCTION TO THE ECONOMIC LOCATIONS OF FARMS

LIKE THE PROBLEM OF INTENSITY, that of the differentiation of the lines of production or of the location of the systems of farming has two fundamentally different aspects which, in the interest of scientific clearness, we must keep separate. Assuming a stable or static condition of the social organization, we shall first investigate the principles which explain for us the coexistence, at a given stage of development, of different lines of production in the same locality. Secondly we shall turn our attention to the living and dynamic economic unit in order to learn the modifications of the lines of production which become necessary with changes in time. The first

consideration introduces the forces, or factors of location, which are in general exerting an influence in the building up of the different systems of farming. The second consideration introduces the readjustments in the relative strengths of the factors of location which occur as a result of changing stages of development of society.

At a given stage of development three fundamentally different factors are effective in differentiating agricultural production:

1. The economic location.
2. The natural conditions, or the climate and the specific capacity of the soil.
3. The personal qualities of the entrepreneur.

The same factors which we have recognized as factors of intensity are also to be regarded as factors determining the locations of the systems of farming. We will first consider the orientation of production according to economic location, because theoretically it is of the greatest interest.

Changing favorableness of the economic location is caused fundamentally, as is generally recognized, by the difficulties in transporting products. The orientation of agricultural production according to economic location, or the market orientation, is therefore equivalent to a transportation orientation. Owing to the transportation costs involved, the place of production of each product, considered by itself, is attracted toward the market, because the product can be delivered at a price which is lower as the resistance offered by distance is less. All products try to occupy locations as close to the market as possible and therefore compete with one another for the absolutely most favorable locations. As long as they compete with equal weapons, that is, as long as they derive equal advantages with a nearer approach of the locations of their production to the market, this competition must of course be without importance for the combination of the enterprises on the farm. If, on the other hand, the weapons are unequal, that is, if the advantages from savings in transportation costs are greater for one product than for another, the first will be more strongly attracted than will the second, and will occupy the absolutely more favorable location; or will at least secure a predominant position within

the combination of enterprises, and will press back the competing product, and thereby limit accordingly the combination in which it is produced. This gives rise to a regional—in the "isolated state" a circular—arrangement of production in which the different lines of production follow one another from the inside to the outside according to the attractive power which the market exercises over them—the well-known zones of Thünen. Thus in the market orientation of production two opposing forces, both originating in the market, are effective: a centripetal force and a centrifugal force. The advantage which the favorableness of the economic location gives to the product itself works centripetally; the advantage given to the competing product works centrifugally. Where the centrifugal force predominates the product must vacate the place.

In this brief discussion we have only touched the problem. We need a more fundamental basis. In explaining the theory of the location of production, until recently one was as a rule satisfied to consider the specific transportability of a marketable agricultural product and the consequences of this. One argued as follows: The costs which arise in the marketing of a product do not depend upon its value but primarily upon its weight. They therefore represent a varying burden upon the product depending upon whether it has a high or a low price per unit of weight, that is, upon its valuableness (Wertigkeit). The lower the value of a product the more, relatively, will its selling price be reduced by the costs of marketing, and the earlier will its value be entirely absorbed by these costs. Depending upon the distance from the market of a given producing area, now this product, now that will come into the most favorable price situation and its production will consequently result in the greatest advantage relatively. Thus an orientation of agricultural production according to the relative or specific transportability of the various products comes about in such a way that, in favorable economic locations, those products receive preference which, because of their low market prices per unit of weight, can bear only small costs for transportation; while in unfavorable locations products of high value per unit of weight will be more and more preferred. This rule is violated only so far as the specific transportability of the products is in reality not merely a purely

economic attribute but is, in addition, one which is influenced by the technical nature of the product. In practice it is not always possible to transport the same weight with equal expense. On the contrary, some products require higher tariffs per unit of distance and weight. This may be true, for example, of milk, which because of its perishable nature requires frequent haulings and for that reason does not utilize the means of conveyance efficiently; or of sugar beets, which require large transport facilities at inconvenient times, etc. For such products this factor increases the attractive power of the market.

In this way was explained the fact that potatoes (for table use), hay, and straw are carried to market mainly from the producing areas nearest at hand, while in other economic locations the marketing of grains and of butter, and in others again the sale of wool, occupy the leading place. It was then not difficult to set up a scale which, by taking the market prices and certain tariffs, especially those of railroads, would express numerically the transportability of the most important products.

The table on pages 82 and 83 has been compiled by H. Settegast.

As we have already said, one cannot consider this traditional line of reasoning entirely wrong. It has, however, the serious defect that it does not reach the fundamentals, because it does not at the same time explain the differences in amounts of the relative costs of transportation, but accepts these simply as facts. In order to explain fully the principle of regional orientation of production, we must first disregard entirely the relationship between marketing cost and market prices for the product. Consideration must rather be given, first, to the varying relationship in which the costs of production stand to the marketing costs in obtaining a unit of weight of different products and, secondly, to the varying areas which the different products require for their production.

Let us first consider only the first-named problem by assuming that, on a given unit of land, an equal quantity of freight (Frachtmengen) is produced by each of the products competing for the particular location. Those cost elements in production which can vary with the favorableness of the economic location and with the nature of the products raised, act upon production as

Designation of goods	Market price per 50 kg.	Percentages of market values of goods required for transporting one mile:			The goods loses its total value through transporting it the following number of miles:		
		on country roads at 15 Pfg.	on improved roads at 10 Pfg.	on railroads at 0.25 Pfg.	on country roads	on improved roads	on railroads
		per 50 kg. hauled one mile					
	Marks						
Manure	.40	37.50	25.00	6.25	2.67	4	16
Green feed	.50	30.00	20.00	5.00	3.34	5	20
Pulp	.50	30.00	20.00	5.00	3.34	5	20
Mangels	.60	25.00	16.60	4.17	4.00	6	24
Sugar beets	1.00	15.00	10.00	2.50	6.67	10	40
Straw	1.00	15.00	10.00	2.50	6.67	10	40
Brewer's grains	1.40	10.71	7.10	1.78	9.34	14	56
Potatoes	1.50	10.00	6.60	1.66	10.00	15	60
Hay	2.00	7.50	5.00	1.25	13.34	20	80
Fresh fruit	4.00	3.75	2.50	.62	26.67	40	160
Milk	4.00	3.75	2.50	.62	26.61	40	160
Rye, barley, oats	7.50	2.00	1.30	.33	50.00	75	300
Beer	8.00	1.87	1.25	.31	54.00	80	320
Starch from potatoes	10.00	1.50	1.00	.25	66.67	100	400
Wheat, legumes	10.00	1.50	1.00	.25	66.67	100	400
Oil, seeds	12.00	1.25	.80	.21	80.00	120	480
Dried fruit	16.00	.94	.62	.16	108.00	160	640
Live animals	20.00	@5Pfg..25	@5Pfg..25	@5Pfg..25	400.00	400	400
Alcohol	20.00	.75	.50	.12	133.34	200	800
Starch from wheat	30.00	.50	.33	.08	200.00	300	1200
Sugar	35.00	.43	.28	.07	233.34	350	1400
Tobacco	35.00	.43	.28	.07	233.34	350	1400
Oil	36.00	.42	.28	.07	240.00	360	1440
Tallow	40.00	.37	.25	.06	266.67	400	1600

COST OF TRANSPORTATION OF AGRICULTURAL AND FOREST PRODUCTS—(*Concluded*)

Designation of goods	Market price per 50 kg.	Percentages of market values of goods required for transporting one mile:			The goods loses its total value through transporting it the following number of miles:		
		on country roads at 15 Pfg.	on improved roads at 10 Pfg.	on railroads at 0.25 Pfg.	on country roads	on improved roads	on railroads
		per 50 kg. hauled one mile					
	Marks						
Flax	45.00	.33	.22	.05	300.00	450	1800
Honey	50.00	.30	.20	.05	333.34	500	2000
Cheese	60.00	.25	.16	.04	400.00	600	2400
Clover seeds	60.00	.25	.16	.04	400.00	600	2400
Hops	90.00	.17	.11	.03	600.00	900	3600
Butter	100.00	.15	.10	.02	666.67	1000	4000
Skins	100.00	.15	.10	.02	666.67	1000	4000
Wax	150.00	.10	.07	.01	1000.00	1500	6000
Wool	210.00	.07	.05	.001	1400.00	2100	8400
Extract of meat	600.00	.03	.02	.0004	4000.00	6000	24000
Firewood (average of deciduous and coniferous trees)	.46	32.6	21.7	5.43	3.0	4.6	18.4
Timber from coniferous trees	1.66	9.0	6.0	1.50	11.0	16.6	66.4
Bark (birch, pine, etc.)	1.70	8.8	5.9	1.47	11.3	17.0	68.0
Timber from deciduous trees	2.75	5.5	3.6	.90	18.3	27.5	110.0
Oak bark	3.50	4.2	2.8	.71	23.3	35.0	140.0
Charcoal	3.60	4.2	2.8	.70	24.0	36.0	144.0
Lumber from coniferous trees (half-dry)	4.20	3.6	2.4	.60	28.0	42.0	168.0
Paper pulp from wood	4.50	3.3	2.2	.56	30.0	45.0	180.0
Basket osier, barked	8.00	1.9	1.3	.31	53.3	80.0	320.0
Resin	13.65	1.1	0.7	.18	91.0	136.5	546.0

forces of orientation. These elements are, on the one hand, the costs of marketing (transportation costs in the broadest sense), on the other hand, costs of production. As we have already explained, the costs of marketing act upon production centripetally, the costs of production partly centripetally also and partly centrifugally. Those elements of production cost which devolve upon wages and the farm-produced inputs (the part of the business capital that is of farm origin) act centrifugally, those cost elements which consist of inputs of industrial origin (the part of the business capital that is of market origin) act centripetally, as we know, because the first decrease while the latter increase in price with decreasing favorableness of the economic location. The net force with which a given product is attracted by the market is therefore the result of two positively and two negatively acting forces. Calculated per unit of freight and distance, the more it is necessary to use transportation and industrially produced means of production and the less it is necessary to use human labor and farm-produced materials in obtaining a given product, the stronger is the net force and thus the greater the attractive power which is exercised by the market upon the location of the given line of production. Or to state the matter possibly more clearly: Suppose a given line of production successively shifted into more and more favorable locations, the saving in transportation and marketing costs and in costs for the industrial part of the inputs is partly offset by the increase in labor costs and in the farm-produced part of the inputs. This offsetting occurs the more fully the more important the last-mentioned cost elements are, both absolutely and in relation to the total production costs. To measure in figures the net force with which the market influences, as a locational factor, the various products we need only to add all the cost differences per unit of freight which arise if the location of a given product is moved a given distance nearer to the market. In this, the savings in cost are to be treated as positive quantities and the additional costs as negative quantities. This may be illustrated by an example. We will indicate the number of labor units necessary to produce one unit of weight or freight by A, the units of farm-produced inputs by K_1, the units of industrially produced inputs by K_2. We will as-

sume that, in shortening the distance to market by the unit of distance X, the cost of a labor unit increases by .10, the cost of a unit of farm-produced input increases by .12, the cost of a unit of industrially produced input decreases by .20, the costs of marketing the product decrease, per unit of freight, by 2.0. The net force, E, with which the product is attracted by the market is then expressed in the formula:

$$E = 2.0 + K_2 \cdot 0.20 - (K_1 \cdot 0.12 + A \cdot 0.10)$$

The value of E therefore depends upon the relationship in which K_1, K_2, and A stand to one another. The net attraction increases if the value of the variable K_2 increases or if the values of the variables K_1 and A decrease. If one wishes to consider also the fact that various products might have, under some conditions, different rates of transportation charge per unit of distance and weight, he must include in the formula, instead of the constant figure 2.0, a variable. As the value E represents also the excess in savings which is left after subtracting the additional costs from the gross savings, we may term it also the index of savings per unit of weight. The result of the foregoing consideration can therefore be summed up in the following statement: Under otherwise equal conditions the product with the highest index of saving occupies, in the orientation to the market, the location which is absolutely the most favorable.

As far back as Thünen, comparisons of this kind have been made, but without exhausting the subject. Thünen distinguishes only two cost elements in production expenditures; namely, one which is independent of the "price for rye," which he expresses in money (Thaler), and a second, which varies with the price of rye, for which he therefore takes rye as a measure. We would term these the market part and the farm part of the inputs. Thünen assumes the first element—and in this lies the incompleteness of his treatment—to be equal for all the distances of the "isolated state," so that the costs of production according to him act partly in an indifferent way in determining the location of production, partly as a centrifugal force, and therefore always, as a whole, operate centrifugally. Thünen figures that in competing with rye a crop

which requires only half the production costs of rye moves into the more favorable location. On the other hand a crop with twice the production costs of rye must be grown in a zone farther away from the market. He makes the generalization that, with the same yields per unit of land (he says: with equal land rent resting upon each load), "that crop which requires the highest production costs must be grown at a greater distance from the city."[3] In the light of our consideration given above, that is not necessarily true. Of course, far more untrue is the statement diametrically opposite to the opinion of Thünen which recently has been made and which maintains that the cultivation of a product which requires an especially large amount of hand labor per unit of land is drawn into the neighborhood of population centers. If such a crop is drawn there it does not happen because of, but in spite of, the high requirements for hand labor and because another factor which we must add to our theory is decisive; namely, the land part of the cost of production which falls upon each unit of freight, or, in other words, the land requirements of the individual product.

It becomes clear that the savings indexes of the units of freight consisting of the different agricultural products cannot in reality determine finally the arrangement of the production locations if one considers that the effort of the farmer is not directed toward securing the highest profit per unit of freight but toward getting the highest profit per unit of operated area, in other words, the highest land rent. The amount of land rent depends not alone upon the amount of profit per freight unit but also upon the number of units produced on a given area. For example, the greater the yield of a given product, that is, the smaller the land area on which a unit of freight is produced, the greater is the total profit in growing the product. Of two products with equal savings indexes, that one which requires the smallest amount of land will be most successful in competing for a given location. Thus it is the excess of saving in production and transportation costs of the product, which results from the nearer approach of a given location to the market, calculated upon the basis of the land unit and not on that of the freight unit, which finally determines the arrangement

[3] Thünen, *Isol. Staat*, I, S. 188.

of production; that is, the system of farming, so far as the orientation with respect to the market is concerned. In order to distinguish it from the savings index we will call this excess the land rent index, because it is actually equivalent to the increase in land rent which the increasing favorableness of the economic location yields in the production of the various products. The greater the land rent index, that is, the faster the land rent increases with approach of the location to the market, the greater is the attractive power exercised by the market upon a given type of production.

This was also recognized by Thünen. He assumes two crops competing with rye for a given location of which one requires half the area per "load," the other twice the area, as compared to rye, and finds that the production of the second belongs in a district farther away from the city. He concludes therefore that, in general, with equal costs of production per load, that crop "which requires the largest area must be grown farthest from the city."[4]

In order to obtain an algebraic expression of the net pull exerted by the market on products having different land requirements, that is, to obtain a quantitative index of land rent, we need only to multiply in our formula the value of E by the yield per unit of land. We designate the index for land rent as G, the yield per land unit as M, and have then

$$G = [2.0 + K_2 \cdot 0.20 - (K_1 \cdot 0.12 + A \cdot 0.10)]\, M$$

or in shorter form $G = E \cdot M$.

One can see readily that the land requirements of the various agricultural products sold show in reality very great differences. One needs only to compare the water-containing crops with those which are air-dried, as, for example, potatoes with grain, or the unrefined with the refined products, that is, products which are freed of their bulkiness by means of live-stock or commercial enterprises, for example, hay with butter. The watery and unrefined products nearly always require far less area per unit of weight than do the air-dried and refined products. The figures in the table on page 88 may give some indication.

[4] *Isol. Staat*, I, S. 186–187.

ASSUMING AVERAGE CAPACITY OF THE SOIL, ONE HECTARE OF CULTIVATED LAND

	Yields	Requires per Zentner of the product
Potatoes for table use	250–300 Zentners	1/300– 1/250 hectare
Hay	120–160 Zentners	1/160– 1/120 hectare
Grain	40– 60 Zentners	1/60 – 1/40 hectare
Milk	25– 49 Zentners	1/40 – 1/25 hectare
Butter	1½– 2 Zentners	½ – ¾ hectare

Thus the land requirements of butter are about 100 times greater than those of hay, and 150 to 200 times greater than those of potatoes for table use.

In fact, it is mainly the changing yields of marketable product per land unit that are decisive in the orientation of production according to economic location. If one ranks agricultural products according to increasing yields per land unit, one obtains a line which in general runs parallel with the gradation according to increasing indexes of land rent. This is emphasized even more by the fact that products with a high yield per land unit are usually of such a nature as to have a relatively high savings index. Thus both of these factors, namely, the savings index and the land requirement, are usually effective orientating influences operating in the same direction. This may be explained by the fact that products which show a high yield per land unit for that very reason require, as a rule, low production costs calculated upon the unit of weight; so a saving of transportation costs for these can be offset only slightly by the additional production costs (increased cost of labor). Illustrated in our formula: For products with a high yield per land unit the values A and K are relatively low (of course K_2 also). Therefore the value of E can go only a little below the value of the constant 2.0. Potatoes and wool are in this respect very characteristic opposites. Potatoes, as compared with wool, are a product having a very high marketable weight per hectare and very low production costs per Zentner. They therefore have a high savings index. If the location of production is changed the differences in transportation costs are by no means so largely offset by the differ-

ences in production costs in the case of potatoes as in the case of wool. In respect to the latter, one may even question whether, under present conditions, it shows any positive savings index at all. There are, however, exceptions to this rule, some of them indeed of great practical significance. They concern of course only those products for which the land requirements do not show such great differences. Examples of this are to be found in the cases of milk and grain. One might suppose that milk does not show a very much smaller yield per land unit than does grain. Yet, in spite of that fact, the market exercises a much stronger pull on the location of milk production (fresh milk, of course) than on that of grain production. The reason for this lies in the fact that, in this case, the yields per land unit do not run parallel with the savings index. Milk has, in spite of its smaller yield per land unit, a disproportionately larger savings index than grain; so the result of the two, that is, the index of land rent, remains distinctly superior for the milk. The high savings index of milk again is traceable to its low transportability, from a technical standpoint; that is, to the high freight rates which must be taken into account. We are concerned with a special, although here typical, case by which our general formula is modified (see p. 85).

Summarizing these statements we arrive at the following principles:

1. The greater the yield per land unit, that is, the lower the land requirements, and, further, the greater the savings index of a marketable product, the greater the pull which the market exercises upon the location of its production.

2. The land requirements are, as a rule, decisive in the competition for a given production location.

3. The savings index becomes of practical importance only for products with similar land requirements, especially if it is influenced by differences in the rates per unit of freight.

We started with the practical observation that, in competing for a given location, a product advances closer to the market the lower its market price per unit, or its value, and therefore, with given transportation rates, its transportability. We must further consider how far the conclusions from the foregoing discussions agree

with this practical observation, and, further, if and why a gradation of products according to decreasing value also coincides with a gradation according to increasing index of land rent. For reasons of clearness we start again with a numerical example.

Of the two products M and N

M gives a yield per land unit of 1000 units of freight
N gives a yield per land unit of 100 units of freight

while the production and transportation costs per unit of freight as well as the indexes of land rent per unit of land are as follows at places at different distances from the market:

Distance of location from market	Production costs P (=A+K₁+K₂) See page 84	Transportation cost T	P+T	Indexes of land rent with the distance of 20—0
M 0	3	0	3	
M 10	2.5	10	12.5	(20—1) times 1000
M 20	2	20	22	=19,000
N 0	30	0	30	
N 10	25	10	35	(20—10) times 100
N 20	20	20	40	=1000

Because of the relatively high index of land rent M moves into the zone near the market, N into the more distant zone, and the question now arises: What will be the market price per unit of freight with a given market demand for M and for N?

We assume that the demand can be covered if the zones 0–10 are used for the production of M and the zones 10–20 are used for the production of N. In the market price of M are included then—according to the well-known price law—the production and the transportation costs required at and from the marginal location, 10; and, further, since the location 10 lies within the zone of land rent of N, the land rent which could be obtained in the growing of N is also included. The market price of N consists only of production and transportation costs which originate at the marginal location, 20. Since N is without competition, its price does not include a part which is the result of a charge for land rent. The result in figures will be as shown in the table on page 91. In that table

product N shows a market price per unit of land which is three times as great as that for M, because on the one hand the obtaining of the marginal quantity requires relatively high production costs and on the other hand the great distance of its marginal location from the market requires high transportation costs. Although the market price of M includes a cost item which N does not include,

	Marginal location in distance	Cost of marginal quantity		Burdening of production with land rent*	Market price
		Production costs	Transportation costs		
M	10	2.5	10	$\frac{5\times100}{1000}$	13
N	20	20	20	.....	40

* Explanation: M competes here with N. N has a market price of 40, requires in production and transportation costs (at distance 10) 35, gives therefore a land rent per unit of freight of 5, or per unit of land (that is, 100 units of freight), 500, which must be distributed over 1000 units of freight of M.

namely, the land rent which N yields at location 10, this burden is relatively small and does not by any means offset the advantages of lower transportation and production costs which M has in its favor. As long as, according to our assumption, the differences of the indexes of land rent are traceable to differences in yields per land unit, the land rent can neither here nor elsewhere nullify these advantages. The burden of land rent for M, by which its market price is increased, nullifies only the additional transportation costs which the obtaining of a marginal quantity of N requires in comparison to M and even this only partly,[5] never the difference in production costs of the two marginal quantities.

The rule, based upon experience, that "under otherwise equal conditions" products of low value per unit of weight (Wertigkeit)

[5] Because on the one hand the land rent is distributed over more units of freight than are concerned in originating it, and on the other hand the maximum land rent charge is limited by the additional transportation costs which are required for the marginal quantity of N. In our example the increase in market price of M by the land rent of N could at most reach the value $\frac{10 \times 100}{1000} = 1$. That it does not reach this height is explained by the fact that the costs of obtaining the marginal quantity of N do not increase by the full amount of the additional transportation costs, but by these minus the decrease in production costs.

are produced in the zones near the market, products of high value in the distant zones, must therefore be recognized as correct. It represents merely a confusion of cause and effect if, as has always been done up to the present time, the difference in value is looked upon as the cause of the orientation of production. The causes lie deeper and the differences in the values of the products are even partly the consequences of their orientation of production.

"Under otherwise equal conditions" means, in this case, with equal rates of transportation as well as with a proportionately equal constitution of production expenditures. Products which for technical reasons have a low transportability can of course very well be of higher value than others which they displace, as we have stated before. The same exception holds true for products which have relatively high requirements for industrially produced elements of production; in short, always when the savings index is decisive for the orientation.

One may also look upon the problems of economic location from another point of view which, of course, does not really mean much more than a certain version of the illustration given. Every product goes to that location in which it can be most cheaply produced for the market. If the production of a given product could take place entirely without the competition of others it would find its most favorable location in the immediate vicinity of the market. But since it must in reality compete with other products for the location which is absolutely the most favorable, and since the land rent yielded by these other products passes over into its delivered cost at the market, it can be delivered most cheaply sometimes from the vicinity of the market, sometimes from areas at great distance from the market, depending upon the relation in which the land rent of the other products stands to the advantages which are offered in locating the given product nearer to the market. Going back to our example we can make more clear the order in which the locations of the production of M and of N occupy the land by including the land rent of N in the delivered cost of M and conversely by including the land rent of M in the delivered cost of N. Thus the calculation of land rent can be based upon any desired zone, but in both cases it must be in the same zone as the one determining

Distance	Considered by itself requires or yields respectively					With mutual competition for location, delivered costs amount to		
	per unit of land			of land rent		production and transport cost (P+T) per unit of freight	the burdening through land rent per unit of freight	Total
	in production costs	in transportation costs	P and T together	per unit of freight (= savings index)	per unit of land (= index of land rent)			
	Product M					Product M		
0	3	0	3	22−3=19	19×1000=19,000	3	$\frac{1000}{1000}=1$	4
10	2.5	10	12.5	22−12.5=9.5	9.5×1000=9,500	12.5	$\frac{500}{1000}=\frac{1}{2}$	13
20	2	20	22	22−22=0	.....	22	0=0	22
	Product N					Product N		
0	30	0	30	40−30=10	10×100=1000	30	$\frac{19,000}{100}=190$	220
10	25	10	35	40−35=5	5×100=500	35	$\frac{9500}{100}=95$	130
20	20	20	40	40−40=0	.....	40	0=0	40

the market price. We may choose the distance 20 and thus assume that without mutual competition the market price of M would be 22 and that of N 40. The result is then as shown on page 93.

Product M can be obtained most profitably from zones near the market, product N from those at a distance. As soon as M and N compete for a location with the result that the land rent of one passes over into the delivered cost of the other, the cost of supplying N increases as the location of its production approaches the market, while the cost of supplying M decreases thereafter as before.

Theoretically it is of course conceivable that a given product, even though it is not burdened by land rent, can be obtained more cheaply from distant zones than from zones near the market. This will be true if the negative savings index of the production costs alone is sufficient to exceed the positive savings index of the transportation costs. The savings index as a whole then becomes negative, as, for instance, in tripling the production costs of N.

Distance	Production costs	Transportation costs	Total
0	90	0	90
10	75	10	85
20	60	20	80

One of the two centrifugal forces is therefore sufficient in this case to drive the production away from the market. The only question is whether such a situation could in reality arise.

Thünen affirms that it can. He maintains that in the "isolated state" butter is produced more expensively in the vicinity of the market than in distant zones even if we do not consider the land rent which rye production yields, and he has even emphasized strongly to critics that he claims for this result of his investigations a more than theoretical significance. His argument concerning it is as follows: Butter is a product which requires extremely high production costs, especially much human labor. In comparing production costs, rye and butter stand about as 1:13 to 15. Butter is a product of relatively high value, grain, one of relatively low value.

Therefore, under the influence of increasing favorableness of the economic location, the local price of rye increases much faster than the local price of butter. But since at the same time the money value of the labor, that is, the wages, increase and decrease with the local price of rye, it happens that the production costs of butter, as a whole, increase faster with the approach of the location of its production to the market than its local price increases or than its marketing costs decrease. The production of butter would only be profitable, therefore, where grain for the market cannot be produced at all, and where its price is no longer influenced by the market. But in the last analysis the matter in question is here again the competition of butter with another product; namely, grain. The only difference is that the reaction of the price of grain upon wages and through them upon the production costs of butter is alone sufficient to make butter production unprofitable in the grain zone.

Our earlier explanation of the combination of enterprises on farms and the advantages resulting from it leaves no doubt concerning the attitude we are taking in regard to Thünen's investigations with which the critics have recently again been busy. We can only concede that the given conditions lower relatively the importance of butter production with increasing favorableness of the location of production. On the other hand, we cannot concede that the conditions given make butter production absolutely unprofitable in the grain zone. Moreover, the question here is merely one of "more or less," not of the alternative "either or." It should also be recognized that today the technical conditions surrounding the production of butter are quite different from those which existed in Thünen's time. To mention only one factor: the production of butter is no longer a hand-labor process but is mainly a mechanical one. The savings index may now, therefore, be as a whole positive rather than negative in its effect. Fundamentally it cannot be denied, however, that there are products for which the negative savings index of production costs exercises a greater force than the positive savings index of transportation costs. That is certainly true of cotton, for instance, and possibly also of flax.

Granting this, still another fundamental factor, and one not un-

important, must be recognized. Products such as those mentioned above constitute, then, an exception to the general rule, set forth in earlier pages (see pp. 12–13). According to this rule, wages increase with increasing favorableness of the economic location but only absolutely, not relatively; that is, not in relation to the local prices of the agricultural products. This rule therefore requires some limitation. It refers only to the great mass of products; that is, to these considered as a whole and particularly to those products which make up the principal part of real wages of agricultural labor, namely, the bread grains. It also refers especially, of course, to products which require less labor expenditure per unit than do the bread grains. On the other hand, this rule does not apply without some modification to all those products of which the production requires an extremely high labor input. In general terms, it may be understood as stating that in agricultural production the spread between the gross money return and the costs of labor input widens gradually with increasing favorableness of the economic location, and that, because of this, the most significant aspect of the matter is that the make-up of the gross return shifts in favor of those products which require small labor costs per unit and which for this reason show low transportability and have rapidly increasing local prices.

We have now for the most part covered the theory of the orientation of production according to economic location so far as it relates to the kinds of forces at work and their interrelationships. If we review the preceding discussion we shall find that the following principle assumes predominance. Although the effects of the factors jointly influencing the orientation of production—transportation costs, production costs, and their elements, as well as land rent—operate partly in a positive and partly in a negative way, in the last analysis they all originate from the same source, namely, the differences in transportation costs. This factor, in itself, operating positively, creates land rent and reacts through the local price of a given product upon the production costs of the other products. It thus produces negatively operating locational forces which lessen its own effect. The negatively operating differences in production costs and the differences in land rent are contrary

tendencies created by the differences in transportation costs themselves. We can therefore still regard the economic orientation of production simply as an orientation determined by transportation costs.

Finally, let us consider in a more quantitative way the orientation of agricultural production according to economic conditions. We have shown, in our earlier discussion of the necessity for diversification in agricultural production, that shifts in types of production, under the influence of economic location, do not mean a regional arrangement in the sense of a sharply defined division into different lines of production, and frequent mention has been made of this fact. These shifts, however, are more than mere changes in emphasis in production toward one or another enterprise on a farm consisting of enterprises that are otherwise equal. Although the farming combination will not be dissolved completely into its individual elements in terms of the economic forces in production, this does not exclude the fact that under the influence of these forces the number of individual elements making up the whole farm business changes. The necessity for diversification insures, on the one hand, that products with a low index of land rent, as grain and even wool, do not lose their importance entirely, in zones near the market. Yet, on the other hand, this necessity is not great enough to insure also that all the products with a high index will have a place in the farm organization in the more distant zones; because, in any case, the production of a market product ceases to be profitable where the market price is entirely absorbed by marketing costs. The more favorable the location in relation to the market the larger is the number of marketable products. The result is that, as we approach the market, not only is the emphasis within the combination of enterprises shifted but the combination itself increases in diversity of crops. A fact which we have briefly mentioned earlier finds its basis in the following consideration: the more favorable the economic location the larger the number of marketable products which agriculture has at its disposal to meet the needs of diversification.

A not unimportant rôle is played by the fact that, in agriculture, the production of two or even more products is combined on many

farms for technical reasons, and thus one product often gains in relative importance what the other loses. If, for example, zones near the market show wool production the reason lies in the fact that sheep kept for mutton production also produce wool. If the production of grain were not inseparably connected with the production of straw, grain production would without question be of far less importance in zones near the market than it actually is. Production of alcohol associated with the production of pulp is another example, and many more could easily be given.

A further characteristic of the orientation of agricultural production under the influence of economic location is the changing relationship in which the unrefined products stand to the marketable products which are refined through feeding to live stock or by technical processes. The increase in the number of marketable products which occurs with increasing favorableness of the economic location concerns mainly the first-mentioned type for the following reason: Most of the primary products in agriculture can be marketed in different stages of refinement. Hay, for example, can be marketed either as hay or as animal products, and in the latter case again in its different forms, live animals, meat, milk, butter, cheese, wool, etc. The same is true of potatoes and grain. They can be marketed either as raw products or after transformation into animal or commercial products. Processing or refining of this kind is usually connected with a reduction in the weight of the raw product and means economically a diminution in the index of land rent. For the production of one ton of alcohol more land area is required than for the production of one ton of potatoes. The arrangement of types of production according to indexes of land rent must therefore be, as a whole, an arrangement according to stages of refinement. Distant zones are mainly concerned with supplying the market with refined products while the supply of unrefined products comes more largely from the zones near the market. The more favorable the economic location the lower in general can be the stage of refinement in which an agricultural product is brought to the market. And conversely: the more unfavorable the economic location the more will agriculture tend to increase, by refining, the transportability of the products raised.

Furthermore, this tendency is increased by a circumstance connected with the fertilizer economy of farms, which demands our special attention. If farm products are sold from the farms largely in an unrefined state this means that, in general, there is a heavy exportation of those plant foods on which the farmer must depend, as he has found by experience; while in transforming the farm products into technical or animal products a large, possibly even the largest, part of the plant foods contained in them remains on the farm and can be put back into the soil without great expense. Thus, for instance, direct sale of potatoes involves a heavy export of plant food, while their conversion into alcohol retains nearly all their fertility on the farm, or, at least, exportation occurs only to such an extent as is necessary in utilizing the by-products through feeding them to live stock. The sale of potatoes, and of unrefined products in general, is therefore the more feasible the more cheaply the plant foods removed from the soil can be replaced; that is, the more favorable the economic location. Theoretically speaking, this means that unrefined products show in general a high index of costs for fertilizer and are therefore attracted to the zones near the market.

4. ADJUSTMENT OF THE LOCATION OF PRODUCTION TO THE NATURAL CONDITIONS OF FARMS

No LOCATION is originally equally well fitted for each of the agricultural crops. Each location, moreover, has a specific yield capacity in one or another direction because of the various demands which the individual plants make upon the external conditions of growth. Of course, this specific yield capacity is not so narrowly defined for some locations as for others. There are soils upon which a great many crops, if not all, grow with certainty and reward the cultivation expenditure with "highest yields." There are others which are especially suitable only for particular crops, possibly because these crops are, as a whole, less particular with respect to the constitution of the soil or because they can, under these particular conditions, satisfy their special requirements.

The farmer tends, as a rule, to measure the producing abilities of soils, with respect to specified crops, in terms of their yields—or

gross returns. Scientifically this measure is not tenable, because, for the production of a certain gross return, an expenditure which varies greatly may be necessary, and this presumes corresponding differences in the yield capacities of soils. Even the "relative" yield or the relation in which, for a certain crop, gross return stands to input, is not an entirely reliable expression because it may happen that, of two soils, the one with relatively high input is the more productive because it returns a higher land rent by yielding a correspondingly higher number of units of gross return per unit of land. The superiority which some ameliorated soils show over others not infrequently arises in this way. The productivity of a given soil can only be measured accurately, therefore, by the amount of land rent. In consequence of this, productivity becomes again, in spite of its dependence on natural conditions, a varying quantity dependent upon existing price conditions. When the relationship between the prices of products and the costs of the factors of production shifts, a certain soil may under some circumstances change its place in the scale of graduation according to yields. If the spread between these prices is enlarged a given soil, with relatively high inputs, may gain in yield capacity as compared with other soils. The "best" wheat land in Argentina has different attributes from that in Germany, because in Argentina wheat prices are far lower than in Germany. The greater the spread between the prices of products and the prices of the factors of production, the more the absolute amount of gross return is decisive in determining the productivity of the soil. On the other hand, the smaller the spread, the more the requirement for input becomes decisive. A classification of soils according to their productivities for certain crops assumes, therefore, a given price condition; also, of course, a given stage of development of technique; but this point we shall not follow further.

Adjustment of land utilization according to the natural conditions of production also takes place in accordance with the principle of the least input of effort. Production as a whole has a tendency to be distributed upon the natural locations in such a way that it can be carried on with the lowest real cost. If the requirements of the individual crops for the conditions of growth

were differentiated so that a different type of soil would be especially suited to each individual crop as the most profitable for its production; if, further, virtually unlimited areas of all kinds of soil were available; and if, finally, all interfering influences of other kinds did not need to be taken into consideration, the distribution process would take place without any reciprocal influence of the crops upon one another; that is, without the competition for individual locations which is so charactertistic of the orientation according to economic location. Every crop could then occupy a location where it could be produced with a minimum of labor and capital—though not necessarily with a minimum of area—and entirely without competition from other crops for that location. However, these are not the conditions that exist; indeed, quite the contrary, several, often many, crops tend to be grown on the same soil. The process of distributing production is therefore very complicated. Orientation of production according to natural conditions is also, at least to a great extent, a competitive struggle for the most favorable location. In this competition one crop displaces another with the result that now no longer is each individual product, but only the total of all the products, raised with the minimum of labor and capital. The kernel of the problem is, therefore, Which factors are decisive in this competition?

Even though two or more plants may very well be capable of producing their highest yields on the same soil, it seldom happens that their requirements of soil and climate are the same in every respect. On the contrary, such crops do not as a rule react in the same way to a change in the natural conditions of their location. While one may react to an unfavorable change in conditions of growth with a comparatively large reduction in yield, the other may be far less affected by such a change. This fact determines the choice of the location. For example, in the competition for a soil of a certain kind, the place will be occupied, other things being equal, by that crop for which a change in the production would affect most adversely the covering of the demand for it; or, to be more exact, the crop for which the replacement of this amount of product would require the greatest expenditure per unit of land. This results from the fact that as these expenditures are greater, which

Quality of soil	Product A		Product B		Product C		Product D		Product E	
	I	II	I	II	I	II	I	II	I	II
Input per land unit in Marks	100	100	100	100	100	100	240	240	480	480
Gross return per land unit in Zentner	10	5	10	8	20	15	60	40	60	40
Input per Zentner of gross return, in Marks	10	20	10	12.5	5	6.66	4	6	8	12
In shifting the production from I to II:										
Reduction in gross returns in Zentner	5		2		5		20		20	
Reduction in gross return in percentage	50		20		25		33.3		33.3	
Costs of replacing in Marks	5×20=100		2×12.5=25		5×6.66=33.30		20×6=120		20×12=240	
Land rent on I in Marks	20×10−100=100		12.5×10−100=25		6.66×20−100=33.2		6×60−240=120		12×60−480=240	

larger expense must appear again in the market price of the product if the demand is to be covered, the increase in land rent which the given crop yields at the price-determining location must be greater also, and thus the competing crop is more heavily burdened. The easily understood example shown on page 102 may illustrate the point.

In shifting production from the high to the low quality of soil (I to II), there is a reduction in the gross return per land unit, which, if the demand is to be met, requires in replacement costs not less than the amounts indicated below for each of the respective products.

A	100. M
B	25. M
C	33.3M
D	120. M
E	240. M

These additional costs must always be credited to the better type of soil as land rent; that is, they must there burden the production of the competing product. Product E therefore would in reality displace all the others; product D, the products A, B, and C; product A, the products B and C; and finally product C would displace product B.

One may easily explain further details of this illustration. Of two products with the same input per land unit, that one occupies the better location which proportionately—not according to weight—has the greatest reduction in gross return if displaced (compare A to C). If the reduction in gross return through change of location is proportionately equal, the product with the higher input has the greater resistance (compare D to E).

The concept of the index of land rent also could be used in this connection. As the index of land rent we must now have in mind the savings in production costs (including interest on capital) which result from the increasing favorableness of the location of production, computed per unit of product and multiplied by the yield per land unit. Applying this concept to the foregoing exam-

ple we shall again obtain the figures shown above. If a given crop competes with another for a location having certain natural conditions, its own index of land rent operates centripetally while the index of the competing crop operates centrifugally. The crop with the highest index will therefore take possession of the location. The above-mentioned rule that not every product, when adjusted to the natural conditions, can be produced with a minimum of costs, is true only so long as we consider as costs merely the direct inputs (labor, capital, and interest on capital). It no longer holds true if we include in the calculation, as the farmer must do, the land rent which the competing crops yield. If a crop must be grown in a less suitable location, this is only done because the additional direct costs are offset by the savings in land rent, both being calculated on the basis of the unit of product. Product B, for instance, would have to bear in location I, besides its own production costs of 10 M, a burden of land rent of 10 M per Zentner, while production costs in location II amount to only 12.5 M. The ideal orientation according to natural conditions is obtained, therefore, when each unit of every individual product is produced at a minimum of input in this broader sense, that is, including the land rent obtainable.

There is, after all, a far-reaching similarity between the orientation according to natural and that according to economic location. In both cases the net force of orientation is the result of a positively and of a negatively operating power. The only difference is that the common origin is not now the difference in transportation costs resulting from the economic location, but the difference in production costs resulting from the natural conditions in the different locations. If the adjustment of production according to economic location is fundamentally an orientation according to differences in transportation, the adjustment according to natural conditions is, in the final analysis, an orientation according to production costs. The fact also remains, of course, that not all crops strive for the same location as in orienting to market: some strive for different places without mutual competition. Rye gives place to wheat only if forced to, but potatoes to meadows usually voluntarily.

That the specific productivity of the cultivated land causes in reality an extremely vast differentiation of the methods of production is well known. It causes contrasts in the forms of land use which leave far behind the differences depending upon economic or personal considerations (see below), and as a matter of fact this influence appears in the largest and in the smallest local fields of observation as well. We need only to recall the extreme contrasts between tropical, subtropical, and northern agriculture, the basic differences presented in the management of "Geest," "Marsch," and "Moor" soils, of sand, and of clay soils, etc., even under the same climatic conditions. One can go even farther and bring into the closest causal connection the differentiation of agricultural production according to economic conditions and that according to differences in the natural conditions, so far as experience shows improvements in transportation to be adjusted mainly to the soil and climatic conditions. Mountain countries usually have unfavorable trade conditions, river and coast districts favorable ones. Furthermore, it is not an accident that the most fertile districts have been from ancient times the centers of trade. It would mean discussing self-explanatory things if we were to explain further the fact that the natural conditions give direction to the farming methods of the agricultural enterprise. Agriculture is and will remain mainly a using of nature, and therefore the methods of production receive their chief characteristics from their adjustment to natural conditions.

Another point may also be touched upon in passing. The productivity of a field is the result of a working together of various factors, every one of which in turn is connected with a certain attribute of the soil. The question now arises, Which of these attributes is mainly responsible for the modifying influence upon the cultivation of the soil? According to the law of the minimum the decisive influence upon the productivity of the soil is exercised always by that attribute, that is, by that factor, which is most unfavorably situated as to extent in comparison with all the other coöperating factors. That again may be sometimes this, sometimes that factor, and it may seem as if every single soil condition has or at least could have virtually the same importance for the degree of

productivity. Such is not the fact, however, because we must consider in appraising this statement that a lack in one or the other direction will not always be accompanied by the same consequences; for the farmer in one case may have effective means for correction through a changed technique, while in another case he may be entirely impotent. Of the factors of productivity those are most decisive practically which are least susceptible to correction through changes in technique. Most important of these undoubtedly are climatic conditions, namely, temperature and precipitation, because they are almost entirely beyond the farmer's control. Second in importance are the attributes of the soil, even though in particular cases very great differences appear with respect to this factor in the situation. Such differences become clear if one thinks, on the one hand, of the hardly changeable topography and of the constant physical composition, possibly also of the underground water, and, on the other hand, of the content of humus and of plant food in the soil, both of which can be effectively corrected by means available to the farmer. The farmer can more readily level out mountains than he can change the climate completely. Of course, climate is peculiar in that its local differences are of great extent only as between large regions, in contrast to the often very radical differences in soil composition which occur as between the different parts of relatively small areas. In daily observation the modifying influences of soil composition upon the cultivation of the land are much more noticeable than the differences caused by climate. The latter will appear more distinctly, however, if comparisons of greater extent are made. The economic geographer who wishes to differentiate zones of cultivation or farming must keep in mind the climatic regions, while for differentiation of natural conditions the terms clayey, silty, and sandy soils, or rye, wheat, and beet lands are more familiar to the farmer.

Nature is not only itself one of the modifying factors in agricultural production but at the same time it also determines the extent to which other forces of orientation can be effective. It has already been mentioned that the degree of intensity with which soil and climate favor certain crops is not the same everywhere. While in one case they may determine limitations categorically so that one

speaks even of "absolute" lands, in other cases they permit considerable choice of crops and with it a wide range for adjustment of production to economic conditions. Agriculture in the far north, in high mountain districts, or on poor sandy soils differs from agriculture in mild climates and on rich soils not only in that it takes other forms but also in its inflexible leaning upon nature. There uniformity, here diversification is the characteristic feature of agricultural production. Of course one may also say inversely that the modifying influence of nature depends in some degree upon economic conditions, because the more favorable the trade conditions in a given district the more the agricultural production can be extended to those soils in the district which are less suitable and, equally important, the greater is the number of crops by means of which the farms can be adjusted to varied natural conditions. Let us assume that Thünen's "isolated state" consists of several qualities of soils which lie one beside another like sectors of a circle. We would have in the inner zones a greater variety of forms of production caused by the nature of the soil than in the outer zones. The modifications of cultivation causally connected with the natural conditions are therefore, *mutatis mutandis*, caused by the economic conditions, and, inversely, the latter can cause differences only if nature has provided sufficient range.

The reaction of nature upon the forms of cultivation cannot, as we have tacitly assumed, always be recognized as a direct interdependence between the requirements of the cultivated crop and the nature of its location. It does not always correspond to the relation which exists, for example, between beet cultivation and beet land, but often proceeds in a more or less veiled way—indirectly, so to say. This fact is connected with the previously discussed close interrelationship between the individual enterprises on the farm and the coöperation of factors of production, of land utilization, and of processing the products. Therefore it is not infrequently the case that the climate, during the course of a given year's sequence of operations, causes sometimes great, sometimes small, conflicts whereby the individual crops are affected in various ways and certain crops which are ordinarily quite practical may be subject to considerable interference. In Germany, for instance,

sugar beet cultivation declines more and more as we go toward the north and northwest. The reason for this is not alone the direct disadvantage of soil and climatic conditions for this crop: it is also in part the fact that the hoeing, which is essential to the best development of beets, conflicts in time with an extensive hay harvest. Out of this situation arise difficulties in the farm work which make beet cultivation unprofitable. On other farms, again, an extensive beet cultivation is practiced for the purpose of furthering the cultivation of other crops, so we must, in general, regard the cultivation of some crops more as a means of promoting the production of the farm as a unit than as an end in itself. We may recall the effect of the cultivation of legumes on sticky silt soils. Their insertion into the rotation is intended mainly to satisfy the demands made by the main crops upon the soil resources of the farm, that is, the demands of the farm as a unit upon the fertilizer economy. Moreover, because of these demands, the type and extent of the production of feed crops may be entirely changed even though the productivity of the land be equally as high for such feed crops, not to mention the extreme example of the summer fallow.

The modifications which the types of farming receive through the changing interrelationships of the types of land use are worth special consideration in this connection. The influences of soil and climate upon land utilization are not by any means exhausted with shifts which they occasion in the relationships between tilled land, meadows, pastures, etc. On the contrary, the changing relationships of the kinds of land use also influence indirectly the management of the tilled land. How the proportion between crops and the rotations on the tilled land must be arranged depends largely upon the given relationship of kinds of land use. In this connection the extent of the meadows plays an important rôle for a twofold reason. First, the limitations of the meadow land, more than any other form of land use, are determined by the natural conditions. If the nature of the location, especially the level of the underground water, qualifies a field for use as a meadow, this constitutes an economic force affecting the farmer which can very seldom be offset by interfering influences; and, inversely, it is only in exceptional cases that the farmer can create meadows in any

desired extent. As a rule, the farmer must figure on a constant proportion of meadow land, be it for him, according to his circumstances, a favorable or an unfavorable relationship. Secondly, there exist between meadow lands and the other forms of land use, certain management relationships which grip into the vital functioning of the farm, as has been pointed out in other places. Thus it happens that this given proportion of meadow land becomes a factor the influence of which upon the farm organism is noticeable in nearly all branches of the farm business. First of all, as we have said, in operating the tilled land, if there are no meadows on the farm a much larger number of crops which supply winter feed and manure must be included in the crop rotation than where there are meadows. Under these conditions summer fallow must lose in importance or, where for other reasons it has already disappeared, a similar decline in the importance of the market crops will occur, and, of these, first those which require a large amount of fertilizer. Further, the form in which feed production appears on the land varies according to the proportion of meadows. Where natural meadows are lacking or are unimportant, the effort in feed-crop production must be directed first of all to restoring the necessary balance between the unnutritious straw as a by-product of grain production and hay, which is rich in nutriment. On the other hand, if the proportion of meadows is favorable, the problem of feed-crop production is limited more to the production of tuber and root crops as feeds which supplement the hay and straw for winter feeding. The higher the proportion of meadows becomes, the less important is the production of the main feed crops within the feed-crop production from the tilled fields, and the greater the importance of the supplementary feed crops. At the same time, the latter may change entirely the form in which they appear. Sugar-beet production, for example, if connected with an extensive production of hay, can exercise a strongly limiting influence upon mangel production. Not only the method of cultivating the tilled land but also the proportion of tilled land to the whole area of the farm may, under some circumstances, be greatly influenced by the existing proportion of meadows. This is true mainly for soils which, as the farmer expresses it, stand on the border line of being

worth cultivating. As the meadows, on the one hand, profit from their association with cultivated land, and the cultivated land, on the other hand, from association with meadows, the value for purposes of cultivation of a given piece of tillable land must vary with the favorableness of the proportion of the meadow land to the total. Soils which otherwise would be restricted to forest or to extensive pasture use, if associated with sufficient meadow land, may become suitable for field cultivation and may even reach a relatively high intensity.

We might study in still other directions the problem of the indirect influence exerted by natural conditions upon the method of farming. The form of land use—grazing, for example—which is under some circumstances defined as sharply as the meadow lands by soil and climate (mountain and lowland pasture), could be studied further in respect to its influence upon the extents and methods of operation of the other types of land use. We might further think of the consequences which result if one kind of tilled land is associated in changing proportions with other kinds; for example, sandy soils with clay or with fen soils. But these considerations would lead to details which cannot claim general interest.[6] It may only be mentioned that, under certain circumstances, even the conditions or method of utilizing the products of the land may be influenced by the natural conditions. In southwest Africa, as is well known, ranching stands or falls entirely upon the possibility of getting a sufficient supply of drinking water for the live stock and on freedom of the locations from certain epidemics. Likewise for the farm with a distillery, in eastern Germany, the water problem is of great importance; for sheep ranching in Germany the danger of the leech (Leberegel) is of chief significance.

Finally, there is still another view that deserves consideration. Every factor of orientation—and thus nature—is to be regarded as a force working against the diversification of enterprises by deviating the lines of production from an ideally conceived arrangement. In general, this force increases the diversity of the forms of agricultural production, but for the individual enterprise it constitutes a tendency to one-sided production. Only in

[6] See Aereboe for details, *Beiträge*, S. 48 ff.

exceptional circumstances, however, is this tendency able to counteract entirely the diversifying tendencies. Nevertheless we should not overlook, on the other hand, the fact that, in the varied conditions of natural location, there lies the basis of a not unimportant need for diversification. At least this is true for the majority of farms. It seldom happens in practice that a farm is only made up of fields of the same natural qualities. On the contrary there are, as a rule, on a given farm various fields for which the specific productivities point in different directions and thus favor different forms of utilization. This is most noticeable in the distribution of the area among the various types of land use, which is to be attributed mainly to the condition just described. Therefore we must regard variation in natural conditions not only as a factor of differentiation but at the same time as a factor of integration, operating of course not for internal but only for external reasons. Therein it differs fundamentally from the coöperation of the enterprises in utilizing the means of production, the land, and the products.

5. INFLUENCE OF THE FARMER'S PERSONAL QUALITIES UPON THE LOCATION OF PRODUCTION

No farmer is in a position to operate with equal facility in all branches of agriculture because the demands which the well ordered production and refinement of the individual products make upon manual and mental labor vary as greatly as the mental and physical talents and abilities possessed by the individual farmers. In one branch of agriculture purely physical routine and capacity are of chief importance among the required occupational qualities; in another branch, long experience and scientific knowledge are more significant. In one branch, diligence, steadiness, and persistence play the main rôle; in another, quick decision, farsightedness, and courage. In one branch success depends largely upon cleverness in business matters; in another, more upon the ability to handle human labor; in another, again, success depends not a little even upon the sense for form—one may think of the work of a breeder of live stock—or upon similar "one-sided" talents. Without doubt, a farmer who is perhaps through his talent

and ability preëminent in one field may not always be able to obtain the same results in other fields. It is therefore not a mere indulgence of special inclination or hobby if the farmer tries to adjust the lines of production of his farm as much as possible to his individual capacities, and to utilize these to whatever extent is feasible. Again, besides the objective conditions presented by nature and by economic location, there are at work also subjective influences pertaining to production and business, which contribute to the differentiation of farming systems. The special knowledge and ability of farmers, the entrepreneurs as well as the employees and laborers, and with these the associated labor specialization must be regarded, along with the objective conditions mentioned, as factors of orientation in agricultural production.

Of fundamentals, there remains but little that calls for clarification. The economic advantage which vocational superiority achieves as against the average skill in accomplishing a certain task, that is to say, the actual orienting force, must find its expression either in relatively low production costs or in relatively high sales prices. The first is illustrated by the farmer who, because of special skill in the cultivation of certain crops, gets relatively high yields; the second appears in situations where a successful animal or plant breeder receives for his products special prices. Such farmers understand how to obtain advantages which others obtain only with better soil conditions or more favorable locations in respect to markets. The shifts in location which are caused by their superiority correspond therefore, in their inner connections, with the shifts which are caused by variations in the favorableness of natural and economic location: they are an orientation either according to production costs or according to economic location. Still other similarities exist chiefly again in respect to the indirect influences upon the individual enterprises. If, by reason of special labor skill, a certain type of cultivation has an advantage, it is easily possible that this may affect the whole organism of the farm; it may be that other branches are set back or are put at the service of the favored branch. On the farm of a successful grain breeder grain cultivation will not only be relatively large in extent but there must also be included in the rotation crops which facilitate keep-

ing the fields clean of seed weeds, and which conflict very little with the grain harvest in the use of labor. But if this same farm is under the management of an outstanding live-stock breeder it will present a quite different appearance. The farmer breeding live stock will limit grain production and extend feed crop production accordingly, possibly in the form of pasture; he will also seek crops which can make use of the large amounts of manure that will be produced on such a farm.

It must further be mentioned that the other factors of location do not everywhere resist these shifts equally. The opportunities which special skill can use are the greater the more nature and location, in relation to market, favor a diversification of production. To put it over-simply in schematic form: In the most central zone of Thünen's state, all the phases of the production zones may be repeated, whereas the zone farthest out permits only small variations in the lines of production prescribed by the economic location. It may well be possible successfully to transplant wool production (quality wool) into the central zone, but it is not possible profitably to produce potatoes for table use or fresh milk, in the wool zone. Considered dynamically, over a period of time, variations from the central tendency which may be attributed to personal initiative are greatest in periods of rising development. We have already stated that times of progress are not marked by a uniform change in the economic level, but by the advance of individuals ahead of the great body of farmers. That is true also with respect to the lines of production on farms. Pioneers and leaders move ahead of the great mass of farmers whenever changing times shake the fundamentals of an obsolete system.

There are also many other special circumstances which affect the degree of adaptability which the agricultural entrepreneur may display in respect to the natural and economic conditions. On the very large farm where the entrepreneur is forced to give over the work of management and control largely to other hands, personal individuality cannot play so large a part in its adjustments as on the small or medium-sized farm, because the more the organization varies from the arrangement indicated by the objective conditions of location the greater is the possibility of loss through a lack of

suitable assistants. The same is true, of course, for all farms which are continuously operated by managers. It is also true to a limited extent for tenant-operated farms where on the one hand the owner, bearing in mind the possible change of tenant, is interested in the maintenance of an organization of about medium type, and on the other hand, the tenant often is not in a position to amortize in a limited period the investment needed for a considerable change in the organization.

It would of course be a mistake to attribute the great differences in the lines of production, which experience shows to exist on farms of various sizes, under conditions otherwise objectively equal, solely or even mainly to the greater adaptability of the small farm. One must not overlook the fact that the various sizes of farms themselves react differently to certain objective conditions. It is well known that, because of fixed sizes of many units of capital goods, the smaller the farm the more expensive is the use of capital, and that enterprises which need tools, machines, or other forms of capital goods involving an especially high investment, or at least which can be operated most profitably with them, find on the large farm a more profitable place than on the small farm. A typical example, to which many others could be added, is the farm with a distillery. The opposite is true for enterprises which require much hand labor and a very careful control if success is to be achieved. The small farm ordinarily is forced to support a relatively larger amount of labor than the large farm because one cannot lessen the amount of labor proportionately as the size of farm decreases. The small farmer therefore has the alternative either of keeping the available labor busy continuously, if possible, or of letting it go partly unused. He will of course choose the first possibility, at least as long as by that means an increase of the gross return which covers the added necessary costs can be obtained. The consequence is that forms of production can have a place on the small farm which, because of their high labor requirements, are out of place on the large farm where every increase in the quantity of labor used means an increase in labor costs. This consideration is again the more significant the more it involves operations in the performance of which special skill or special carefulness and conscientiousness

are required. These are conditions which the small farmer working for himself fulfills far better than does the hired laborer in the service of a large farmer. The cultivation of vegetables, vines, fruit, and commercial crops and also some branches of live-stock breeding and keeping are in many places the specialities of the small farm. The cheaper labor and the superiority in labor accomplishment make for this.

The lines of production most profitable for the individual farm are influenced not only by the professional and mental ability of the agricultural entrepreneur, but also by his material resources, that is, his "financial power." This problem has already been touched upon in another connection (see pp. 55 and 56). Crops which require much capital also carry a correspondingly high risk. Such a risk can be undertaken by the financially strong entrepreneur but is rather dangerous, under certain circumstances, for the financially weak farmer operating without a sufficient risk fund. We must add also that the risk which inheres in the production of the various crops is mainly dependent upon circumstances which are associated, on the one hand, with the natural conditions of growth of these crops and, on the other hand, with their market conditions. It is well known that there are "certain" and "uncertain" crops, a contrast which may, under some circumstances, take the most drastic forms and does not lose its practical importance even when we consider different species of the same crop. There are also some products the market prices of which show extraordinary stability, and others which frequently show sudden and large variations in price. All this the farmer must consider in deciding upon the lines of production. The less dangerous, in the light of his financial condition, the risk will be for him, the greater the acreage he allots, for example, to the cultivation of hoe crops, which are high in risk not only because of their high capital requirements but for natural reasons as well, or to the commercial production of vegetables, which are risky because of their price movements.

Experience teaches that differences in the lines of production which have their origin in the personal qualities of the entrepreneur may, even over large fields of observation, not infrequently

greatly overshadow the influence of the natural and economic conditions. It also happens that significant regional variations are caused solely or at least mainly by labor specialization in regions where whole groups of people have, through long established tradition, reached an occupational superiority in certain branches of agriculture as against the laborers in other areas who cannot easily catch up with them. The development of the production of vegetables in the Netherlands, of flax in Flanders, and of cheese in France must certainly be attributed chiefly to this factor.

However, in spite of these and similar observations, a certain tendency to level out is noticeable. This tendency may lessen the importance of the personal factor in the differentiation of the lines of production as compared to that of the objective influences. The farmer cannot harmonize artificially the nature of the soil and the economic location if they diverge as forces of orientation, but he may in many cases be quite successful in adjusting the farm to his knowledge and ability. In other words, he can choose a farm which corresponds with his special capacity. He follows the precepts of efficiency if he takes advantage of such possibilities because it is evident that even the greatest ability can only shift but never eliminate entirely the limits which nature and economic location have set. Even a genius can achieve the greatest success only if he needs to do but little violence to the objective conditions affecting his activities. Also the genius will, if it is possible, avoid doing such violence. Where small or large farmers are settled and cannot choose their farms at will, it is a matter of course that in the schooling and training of their special abilities they tend to meet as much as possible the demands of their inherited properties. Naturally this tendency is strengthened in their case by the fact that they are usually assisted in this adjustment by tradition.

6. THE POSITION OF THE PROCESSING ENTERPRISES, ESPECIALLY LIVE STOCK, ON THE FARM, AND THEIR LOCATIONAL ORIENTATION

THE UTILIZATION OF THE PRODUCTS of the soil, that is, of the primary products of the farm, proceeds along various lines. One part, as, for example, seed, feed for work animals, wages paid in kind, or

the green manure, after its production is completed, at once goes back again into the cycle of the farm business. Another part serves in supporting the private household which is usually connected with the farm. And finally, the remainder is destined for the market and finds its utilization through exchange, this being converted into money, which again may be either a part of the net return from the farm business or may be used for obtaining purchasable production goods.

Only in exceptional cases is a product of the land in the stage in which it is harvested a consumable or even a salable good. Most of the products which find their utilization in the farm household or which are to be marketed need for these purposes a more or less thorough preparation. If, on the one hand, we are concerned with a comparatively simple, purely mechanical changing or sorting process, we speak of it as being a direct use—especially in a direct sale—of the product of the land, though strictly speaking this is not quite correct. On the other hand, if there are involved more complete mechanical, and especially chemical, transformations of the original products, which can be accomplished only through special equipment of the farm, that is, through special farm enterprises, we speak of it as a processing or refining of the products of the land.

There are two main branches of refinement of the raw products; namely, the live-stock enterprises and the so-called technical side lines of agriculture, of which each again has a number of subdivisions, as may be seen from the table which has been given in the first chapter (p. 5). It is evident that no sharp line of demarcation can be drawn between the technical enterprises and the business arrangements which may be required in the "direct" utilization of products. There is room for controversy as to whether or not home industries have the characteristics of special farm enterprises and therefore of technical side lines. That is a factor, however, which may be neglected in our further discussion without interfering with the clarification of the principles involved.

The point under consideration is the fitting of the refining or processing enterprises, also called the enterprises of utilization, into the farm business as a whole. There is here involved the in-

vesting and tying-up of large amounts of capital, so that it becomes a problem of farm organization along with the one of most profitable utilization of the products of the land. If all the raw products not needed on the farm could be sold directly, we would only need to investigate the way in which the farm manager could best arrange the sale, whether through retail or wholesale channels, or through coöperative selling agencies, etc. But utilization would then no longer be a problem of farm organization proper.

It would seem, of course, in view of the secondary function which the converting enterprises must perform on the farm, that the question of their organization is really answered in the previous explanation of the orientation of the forms of land use, or that it would be sufficiently explained by a few references to the dependence of the converting enterprises upon various branches of land use, because it is no doubt true that the former must adjust themselves to the latter. If economic location, nature, and the initiative of the entrepreneur make a certain system of land utilization seem rational, along with it they also prescribe for the farm certain definite facilities and ways of converting or refining the products of the land. Every system of land utilization assumes the existence of the corresponding converting facilities.

Nevertheless, there are still many questions to be answered which grow out of the special characteristics of the converting enterprises. In reality things are not so simple as they may seem; for example, that for a certain farming system a particular mode of converting the products must be considered to the exclusion of others; or that, for a given product, there is a certain corresponding way of converting it. On the contrary, we are here concerned, as in land utilization, with a complicated array of coöperating and mutually supplementing ways and branches of refining. Up to now we have tried to solve the problem of organizing land use but under the tacit assumption that all the products of the land are given their highest utilization. Actually, however, we are as yet far from knowing how to do this.

In order that we might consider the problems in a scientifically rational arrangement, we have up to now disregarded this aspect of the matter. One can make of the great number of questions

which are put to the agricultural entrepreneur three fundamentally different groups. All the questions refer to the selection, from time to time, of the cheapest means of production, to the application of these in a way to obtain the highest returns, or, finally, to the highest possible form of utilization of the products of the land. If we wish to clarify these questions through scientific thinking it can only be done by taking them one by one, the remaining two meanwhile being regarded as solved. The question which has so far occupied our attention, namely, getting the highest possible yields from the land, could only be clarified in respect to principles by taking the means of production as given and assuming the best utilization of the land products. We are now concerned, figuratively speaking, with adding the last stone to the building; that is, with investigating how a given product of the soil can be utilized to the greatest advantage. The problem we are concerned with is the following: According to what points of view must we proceed in distributing the products among the various forms of utilization? According to what principles, therefore, must the enterprises of refining be included in the farm organization?

Some may question such a procedure by remarking that in this way we may be able to solve in theory the problems of organization of the farm business (through mathematical computations), but that this cannot be done in practice. The farmer could not operate with "tacit assumptions" in his calculations, for these are like unknown quantities. He must be given a substantial foundation as a base from which to start in further calculations. In order that the farmer may be able to balance methods of farming and their intensities in a rational way, he needs to know the possible realization from the products of the land as a concrete quantity in figures, and thus one will demand: show first how this unknown quantity is to be found in order that, through this, the values of the others may be ascertained.

We can only reply that there is in fact a vicious circle but that the farmer is forced to meet the problem in that form. There is no solid base which could be regarded as unchangeable, for the farmer to use in his calculations. The reasons for this lie in the particular interrelationships which exist between the production and the

utilization of the products of the land; that is, between the kinds of land use and the types of processing. It is impossible to separate entirely the one calculation from the other. In order to be able to calculate the most profitable organization of land use upon a numerical basis that is free from objections, an accurate knowledge of the obtainable return from all products would be necessary. This would need to be based again upon an already established organization of the types of refinement. On the other hand, the calculation of the kinds of refinement could only be undertaken as an exact computation if the quantity of the obtainable production was already known; that is, if an established organization of land use was at hand.

In practice, therefore, approximation is the only way out. The entrepreneur must try to approach step by step the goal of the farm organization. In approaching the problem of organizing the utilization of the products, he must assume the actual given land utilization of his farm to be, for the present, rational. He must also start from the utilization of products actually obtained prior to this time if he wishes to investigate the organization of land use in respect to its efficiency. If even the farmer is forced in his calculations to separate in a violent way the two phases of farm organization, surely the theorist has at least the right to take the method of isolating observations in making his deductions.

In attacking the problem, first of all the concept of utilization (Verwertung), which we must use as a basis in comparing the capacities and competitive strengths of the various ways of utilizing products, calls for a certain amount of clarification. To ascertain the results of utilizing a product, all the elements of money gross-return and money costs must be considered. These may vary according to the method of utilization chosen. We must start from the gross receipts which are received from the sale of the finished or unfinished products. From that amount we must subtract, first of all, the expenses which arise after the completion of the harvesting of the raw products, that is, the marketing and storage expenses; second, the costs of processing, which may have preceded the sale; and finally, the expenses necessary for restoration of the fertility of the soil. While the latter do not form a part of the

actual utilization expenditures, they are high or low depending upon the form of utilization which is chosen. To the gross receipts must be added possible indirect advantages that may be associated with the individual forms of utilization.

In comparing the three ways of utilization, namely, direct sale, feeding to live stock, or supplying the technical side lines, we have the following principal differences. Direct sale requires ordinarily only low utilization costs, but relatively high restoration costs for soil fertility because it carries many plant foods off the farm. In feeding the products to live stock the last-mentioned costs are relatively low, but utilization expenses are high because these include all the costs of maintenance and support of the live stock including interest on the investment in it. On the other hand, the feeding of products to live stock often offers, besides the actual receipts, a number of indirect advantages connected with the fertilizer economy. For the technical side lines, conditions are similar: high utilization costs but low costs for the replacement of lost plant foods and usually also many indirect advantages.

As manifold as the production of crops on a given farm are the forms of their utilization. It is a rule seldom broken that the raw products find their best utilization only if several methods are used side by side. We know of course from previous discussion that, with increasing favorableness of economic location, an increasing amount of products in unfinished condition becomes relatively more marketable, but only in exceptional cases does this shift go so far that all other forms of utilization are eliminated. Here again, of the two main types of processing, it is the live-stock enterprise which nearly everywhere, along with the direct sale of crops, maintains its position to a greater or less extent, now through this, now through that subdivision. The reasons for this are, in particular: the superior position, on the one hand, which the animal products occupy in the market, together with the fact that the live-stock enterprises as a whole supply products of widely varying kinds, some with a low and some with a high index of land rent and of production costs; and, on the other hand, the favoring of forage-crop production, which is caused by the urge toward diversification in the utilization of the land. Further reasons are the posi-

tion of the live-stock enterprise in the fertilizer economy of the farms, which verges upon indispensability, the advantages in the way of better distribution of labor, and finally, the fact that, in obtaining crop products suitable for the market, waste products usually result which as such are absolutely without a market value and cannot be utilized at all except as converted by live stock. We do not exaggerate when we say that agriculture in the temperate zones is a close coördination of land use and live-stock production. This connection is so close that in places where, under exceptional conditions, utilization of the raw products has an entirely one-sided character, it is in most cases not the direct sale of the crops but rather live-stock production which assumes the predominant rôle. Entirely different of course are the technical side lines in agriculture, which are connected in a comparatively loose way with the forms of land use. Most farms in Germany do not show such a connection at all. The explanation of this is that, on the one hand, the technical side lines do not, like live-stock enterprises, utilize waste products for which other forms of utilization do not compete at all; on the other hand, and this is the deciding factor, the minimum limit of the extent to which a technical side line can be operated with profit involves a comparatively high input. A large potato distillery, for example, is operated much more cheaply than a small one, and the price of the alcohol therefore operates in such a way that, in decreasing the extent of the business, the point is soon reached where a different utilization of the potatoes is more profitable. On farms where there is not sufficient raw material to provide the advantages of large-scale operations this reason alone is sufficient to prevent the erection of a distillery. There are also certain live-stock enterprises in which the relative costs increase rapidly if the enterprises are contracted below certain limits. This is true, for example, of some forms of the sheep enterprise. There are others, however, for which the extent of the enterprise is an indifferent factor, in respect to its effect upon costs, and there are even some which gain rather than lose in profitableness with decreasing extent. However, there is in general in this respect a sharp contrast between the live-stock enterprises and the technical side lines in agriculture. This large-scale tendency of the technical side

lines is also the chief reason that only a few branches of technical processing of raw agricultural products have retained the characteristics of agricultural side lines. The great majority, in the present stage of economic life, are carried on in the purely industrial sphere of production or at least occupy an intermediate position (for details see later pages).

The preliminary question in the organization of the conversion enterprises is whether or not a given conversion enterprise is entitled to inclusion in the farm business. The answer to this depends upon the conditions which it demands with respect to minimum extent for profitable operation. The main question then has to do with the actual extent which it must be given. Both questions are comparatively easy to answer if we are dealing with a technical side line in which only one certain product is refined. They are more complicated for the live-stock enterprises, which, for reasons already mentioned, must as a rule make use not of only one but of a whole series of raw products which supplement one another in their physiological and chronological relationships, and which, furthermore, must make use of products which, since they are entirely without market value, can be used only in this way, as well as of those which might also be utilized in some other way. The problem is then to determine the extent to which the latter types of products shall be included in the "coöperating forms of conversion" to the betterment of the combined effect. The circumstances may vary greatly according to the relative quantities in which the various feedable products occur and the ways in which they supplement one another. Assuming, for example, that pasture, mangels, chaff, and the straw of spring grains can be utilized on a certain farm only by the live stock, and that straw from winter grains, hay, grains, and other feedable products have, as well, a market in their unrefined forms, it may, with equal market prices for animal and other products, be profitable in one case to devote everything to the live-stock enterprises; but in another it may be more profitable to supplement the products which cannot be otherwise used (absolute feeds) with only a part of the marketable feed products, and to market the remainder of these in unrefined form. In a third case it might even be desirable to feed only a part of the products

having no other use and to put the remainder back onto the soil as green manure, or even to let it go to waste. Feeds can yield their maximum results as a rule only when used in a certain quantity relationship. Because of this, the more incomplete their complementation, the more the surplus feeds lose in "feeding value." Beyond a certain limit, therefore, they can be utilized in other ways with greater profit. There must therefore be included in every case in the coöperative forms of conversion by the live stock, such quantities of "absolute" feeds (feeds having only one possible use) and of "fakultative" feeds (feeds having more than one possible use) that the highest possible total return will be obtained. These quantities of feed give then the outlines of the extent of the live-stock enterprises.

Of course, we are not concerned exclusively with the feed products that are produced on the farm. There is still one important means which is suited to the correction of the relationships of feeds produced on the farm, to increasing their utilization, and thus to the enlargement of the base for the live-stock enterprises as a whole: this is the use of commercial feeds. Nevertheless, even this means of balancing, for economic reasons which we shall later consider in more detail, is limited in its application so that the situation is not fundamentally changed.

If one keeps in mind all this, together with the great extent of the live-stock enterprises—that is, together with the fact that on most farms live stock is regarded as indispensable—the fitting of the live-stock enterprises into the farm organism occupies the central position in the whole conversion problem. We must first know the requirements of the live-stock enterprises before we can approach any other questions of conversion. This includes, of course, not only the problem of determining what *in toto* shall be assigned to utilization through live stock, but also how this shall be subdivided between the branches of live-stock production. These special questions, however, we shall not follow up at this time.

The guiding principle which runs through all of these considerations is not new to us. Again we are concerned with that principle which we may call the search for the extreme limit of profitableness and which we now meet for the third time. As the farmer must

seek in determining the intensity of his farming the final input which is still paid for, as he must seek, in organizing the utilization of the land, the last acre which can profitably be given to a particular crop, so he must now seek an answer to the same question for each individual product: Where is the last unit of product which can still be used in one specific type of conversion with greater profit than in any other? If we investigate farther, we find here again as a causal factor the law of diminishing returns. For the reason that the most important type of refining, namely, livestock production, can, after a certain point is reached, utilize increasing quantities of a given feed crop only with decreasing returns per unit, the use through live stock must sooner or later be checked by the competition of other types of refining. This use must therefore be balanced with other uses so that an optimum effect is obtained.

Of special significance is the fact that increasing quantities of a given product do not, under all circumstances, result in a constant utilization, especially if we think of the interrelationships between utilization and the production of raw products. The extent and intensity of a given type of land use must, as we know, be related to the possible utilization of the resulting product and, as we now can add, one must always begin with the utilization which can be obtained for the last unit of quantity produced. If one wishes, for example, to calculate the profitableness of an increase in the intensity or extent of hay production, one must at the same time raise the question: Can one obtain for the additional quantity of hay the same utilization as for the quantities now being produced? Furthermore, the last portion of hay from every acre of meadow must still be utilized with a return high enough so that the production costs of that portion are covered, and the yield of the last acre of meadow must be high enough so that its money value balances with the production costs, including the land rent which might be obtained through other ways of utilizing the land. It is assumed, of course, that the hay cannot be obtained more cheaply from other farms, which may very well be possible because of variations in the amount of utilization resulting from individual differences in the farms. If the purchase price is below the costs on the given farm, it

limits the production on this farm both in extent and in intensity. The mountain farmer who suffers from a lack of winter feed and can make very high use of such feed would be wrong if, with his high costs, he produced hay for himself instead of covering his needs at a relatively low cost by purchasing the surpluses from farms in the valley, which are well supplied with meadows. The same holds true for the farmer who has a distillery and undertakes to produce the necessary quantity of potatoes on his own farm, regardless of the cost and in spite of the fact that after a certain limit has been reached the purchase of potatoes involves lower costs than their production on his own farm.

It is now clear what we have in mind in speaking of marketable and unmarketable agricultural products. There are no doubt certain raw products which we may speak of as absolutely unmarketable, since they must be refined wherever they are produced if they are to be sold at all. There are also raw products which nearly everywhere have a sale price and may therefore be looked upon as absolutely marketable. We should not, of course, regard the marketability or nonmarketability as an attribute of the agricultural product which is unconditionally inherent and absolute, but only as a purely relative category which is dependent upon the economic conditions. A product is marketable (marktfähig) if it has a higher utilization through direct sale than through processing on the farm; that is to say, it is marketable only in that stage of refinement at which it receives its highest utilization. For example, potatoes are marketable where they can be most profitably sold as potatoes; they are nonmarketable where they are better utilized through being refined into alcohol or starch, or through transformation into animal products. Hay and straw are marketable in some cases as raw products of the land, in other cases in the form of fresh milk, and in still others, after far-reaching transformations, as into butter and cheese. Decisive with respect to the marketability of a product, therefore, are all the circumstances which we have recognized as factors of differentiation; namely, the economic location and, as well, the natural and personal conditions on the individual farms. This is especially true for the economic location in that, with decreasing favorableness in this factor, the num-

ber of marketable unrefined raw products usually decreases. These factors moreover do not, with respect to a given product, appear as definite alternatives, but rather as considerations of "more or less." Furthermore, we may have on the same farm a certain product which is partly nonmarketable, partly marketable, depending upon how the types of processing participate in its utilization. Quantities of hay which must be fed to live stock are nonmarketable; the possible surpluses, on the other hand, are marketable.

Up to this time we have learned only the general reasons why, under our conditions, the live-stock enterprises are, almost without exception, associated with the farm business for the purpose of utilizing a part of the total products of the land, and the reasons, too, why they must in many cases be combined with direct sale and with other types of processing in the utilization of a given product. We must now define more clearly their position within the whole farm organization and the limits to their extents, which as yet we have mentioned only briefly. This can be done only by bringing into the discussion those questions which arise in our following out of the principles of decreasing diversification and increasing specialization, which make up the specific characteristics of this type of processing. We are concerned with the following problems:

1. The function of the live-stock enterprises in the fertilizer economy of the farm.
2. The expansion of their basis by purchase of "concentrates."
3. Their subdivision into various branches.

We have already mentioned that the live-stock enterprises on the farm fulfill a twofold purpose. Besides the transformation of raw products, which are absolutely or at least relatively unmarketable, into marketable products, these enterprises have important functions in the maintenance and increase of fertility.

The live-stock enterprises, by the transformation of raw products into animal products, take care of the maintenance of fertility in that a large part of the fertilizing materials contained in the raw products, namely, plant foods and organic matter, remains on the farm as by-products. Of course, this is no positive accomplishment, but means merely a saving in cost as compared to the direct sale of the raw products, because in the latter event a more exten-

sive destruction of the farm's fertility is involved which can only be restored by the purchase of fertilizer or by expense for green manuring. In this sense we may say with Aereboe that it is one of the purposes of the live-stock enterprises to provide as much as possible for the maintenance of the fertility of the farm.[7]

The live-stock enterprises not only lessen the export of fertilizing materials but in addition bring about also a direct increase in the fertilizing value. They do this not only by actually increasing the plant foods on the farm; more important, we find this positive accomplishment expressed in certain useful changes in the form and location of the fertilizing elements of the farm. Organic matter and the plant foods in forage crops and straw are, through live-stock enterprises, changed into a more effective form. It is not the same whether hay, straw, or similar products are given directly back to the soil as fertilizer, or after partial transformation into dung and urine. The fertilizing value of dung and urine is far greater than that of the quantity of hay and straw from which they originated. Besides making the plant foods available, the live-stock enterprises perform another service of great importance though perhaps not on every farm: they make it possible for the farmer to bring into circulation on the farm plant foods and organic matter which represent only dead capital where they lie or where they were grown. We know from our earlier discussion that fertilizing is not a mere returning of plant foods which have been taken out of the soil, but is at the same time a taking out of plant foods from the one field and applying them on the other. Fertility-producing and fertility-consuming crops must supplement each other. This work of fertilizer transfer is also accomplished in large part by the live-stock enterprises. We may think, for example, of the benefit which comes to the farm from sheep production, through collection of the scarce pasture-feed and the concentration of the plant foods contained in it on the dung pile or in the corral, thus making them available for application on the farm. All these beneficial effects—namely, maintaining, making available, and collecting fertility—must be counted on the credit side in comparing the live-stock enterprises with other types of utilization.

[7] *Beiträge*, S. 81.

Manure production, therefore, together with other factors, is to be borne in mind when one is determining the most profitable extents for the live-stock enterprises. The point where they are surpassed by direct sale in the utilization of the raw products has not yet been reached when the money returns of both, after subtracting the direct expenses of conversion, are equal, but only when the returns above the expenses from direct sale exceed the money return above expenses from the live-stock enterprises, plus the savings in expense for fertilizer and the increase in fertilizing value brought about by these enterprises. If no other form of utilization is competing, a product can be employed in the live-stock enterprises until the increase in fertilizing value just covers the cost of keeping the additional live stock. All this is clear without further explanation and has for the most part already been mentioned.

Two special circumstances which play an important rôle in defining this limit must, however, be described in more detail. We must first consider that a given farm business is not concerned with the production of manure in unlimited amounts, because the value of manure to the farm decreases as its quantity increases, and second, that the production of manure is not the only way of obtaining fertility.

The value of the manure cannot exceed the benefit which it yields to the farm. Its benefit, on the other hand, must decrease step by step with greater disposable quantities of it, in accordance with the law of diminishing yield increase. One reason that the profitableness of the live-stock enterprises decreases with increasing extent we have already learned; namely, the increasing one-sidedness of the feeding, or better, the increasing difficulty of obtaining a balanced feed ratio. The second reason is the decreasing value of increasing quantities of manure. If we divide the net sale price which is obtained for a raw product through feeding, that is, the so-called feed value, into the two components, the sale or market share and the share resulting from its fertilizing value, we shall find that both decrease with an increasing extent of the live-stock enterprises. The decrease may be greatest for the one or for the other of these components, depending upon the natural and economic conditions. Thus the function which the live-stock enter-

prises must perform within the farm organization as a whole is in a sense shifted. If the point is soon reached beyond which a further increase in the live-stock enterprises for the sake of manure production is no longer of importance, while increase is still very profitable for refining nonmarketable products, the main justification of the live-stock enterprise rests as a whole more on the latter basis. Manure is produced then as a costless waste product. If the conditions are such that these enterprises must be extended beyond the point where the money return from the last animal just covers the expenses, manure production becomes more and more the main purpose of the live-stock enterprises. The practical farmer who judges the profitableness of an enterprise by the cash income which it yields, usually in such circumstances calls the live-stock enterprises a "necessary evil," an expression which is, of course, really a contradiction in terms but which nevertheless indicates that otherwise fertilizers must be purchased.

Whether the chief emphasis in the live-stock enterprises lies more in the conversion processes or in manure production depends, so far as the natural conditions of the farms are concerned, especially upon the cropping systems and the need for fertilizer on the tilled land. A farm which has relatively large quantities of meadow and pasture land will limit the extent of the live-stock enterprises in such a way that the utilization of the last ton of hay, as accomplished through the sale of animal products alone, just balances with the return from direct sale of the hay. To go beyond this point would be unprofitable because manure is already produced in such quantity that the small amount needed is more than supplied. A typical example of this kind is to be seen in the marsh pasture farms engaged in dairy production, where not infrequently an effort is made to lessen the production of manure by restricting the bedding material and employing bedding-saving barn construction; or, where it is feasible, manure may be sold. In sharp contrast to such farms are those made up predominantly of tilled lands the soil of which, because of its heaviness, requires large and frequent applications of manure. In this case the expense of the live-stock enterprises must in large part be paid by the manure production.

In order to appraise the influence of the economic location upon

the position of the live-stock enterprises, we must first take into consideration the fact that the live-stock enterprises are not the only source of fertility, but share the function of providing fertility with the purchased fertilizers and with the cultivation of green manure crops. The production of manure in the barn is therefore justified only to the point where the expense of the last ton of manure, plus the price which the given feed would yield if utilized in other ways, balances with the cost of purchasing substitutes for the manure. Let us consider first the fertilizers. The price of fertilizer decreases with increasing favorableness of the economic location, and because of this the live-stock enterprises are more and more released from the functions of maintaining and collecting fertility, while their function of refining gains relatively more importance. Commercial fertilizer cannot, of course, be substituted for manure for all fertilizing purposes. It serves mainly to supply plant foods, while the indirect or so-called physical effects on the soil are considered as a special benefit derived from the manure. The importance of this latter type of benefit slows down rather rapidly, however, as the quantities of manure are increased; that is, more rapidly than does the effect of the increasing quantity of plant foods, so that finally, so far as these effects are concerned, fertilizer can be substituted for the manure. Soon the commercial fertilizer even becomes superior with respect to its mere fertilizing effect because it contains the plant foods separately, and thus it is possible to adapt it so that it meets the special requirements of certain plants and of the fertility content of the soil. This is not possible to anything like the same extent with manure, which contains the plant foods in a less flexible combination. Where manure is used alone one or another plant food may possibly be wasted. It follows therefore that decreasing prices for fertilizers lessen the importance of live stock for the production of manure.

It would, of course, be a mistake to draw from the foregoing discussion the conclusion that the function of live stock in unfavorable economic locations rests more upon manure production while in favorable economic locations it rests more upon the refining of the raw products. Although manure substitutes are relatively cheap in zones close to market, yet the optimum intensity in the

application of fertilizer increases in these zones. This justifies a correspondingly higher expense for manure production. Further, we must consider the fact that, with increasing favorableness of the economic location, direct sale becomes, as we know, a strong competitor of the live-stock enterprises for the reasons that, first, the types of land use have changed in its favor, and, second, the feedable raw products, such as hay and straw, have gained more and more marketability. These are important considerations which detract greatly from the live-stock enterprises in their rôle as refiners of unmarketable products, while they increase the importance of manure production, thus offsetting again the influence of the decreasing prices of fertilizers. If we consider further that the live-stock enterprises produce products both of high and of low transportability, we must concede that, in respect to the influence of the economic location upon the relationship of the twofold functions, we can no longer speak of a tendency which proceeds in a straight line. One cannot maintain without qualification that with increasing favorableness of the economic location the one or the other function—that is, refining or manure production—gains in importance. Thünen, as we have already mentioned, is of the opinion that, measured in terms of income and expense, the profitableness of butter production decreases with approach to the market. This would mean that the cattle enterprise, as long as it is maintained for this purpose, must, with nearer approach to the market, shift its function more and more in the direction of manure production. Thünen concedes however that in the fresh-milk zone the conditions of profitableness are just the opposite, from which we would conclude that, in this case, as economic location becomes increasingly favorable, manure production decreases in importance as compared to the total usefulness of the enterprise. Therefore we can only say in a general way that in a given economic location the more the animal products gain in importance in terms of the indexes of land rent the more the live-stock enterprises become, as a whole, conversion enterprises. On the other hand, the more the directly salable raw products gain in these terms the more is the function of the live-stock enterprise restricted to manure production.

It may already have been recognized from the foregoing discussion that a certain extent of the live-stock enterprises is not always essential to a given quantity of feedable raw products. This may become clearer if we turn to a discussion of the second of the above-mentioned special questions: the expansion of the feed base of a farm by purchase of the so-called concentrates.

We speak only of an expansion of the feed base. On account of the special functions which these feeds perform, we cannot, by purchase of concentrates, any more than we could with home-produced feeds, expand the live-stock enterprises to any desired extent. Concentrated feeds by themselves alone are usually not suited to the carrying on of a given form of animal production. On the contrary, their purpose in the feed ration is to correct an unfavorable relation with respect to the volume or the nutritiveness of the ration. They serve as complements to the home-produced feeds which are low in nutritive value or high in bulk. From the economic viewpoint they are thus a means of increasing the utilization of the latter, or at least of making their utilization possible. The use of concentrates must therefore be limited to a range within which this purpose is fulfilled. This will vary according to the available quantities of home-produced feeds. As a rule, even before the limit of such range is reached, the use of concentrates becomes unprofitable; that is to say, on a given farm not all the home-produced feeds can be brought to a profitable utilization by using concentrates, although from a technical standpoint it may very well be possible so to supplement them as to make a suitable ration. This is because the profitableness of this measure depends also upon the costs which it involves; namely, the prices of the concentrates from time to time. To ascertain the return, over and above expenses, from the feeds which are brought to utilization by the concentrates, it is necessary to consider, as a part of the expense of feeding, the cost of purchasing the concentrates just as well as the labor expense, cost of barn and barn equipment, or the depreciation in the value of the live stock, etc. These costs must be subtracted from the total returns from the feed combination. If we call the bulky feeds the basic feeds we obtain the following equation: total returns from the feed mixture minus the expense

for concentrates equals the returns from the use of the basic feeds. The returns from the use of basic feeds stand, therefore, in inverse relationship to the prices of the concentrates. This means a fluctuation up and down with variations in the favorableness of the economic location, because the concentrates become cheaper as we approach the market. Other things being equal, even with ever so low a price for concentrates, a given farm product as we go from the market loses in economic feeding value the more rapidly the smaller its content in effective constituents (starch value), and the larger, because of that, the quantities of concentrates required to make up a normal feed ratio. The best quality of meadow hay, the composition of which corresponds approximately to the optimum of concentration of nutrients required for milk production, does not suffer, when used for this purpose, any value loss as a result of increasing prices for the concentrates. If its valuation declines with decreasing favorableness of the economic location, it does so for other reasons. Such a decline will therefore take place comparatively slowly. For another feed the curve calculated upon the unit of starch value will decline faster; as, for example, the straw of spring grains, which has only half as much starch value per ton as meadow hay and which therefore needs, in order to obtain the optimum feed ratio, a large amount of concentrates. Faster still will be the decline if, in place of the straw of spring grain, we put instead the straw of winter grain, which is far lower in starch value. In unfavorable economic locations it is possible that only the best meadow hay could be used successfully for feeding, while in favorable locations even the straw of winter grains might be so used.

This may be illustrated by the table on page 135, the figures of which will help to make clear and plain the relationships mentioned.

In comparing zones A and C, the return from meadow hay decreases by 25 per cent, the return from the straw of spring grains by 75 per cent, and the return from the straw of winter grains by 175 per cent. These differences have their cause in the fact that of the return from the total feed (basic feed and concentrates), which is constant, an increasing part is used to pay the cost of obtaining concentrates.

	Composition of the total feed		
Ration I	Meadow hay, best quality		40 kg. starch value
Ration II	Straw of spring grain	20	40 kg. starch value
	Concentrates	20	
Ration III	Straw of winter grain	10	40 kg. starch value
	Concentrates	30	

	Economic location		
	A	B	C
Return from the total feed before deducting costs (feed value)	(Pfg.) 800	(Pfg.) 700	(Pfg.) 600
Cost of concentrates per kg. of starch value	22	22.5	25
Return over expenses for the basic feeds I. Hay per dz	800	700	600
Hay per kg. starch value	20	17.5	15
II. Straw of spring grain per dz	800−20×20 =400	700−20×22.5 =250	600−20×25 =100
Straw of spring grain per kg. starch value	20	12.5	5
III. Straw of winter grain per dz	800−30×20 =200	700−30×22.5 =25	600−30×25 =−150
Straw of winter grain per kg. starch value	20	2.5	−15

In using relatively poor organic materials for feeding, which is made possible by the increasing favorableness of the economic location, we are chiefly concerned, in practice as well as in the foregoing example, with an increased feeding of straw; that is, with

utilization of such quantities of straw by feeding as would otherwise have no value except for fertilizing or bedding purposes. It has already been stated that it is an important problem in organizing the utilization of the land to obtain the right relationship between feed straw, on the one hand, which is poor in nutrients, and the hay and other farm-produced feeds, on the other hand, which are rich in nutrients. A problem of no less importance is that of ascertaining the limit of permissible purchase of concentrates and, through this, of the permissible extent of the use of straw for feeding. In the former case, as in the latter, the goal is to remove so far as possible the disproportion between the bulky and the concentrated feeds, which exists on the farm because of the predominant importance of grain-growing. Both problems are, of course, closely related to each other. Where the conditions for the purchase of concentrates are favorable the cultivation of feed crops which serve as supplements for straw, or the factor of the interrelation of the types of land use as based upon coöperation in utilizing the products, loses more and more in importance, and vice versa. This is a connection which, in accordance with the rules of our above stated method, we do not here follow any further.

Two other considerations which are of importance in determining the extent of the live-stock enterprises for a given type of land use deserve our attention. It cannot be overlooked—and this is the first of them—that in purchasing concentrates not only feed values but also fertilizing values, especially plant foods, are added to the farm and that other expenditures for maintaining fertility are accordingly saved. The farmer must therefore seek to balance the successive additions of concentrates so that the purchase costs of the last quantity, after subtracting its fertilizing value, are just covered by the return from animal products and the increase in fertilizing value of the home-produced feeds which are fed. The full purchase cost of the concentrates is not to be charged against the live-stock enterprises, assuming, of course, that the imported plant foods are really needed on the farm and do not increase an already existing surplus of manures. Consideration of the fertilizing value of the concentrates, calculated according to the prices for which the corresponding plant foods can

be bought as commercial fertilizers, works toward a greater expansion of the live-stock enterprises than would otherwise be feasible. The other consideration has to do with the changes which occur in the value of straw for bedding as the amount of straw feed increases. The farmer makes use of many means (barn equipment, straw supplements) in order to limit the quantity of bedding straw per animal. But these do not, as a rule, prevent an increasing value from being placed on a given quantity of straw with an expansion of the live-stock enterprises, and it therefore becomes more and more difficult to increase this value still further by feeding the straw. Only in exceptional cases—that is, for example, if conditions are unusually favorable for obtaining straw supplements, on farms having extensive areas of tilled land or extensive straw production—can the whole straw production be used for feeding. In this statement we disregard the fact that often a more or less large part of the straw finds its highest utilization through direct sale or is needed as bedding or feeding straw for teams.

Finally, the expansion of the feed base by purchase of concentrates is important not only in respect to the most suitable limitation of the total extent of the live-stock enterprises; it also constitutes a special aspect of the question of location of the live-stock enterprises. To repeat, we have seen that not everything feedable, that is, everything having a physiological feed value, has economic value for feeding, but that this economic feeding value comes into existence with a certain concentration of nutritive materials—a concentration that is greater or less depending upon the favorableness of the economic location; and on that again the price of concentrates has a decisive influence. We have arrived at these conclusions through assuming that the type and method of feed utilization or, in other words, the lines of live-stock production, remain unchanged. This assumption does not correspond with the actual conditions. Actually, many and greatly varying forms of live-stock enterprises, both main and sub-branches, compete with one another in the utilization of feeds, and the question arises, Which of these will prevail in this or that situation?—the question, that is, of the location of the different types of live-stock production.

We have already answered this question for the most part. The forms of live-stock production, like the types of agricultural production in general, group themselves around the market according to the indexes of land rent which their products manifest, so far as the contrary forces of combination permit this. Products of which the marketing involves special difficulties and which, calculated upon the unit of freight, require, on the one hand, only a small amount of labor and capital of agricultural origin, and, on the other hand, a large amount of capital of industrial origin, have a relatively high index of land rent and therefore occupy the zones near the market. This we already know.

The indicated special phase of the question of location lies in the fact that, for the height of the indexes of land rent for animal products, that gradation of differences in cost is largely determining which occurs in connection with the expenditure for concentrates involved in different forms of feed utilization or different live-stock enterprises; that is, if the latter are exposed to changes in their economic locations. The expense for concentrates is, as we have seen, a part of the total expense involved in the utilization of the farm-produced feed materials. This factor must therefore influence the index of land rent, and also the location of production if the different types of production must bear varying amounts of expenditure for concentrates. This it actually does. Certain types of live-stock production require feed rations with a relatively high content of nutritive matter while the needs of others are satisfied with a relatively low degree of concentration in the ration as a whole. According to Kellner, for instance, in 1000 kg. of dry matter there are required in feeding:

		Starch value in kg.	Protein in kg.
Oxen at rest		33	3.3
Mature heifers for fattening		48	5.8
Milk cows (15 kg. milk per 1000 kg. live weight)		37	6.5
Wool sheep, coarse breeds		39	4.9
Wool sheep, fine breeds		39	5.2
Mature sheep, for fattening		52	5.7
Hogs for fattening	period 1	78	8.8
	period 2	75	9.1
	period 3	76	7.7

A feed of a certain concentration therefore needs for its utilization a greater or smaller additional amount of concentrates, depending upon the type of live-stock production involved. The results of this are those above mentioned. The more concentrates a ration demands, the more marked will appear the burden, upon the given line of production, of increasing prices for concentrates, and the more will the feed value of the basic feeds be decreased by it. Since the concentrates rise in price with decreasing favorableness of the economic location, those lines of production in unfavorable economic locations which use poor feeds and extensive methods—which have, that is, a wide relationship of volume to nutrients—must, other things being equal, result in the highest utilization of feeds. On the other hand, with approach to the market, lines of production using rich feeds and intensive methods will gain more and more in competitive strength. Not entirely but mainly for this reason, with increasing favorableness of the economic location, the growing of young cattle is displaced by milk production, milk production by fattening, fattening by meat production, keeping sheep by keeping cattle, etc. At any rate, the emphasis of the live-stock enterprises shifts in this direction. The shift to lines of production which can be operated with extensive feed ratios is the means of making it possible, with decreasing favorableness of the economic location, to limit the use of expensive concentrated feeds and to operate with home-produced feeds. We have seen above that, in unfavorable economic locations, only feeds relatively rich in nutrients have an economic feed value. We can now add to this that they receive this feed value by extensive methods of application while, in favorable locations, the poorest feeds under some circumstances receive their highest utilization by the most intensive methods of application.

The problem of organizing the live-stock enterprises is solved only when the total quantity of land products which devolve upon them for utilization is accurately defined and when, among the subdivisions of live-stock enterprises, the right selection and mutual limitation of extent have occurred. It has already been emphasized that, as a rule, on a given farm the highest utilization of feeds can only be achieved by keeping several types of live stock.

Every live-stock enterprise has its peculiarities. There are feeds which are feedable to almost every kind of live stock, but there are others which may in some respects be termed "absolute" sheep, hog, poultry feeds, etc. because they are refused by other kinds of live stock or at least would constitute for them only a scanty subsistence ration, not a productive ration. Most feeds take an intermediate position inasmuch as they are, on the one hand, capable of varying application, and, on the other hand, are better fitted for either the one or the other kind of live stock. The forces of differentiation based on the natural, economic, and personal conditions may shift the emphasis of the live-stock enterprises to the one side or the other, but usually they cannot do away with the force working in the direction of diversification, so much the less since certain live-stock enterprises, like hogs and poultry, can be kept in almost any extent, even the smallest.

The mutual competition of the live-stock enterprises for the feeds begins first with the so-called "by-feed," that is, those feeds, capable of varying uses, which must be added to the absolute feeds in order to utilize them or to increase the effectiveness of their utilization. The expansion of the feed base for a given enterprise through "by-feeds" can go on as long as all the feeds taken together attain a higher utilization than would otherwise be possible. In a calculation dealing with this the farmer must proceed in such a way that he counts in for the absolute feed no value or only the fertilizing value, and for the "by-feeds" the value which can be realized through other methods of utilization. In this case the expansion, at the expense of its competitors, of the live-stock enterprise here under discussion is still profitable as long as a plus results when the expenditures are subtracted from the gross returns. Let us make the procedure of defining the extent of the individual live-stock enterprises clear by an example in which sheep production is to be defined with respect to its extent in competition with cattle production.[8]

The so-called occasional grazing areas on borders around the fields, stubble and fallow fields, poor grazing lands, etc., which would not yield enough for cattle grazing but which offer for the

[8] Aereboe, *op. cit.*, S. 96 ff.

unpretending and quick-moving sheep so much feed that it can gain in weight as well as produce wool and lambs, provide an absolute sheep feed. These grazing areas are not sufficient to support sheep all the year around, but must be supplemented during the summer when grazing is not possible and in the winter by barn feeding with "by-feeds." Feeds which may be considered as "by-feeds" are principally grain straws, mainly the kinds of straw which are poor in nutrients; for example, wheat and rye straws. These can be better used as sheep feed and in greater quantities since the sheep, more than any other animal, is capable of picking out the valuable parts. Other supplementary feeds are also necessary. At lambing time sheep must have hay, and at breeding time the bucks must have oats; even the lambs must receive good feeds. The maintenance of a sheep enterprise is profitable so long as the otherwise obtainable values of "by-feeds," the expenses for shepherd and sheep barn, and the other expenses for the care of the sheep are covered by the gross return, including the value of products sold and of the increase in fertility. Other things being equal, the lower the expense, for a farm with a given amount of absolute sheep feed, and the higher the gross return, the smaller is the minimum number of sheep necessary to insure profitableness in the sheep enterprise. A further question is, Whether and how far shall the sheep enterprise be extended beyond this minimum? If extended, increasing quantities of feeds such as hay, better qualities of straw, hoe crops, and even concentrates, which would otherwise be utilized by the cattle enterprise, must of course be used for the sheep enterprise. As the sheep enterprise increases in size, the absolute sheep feed declines successively in relative importance in the ration as a whole, and sheep feeding becomes more and more similar to cattle feeding. To the same extent the former superiority of the sheep enterprise in utilizing certain feeds decreases. The benefits which the quantities of "by-feeds" yield by making the utilization of absolute sheep feeds possible or by increasing their effectiveness decrease rapidly, and finally become so small that they fall below those obtained through utilization of these feeds by the cattle enterprise. At this point the maximum extent to which it is profitable to carry the sheep enterprise is reached. The problem of the

farmer is therefore to determine which is the last ton of supplementary feed the return from which, through its effect in increasing the utilization of the absolute sheep feed, is still above the return from feeding it to cattle.[9]

The situation is fundamentally the same in the case of sheep for wool production, the mutton sheep or, instead of the sheep enterprise, any other kind of live stock. In these cases also we are concerned always with the question, Does it pay at all to include in the farm organization, on the basis of the available absolute feeds, a certain live-stock enterprise?—and, if this preliminary question has been answered in the affirmative, To what extent is the use of "by-feeds" profitable in this enterprise? Ordinarily, the cattle enterprise comes into the picture as the enterprise to the competition of which the others must sooner or later give way; that is, if the "by-feeds" are not withdrawn through direct sale or utilization by the technical enterprises. The cattle enterprise, because of the greater importance which its products assume in all the higher stages of development, constitutes on most farms the backbone of the live-stock enterprises. It therefore receives the lion's share of the products of the land that can be fed at all.

7. SHIFTS IN THE LOCATION OF PRODUCTION WITH PROGRESSING ECONOMIC DEVELOPMENT

THE BASIS OF OUR FORMER DISCUSSIONS of the location of farming systems was the static condition of the economic structure. We have learned the principles which explain the simultaneous occurrence locally of the various lines of production at a given stage in the development of the national economy; namely, the factors of location in the static economy. As we already know, the problems of location are not exhausted with these explanations. In reality, we do not have a static but rather a living and moving economic structure, and the theory of location must consequently take into account not only the geographic modifications but those of time as well. The further question is, How do those economic forces which, taken as a whole, make up what we call development—meaning development in the good sense; that is, "progress"—affect the

[9] Aereboe, *Beiträge*, S. 100.

lines of production, and how do they influence the organization of the farm according to enterprises?

One part of this question can be quickly answered. Thünen sees the change in locational relationships with the different stages in economic development mainly as a replica of the modifications of location shown by the economic zones in a given stage of development. "The isolated state," he says, "represents, so far as agriculture is concerned at a given time, a picture of the same state in different centuries." We can easily imagine, as Thünen did, how with progressing development, resulting from the expansion of the market, the limits set to the lines of production by adjustment to economic conditions at a given time are overthrown, and how the various zones expand. This, of course, can happen only, so to speak, by pushing the zones over one another from the inside toward the outside. Thus within a shorter or longer period of time all the systems of farming glide over a given place.

This scheme, with which up to this time the theory has in general been satisfied, does not by any means explain everything. Disregarding the fact that one does not learn from this what takes the place in the inner zone, or the type of agriculture which is forced to the outside, what about this as an explanation, based as it is on the narrowly framed assumption that progressing development exercises its influence only through an increase in the intensity of the forces of orientation which come from the market, while the mutual force relationships of the factors of location remain unchanged? This last is not actually true. In the course of time a slow shift takes place among those forces which participate in the establishment of production and among the individual elements of which they are made up. These forces are not always in the same position of balance. They change their individual and their total weight, thereby changing the balance between the enterprises within the individual farming systems. The parallelism between the geographic and the chronological modifications of location disappears, or at least is distorted. To use an illustration: Chronological changes are not only external shifts among the regional locations of the different systems but, at the same time, are also changes within the internal structure of each individual system. To be more

concrete: All the enterprises are not necessarily affected equally by changes in the forces of location. Instead, a change sometimes influences more strongly one enterprise, sometimes another. Thus we may have in a given stage of development, combinations in farming which have never been known before, either in the place where they appear or anywhere else. There is left in the picture only a certain similarity.

Here lies, therefore, the theoretical emphasis of the dynamic side of the problem of location. The individual factors of location must themselves be placed in the living and moving economic structure, and the principles and tendencies according to which their relationships and their influences upon the lines of agricultural production change must be included in the general theory. The assumption of static conditions must be removed entirely.

All the shifts in production—namely, the changes in the relationships between the forms of land use, and between crops and the converting enterprises of the farm—receive their motivation either from changing demand in the market or from progress given a direction along certain lines by changes in technique; that is, technique in general, as well as technique in agricultural production in particular. We must distinguish sharply between these two influences.

If a changed demand—we assume an increased demand—does not involve all agricultural products equally, the favored products increase unilaterally—experience, that is, a relative increase in market price. Happenings of this kind are of daily occurrence. It is a fact well known in the experience of all, and one which has been shown statistically, that the customs of the consuming public undergo great changes in the course of time, changes which again are associated with various circumstances. It may be sufficient to indicate a few of these things here. Even an increase in the wealth of the people usually causes a shift in the relationships of the products demanded. As no one is in a position to satisfy all his demands, everyone is accustomed to making a gradation in the satisfying of his needs, this gradation being according to the relative urgencies of these needs. Even with a small income he tends if possible to obtain certain goods up to the full satisfaction of his

wants. If his income increases, he must necessarily, if he wishes to progress at all in satisfying his needs, take more and more into consideration, in spending his money, other goods or luxuries in the purchase of which he was formerly more or less limited or which he could not afford at all. Provision being made for the consumption of goods which are necessary for subsistence, the consumption of luxuries becomes more and more important. It must be added that even the subsequently felt urgency of these "luxury" needs does not always remain unchanged. For example, changed living and working conditions, like the change from physical to mental work, or from work in the open to inside work in a sitting position, which are a characteristic accompaniment of our modern development, bring about changes in our ways of eating which have their main cause in certain physiological relationships and which are reflected again in the demand for, and the relative price levels of, things produced. Progress in industrial technique is also effective in the same way and often manifests itself with extreme force. The national economy has, as is well known, a tendency to make itself more and more independent of agricultural production by supplying an increasing population, by displacing, with mechanically produced and finished land-products, the organic products which are produced under pressure of the law of diminishing yield increase. For obvious reasons, however, it does not everywhere have the same success in this fight for emancipation. We select only a few typical contrasts. Industrial technique has been able to make almost entirely unnecessary the cultivation of plants for dye production; but the task of supplying the national economy with human food-stuffs is undisputedly the field of agriculture. Industrial technique has further been able largely to displace the sources of light, heat, and power which are of plant or animal origin (oil plants, firewood, animal power) by the use of coal, coal oil, and the kinetic energy of nature; it has replaced timber and lumber by iron and other metals, stone, cement, etc. In other fields it has limited, to a great extent at least, the use of the less productive animal organisms (substitution of cotton for wool, vegetable fats for butter). The agricultural production would be entirely different if the people of today were, as in former centuries, dependent upon

agriculture for their needed supply of food and raw material. Still another influence upon demand is the development of the tropical and subtropical countries, the products of which often serve as supplements to the homegrown products (rice, corn, tropical and subtropical fruits, palm oil).

Among the specific historical facts of the recent past which are especially noteworthy and of the greatest practical influence are the shifts which have taken place in most of the civilized countries in the relationships between the market prices of the bread grains, on the one hand, and of the animal products used for human food, on the other. These shifts have received their impetus mainly from changes in the demand. Taken purely in a quantitative way, the consumption of bread grains in Germany very early reached a certain point of saturation. We may assume that the quantity consumed has not increased very much during the nineteenth century: only the demand for quality has changed. On the other hand, the amount of increase in per-capita meat consumption during this time may be illustrated by the following table, which refers to the kingdom of Saxony.[10]

CONSUMPTION OF BEEF AND PORK IN THE KINGDOM OF SAXONY
(Computed on basis of the butchering tax)

	Kg.
1835–1844	16
1845–1854	17
1855–1864	21
1865–1874	25
1875–1884	30
1885–1894	35
1895–1904	41
1905	38
1906	34

Coinciding with this change in consumption we find an entire shift in the levels of prices in favor of meat, as may be shown also by figures. (See table on p. 147.)

[10] *Handwörterbuch der Staatswissenschaften*, 3 Auflage, Bd. IV, S. 358.

A price development similar to that for meat is shown by milk, butter, and eggs. In comparison to the bread grains they too are today more expensive than they were in the seventies of the past century. This again is a result of the increased demand for such products. It may be assumed that the course of prices in the future will follow this same tendency since, according to statistics, there

PRICES OF AGRICULTURAL PRODUCTS IN PRUSSIA PER 100 KG., 10-YEAR AVERAGE

Period	Wheat	Rye	Beef	Pork
1821–1830	122	87	42	54
1831–1840	138	101	52	62
1841–1850	168	123	57	71
1851–1860	211	166	70	92
1861–1870	204	155	87	104
1871–1880	223	172	114	125
1881–1890	181	152	117	123
1891–1900	164	144	125	129
1901–1910	192	164	150	154
Price from 1871 to 1880=100				
1901–1910	86	95	132	123

are still today great variations in the consumption of the animal products mentioned if one compares the various countries and districts, town and country areas, and small and large towns, and if the individual classes in the population are differentiated according to variations in wealth. These are differences which have a tendency to level out, as long as the economic development is advancing and the purchasing power of the people is increasing.

In considering the mechanics according to which shifts in location occur as a result of price changes, it is clear from our former discussion that a product competing for a given location gains in competitive strength as it increases relatively in price. The product favored by the change in price relationships will occupy a place in districts where its production has not previously been profitable, and furthermore it will gain a more and more impor-

tant place within the combinations of products in the districts where it was formerly grown. Depending upon the stage of development of a district, the change will sometimes be more significant in the former direction, sometimes in the latter. In the agriculture of the United States the consequences of the price shifts, as between grain and animal products, are apparent chiefly in the gradual advance of "diversified" farms into the former wheat regions. This is a type of farming which, in addition to grain-growing, includes feed crops and consequently live-stock production. In Germany, where live stock has always had a greater importance, the consequence of price shifts appears in a steady expansion of the feed base within the farming combinations. This proceeds mainly at the expense of the fallow and of the cultivation of legumes and commercial crops (Handelsgewächsbau), and, in districts well fitted for grass production, at the expense of grain crops or of the entire field-crop production.

In explaining such shifts in location the following factor is also of much importance: The rise in the market price of a given product is of course transferred to the local prices in such a way that the latter rise in like amounts in all the economic locations, because the difference between these and the market price remains unchanged by the shift. The land rent which is yielded by the product must therefore rise in all locations by the same amount. Under these conditions the limiting effect which the increase in the market price of the given product exercises upon the production of the competing products cannot be equally great in all locations. In the vicinity of the market this effect is comparatively small because it finds here the greatest resistance, in the form of a relatively high land rent, from the competing products. With decreasing favorableness of the economic location the given product tends slowly toward a maximum but finally decreases again and disappears entirely where, in spite of the increase in market price, it can no longer yield an economic rent. The maximum effect is observed in those locations where, at the former price level, the growing of the product has only just been profitable. Details concerning these relationships may be seen in the table on p. 149, to which for further clarification a graphic illustration is added (p. 150).

The market price of the product N, because of increased demand, rises from 2.25 M to 2.50 M. The land rent yielded by it therefore increases by 25 M in all the zones where it was formerly cultivated, while two more zones are drawn into the territory in which the product yields economic rent (theoretically the economic rent increases here also by 25 M because it was formerly

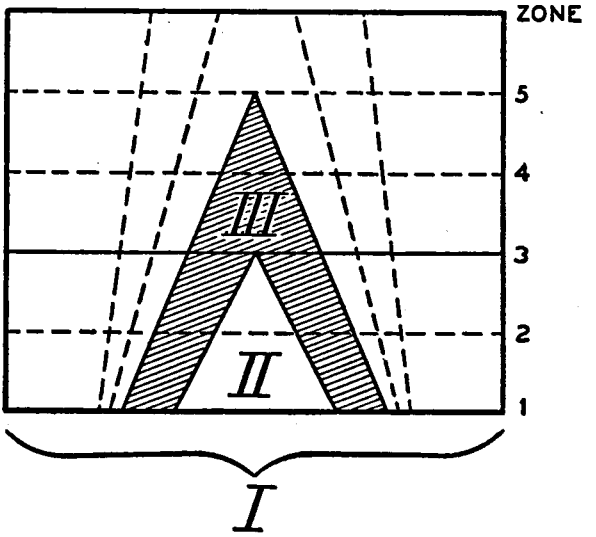
PRODUCT N
Yield, 100 Zentner per Morgen
Production costs (in the broader sense) per Morgen, 200 M
Production costs (in the broader sense) per Zentner, 2.0 M

Market price with lower demand, 2.25			Market price with increased demand, 2.50			
Zone	Local price	Land rent per Morgen	Zone	Local price	Land rent	
					per Morgen	increase
	M	M		M	M	M
1	2.25	25	1	2.50	50	25
2	2.125	12.5	2	2.375	37.5	25
3 (Marginal location)	2.00	±0	3	2.25	25	25
4	1.875	(−12.5)	4	2.125	12.5	(25)
5	1.25	(−25.0)	5	2.00 (Marginal location)	0	(25)

negative). The shift in the lines of production in favor of the product N will be greatest in zone 3, the former marginal location, because, on the one hand, the increase in market price here still appears in full in the land rent while, on the other hand, the economic rent from competing products is here at a minimum. In the favorably located zones the effect is more and more offset by the growing resistance which arises, while in the distant zones this force is losing its power.

Let us summarize: Shifts in the price relationships of the products raised in an economic area, the causes of which lie in changes in demand, bring about, in the lines of production on the farms, changes which favor the products most favored in the price devel-

opment, the effects becoming more pronounced with decreasing favorableness of the economic location. The more unfavorable the economic location becomes, the more the balance between the enterprises on the farms takes on an unstable character and the more easily, therefore, can a shift in the forces of orientation coming from the market affect the farming system. If we think of a relative



I. Total tilled area.
II. Area given over to product N when market price is relatively low.
III. Expansion of the area in product N resulting from a relative increase in its market price.

increase in the market price for one product proceeding by degrees, the main emphasis in the changes in farming is shifted more and more into economic locations farther from the market. At the same time, as a result of this, the farming systems in the various locations must become more and more similar to one another. Other things being equal, price changes caused by change in demand tend therefore to level out the differentiation of agricultural production according to economic location.

This development is especially apparent in German agriculture, particularly in live-stock production. In the districts with favorable location, for example, the provinces of western Prussia, increase in live stock has come to a standstill. The increase which can be noticed in the rest of Germany occurs largely in the parts of the country which are economically less favored, as can easily be seen by a superficial glance at the statistics.

The second type of shifts in location, in its inner cause and effect relations, is connected with development of technique. In order that we may recognize the regularly recurring tendencies in the great mass of individual phenomena, it is necessary to divide the whole group of technical developments into certain categories based upon the differences in effect upon the lines of agricultural production. We must distinguish:

1. Developments in transportation.
2. Developments in the production of farm products.
3. Developments in the conversion of raw agricultural products and in industrial technique in general.

The dynamic phenomena of economic life are the more easily observed and explained as to their causes the less they are offset by influences which are at the same time acting in the opposite direction, the less they are eclipsed by other tendencies working in the same direction, and the faster in general the course of events proceeds. More significant than any other shifts in location, no doubt, are the changes which have occurred in the scope of agricultural production under the influence of the development in transportation; that is, through the improvement and expansion of the means of transportation and communication. If one wishes to characterize the economic developments of recent times by certain events, he can do so in no better way than by referring to the abrupt development of transportation, which at times far outran all other developments in its direct effects upon national and world economy. These changes have put economic life, and with it agriculture as well, upon an entirely new base; have, indeed, revolutionized it.

The inner relationships of the shifts in location caused by developments in transportation will be apparent if we keep in mind

the fact that every achievement of this kind, however it may express itself, is equivalent to a lowering of the expenses and wastes involved in marketing agricultural products. If the marketing costs decrease in general they tend to level out the regional differences and with these, which is of special importance here, the differences in marketing costs calculated in terms of the unit of cultivated land. These existing differences among the various products chiefly determine their indexes of land rent. A general leveling of the indexes of land rent takes place, the market's power of attraction is weakened, and the factor of location—that is, the economic location—loses in its influence upon orientation. Other forces of orientation gain in effectiveness. Chief among these are the varying conditions of soil and climate and, no less important, the forces counteracting the differentiation of farming activities, namely, the forces of diversification. On the one hand a leveling occurs with respect to the differences in the lines of production in the various zones. This leveling is made partly at the expense of the zones closer to the market, differing in this respect from the shifts caused by a relative increase in demand for certain products (in which case one zone was only more favored than the other). The cultivation of products having a relatively high index of land rent gains in extent in the unfavorable economic locations, while it must be limited accordingly in the more favorable locations. On the other hand, however, and this is the most noteworthy tendency in this development, the total orientation of production becomes more and more an adjustment to the natural conditions of location. As savings in transportation expenditure lose in significance, differences in production costs between soils having different natural conditions become more important in determining the methods of farming. The regularity of Thünen's rings is more and more interrupted and distorted. The spatial distribution of production at a high level of transportation costs is mainly an adjustment to economic conditions; at a low level of transportation costs, mainly an adjustment to the natural conditions of production or a utilization of the specific favorablenesses of the various kinds of soils. The freer the farmer is in respect to market outlets the more he is bound by nature.

Such is the picture if we consider the effects of the facilitation of marketing in a very general way. Further consideration must be given to the fact that transportation means, not infrequently but as a rule, a specific favoring of one product or the other since this factor is always of relatively greater importance for a less transportable product than for a product with high transportability. Every acceleration in the overcoming of the handicaps of distance through transportation improvements is therefore to a far greater degree an advantage of the more perishable products, like fresh milk and vegetables, as compared, for example, to grain or lumber. Improvement in the means of transport serving chiefly the local traffic, for instance, the invention of the motor truck or improvements in local narrow-gauge railroads, is of comparatively small importance for grain marketing but of great importance for the marketing of hoe crops and lumber. Again, some improvements in the means of transportation are for the purpose of providing specifically for the special requirements of certain products. Thus the refrigerator equipment of ocean steamers and of railroads facilitates most largely the transportation of meats and butter. The special requirements for marketing milk will be better met by frequent transportation and an increase in its precision. In this connection we must also keep in mind the marketing facilities obtained through the coöperative method, which do not favor all products to a like degree. Finally, one cannot overlook the effects of the rate policies of the public or private transport agencies, which also have, as is well known, a decided influence (e.g., differential tariffs). In short, improvements in transport not infrequently distribute their benefits very unequally, and where this happens the location of the favored products will undergo a shift which, in final result, lessens again the division of labor according to economic location, and at the same time strengthens its division according to natural conditions.

How far in former times the limitations of transport facilities were determining for the location of a type of production may be indicated by the fact that, in the middle ages, wine was evidently produced by the knights in Prussia (West Prussia). Furthermore, Frederick the Great made great efforts to establish the cultiva-

tion of mulberry trees in his country for the purpose of breeding silkworms. Von der Goltz states that, in the fifteenth century, the cultivation of dye plants in certain districts of Thuringia had taken on such an extent that it far overshadowed the cultivation of grains until the discovery of the sea route to East India gave it a sudden check. In order better to realize the contrast between the present and the past it may be recalled that today such an easily perishable product as butter comes from New Zealand, fresh fruit comes from California, and tropical fruits from all parts of the world, to the European market, while flowers and fresh vegetables are imported into Germany from Italy. One must not of course overestimate the strength of these tendencies in the development and entertain the opinion that today the natural forces of orientation, along with the personal, are in reality the only significant ones while the economic orientation, although indeed having theoretical interest, may be neglected with respect to practical significance. Up to this time the development has gone as far as this only for products which, on the one hand, are very particular in respect to soil and climate and, on the other hand, show a relatively low index of economic rent. Because of these characteristics, the location of such products, for example, wine, tobacco, certain kinds of fruit, and similar special crops, shows considerable mobility.

As to their effects, the achievements in conversion technique, which consist of a technical or economic increase in the transportability of agricultural products, are equal to the improvements in transport. Advances of this kind have become increasingly important, especially in the last two decades. As examples we may cite the invention and increased use of straw and hay presses, the increasing use of dehydrating equipment for sugar-beet pulp, waste from wine presses, and, recently, for potatoes and beet tops; also the better conservation of milk and butter. The processes of dehydrating and conserving are important in another connection also; namely, in facilitating the separation of the conversion enterprises from the farm. This we will discuss later.

In the pattern of the "isolated state" the shifts in location of production caused by the progress of transport development appear as a movement from the inside to the outside; that is, from

the economic center to the periphery of the economic district. The stronger it has formerly been the more is the attractive force of the market weakened for a given kind of production. On the other hand, a movement with a contrary tendency (likewise associated with a corresponding shift in the grouping of locations), namely, a stronger pull toward the market, results from improvements in those methods of agriculture which have to do with increasing the yields per unit of land. This conclusion results even from the simple consideration that a product which must supply a given demand is the more effectively limited to the zones near the market the greater is its yield per unit of land. If we investigate further we recognize the main reasons for this in the changes which the indexes of land rent now undergo through the influence of yield-increasing improvements in methods of soil cultivation. While a relaxing of the limitations caused by transportation expense lessens and equalizes the regional differences in land rent (that is, the indexes), an increase in the yield per unit of land must enlarge them because of the greater transport expenses which the unit of land must then carry. As long as these shifts in the indexes affect all the lines of production equally, they cannot disturb the balance of location, at least not directly, but they may well do so if the lines of production are not equally affected. If the relationship in which the indexes of the individual products stand to one another changes as a result of a disproportionate increase in yield, this will lead to shifts in the locations of such a nature that products which, in comparison to others, show an increase in their indexes, will gain space in the inner zones, while they will be limited accordingly in the outer zones.

Occurrences of this kind are not rarities, although they may not be so marked in the web of tendencies and counter-tendencies which make up the real trend of development as are the modifications in location caused by changes in demand and improvements in transportation. They have, however, because of the gradual expansion of improvement in agricultural technique, more the character of a steady and gradual development. Even an equal improvement does not mean for all the crops a likewise equally great increase in the weight of the yield. For example, it may mean a far

greater increase of weight in the case of potatoes than in that of the grains. Furthermore, improvement in methods of cultivation often benefits some types of production more than others, not only temporarily but also for longer periods. It is safe to say that, for certain types of soil, the cultivation of feed crops has shown during the last few decades a greater increase in yields than has the cultivation of grain crops. The difference is still greater if, as must be done for our purposes, we compare with the output of grain the yields in animal products that a given area of forage crops produces, thus taking into account the improvements in live-stock production. Almost no other enterprises in agriculture show improvements which can compare in extent and significance with those of live stock. But there are differences which are still more remarkable. Even the various kinds of grains have not profited in the same degree from improvements in methods of cultivation. The statistics of yields in Germany, for example, make it apparent that oats have benefited more than the other grains. A similar situation appears in the various branches of the live-stock industry, as may be illustrated by comparing wool production and meat production. It has already been stated that the conditions with respect to profitableness of the cattle enterprise for butter production are today entirely different from what they were in Von Thünen's time. As a reason for the fact that today butter production is undoubtedly profitable even in relatively favorable economic locations, it has been stated that, owing to the mechanization of the production process (separators), this enterprise can no longer be greatly influenced by differences in the level of wages. We now recognize another important reason for this as well, namely, the relatively great increase in return which the maintenance of cattle for milk production has undergone. These examples may be sufficient to demonstrate that the dynamic power of technical progress in methods of cultivation is also of more than mere theoretical importance.

All the changes in the lines of production earlier discussed were, without exception, shifts in the location within the specifically agricultural sphere of productive life. They were manifestations of competition among the farm units in their effort to take away from one another a part of the work of supplying the market. In

addition to these there is still another group of dynamic phenomena which affects the scope of agricultural production. These, however, are of a fundamentally different character in that the farm units no longer compete with one another but, rather, the scope of agricultural activity as a whole is compressed. These are phenomena which are generally known both in respect to their actual and their causal relationships, and which have special interest for the economist. They have to do with the separation into separate business units of the agricultural and industrial production which results from a progressing social division of labor; they have to do, as well, with the development of industrial production in the form of independent business activities, and with the lifting of the specifically agricultural activities out of the home economy stage into the business stage.

This, of course, is not the place to follow up this process in all its causal relationships or even in its historical details, though it really overshadows by far in its total importance everything that has happened in the way of other changes in agriculture. It would mean nothing less than to discuss the nature and development of the national economy and as well the genesis of modern entrepreneurship in general. These are the province of other works than this. Let us consider however the main phases. Though the first rudimentary stages are lost in the darkness of prehistoric times, we can recognize clearly in Germany two great periods of progress, which are separated by an intervening period of stagnation. The first period coincides in time and in cause with the development and flourishing of the handicrafts and trades of the middle ages and ends about the middle of the sixteenth century. From the end of this period until the nineteenth century important progress was not made. In the nineteenth century the separating process began again to take place rapidly. As the most important direct and indirect forces in this process we recognize the great increase in population, the development in mechanical technique and other improvements in the technique of converting materials, the development of modern transportation, the changed legal foundations of economic life (liberation of peasants from the relics of feudal servitude, and freedom of trade), and, finally, the entering of the

modern entrepreneur spirit into those groups of the population which were engaged in agriculture. Of first importance were the improvements in industrial technique and in transportation which in this second period exercised a decisive force; the former through their tendency to favor larger-scale business, the latter through the fact that they facilitated to an extraordinary degree the differentiation of the economic life by cheapening transportation.

Two types of enterprise tended to split off and become independent: on the one hand, those which are chiefly concerned with converting products of the land, through home handicraft, for home use; on the other hand, those which convert products of the land which are to be sold—in the narrow sense, the "technical" side lines. Both developments proceeded side by side. Both are also still going on at the present time. Even in countries with pronouncedly capitalistic methods of farm management there is today scarcely a single agricultural enterprise that is entirely oriented to market and entirely released from the principle of self-sufficiency. It may even be questioned if we shall ever come to a complete separation between original production and the converting enterprises. Agriculture is intrinsically not a pure "profit economy," like an industrial or commercial business, and it is scarcely likely ever to become so. Its particular characteristics, which consist in the production of food and clothing and which enable it to satisfy independently and directly a large part of the needs of the household, do not permit this. There will certainly always be a remaining part which will not be entirely directed by market viewpoints, no matter how far the division of labor in the national economy may proceed.

On the other hand the individual converting enterprises of course behave very differently with regard to separation from the farm unit. First, with respect to the enterprises for the provision of farm supplies for home use, we may say in general that those will devolve upon the social division of labor and separation into professions which, on the one hand, require a far-reaching expert training and extensive technical facilities and which, on the other hand, satisfy needs that recur in the farm household only infrequently or irregularly and therefore contribute little to the balance between periods of much work and those of little work. Fi-

nally, those home enterprises will also be first separated from the farm which produce products easily usable in exchange; that is, enterprises which convert easily transportable raw products and which supply such products. For all these reasons, in Germany the commercial tannery very early put a stop to home tanning. Also professional spinnery and professional weaving are very old. That, in spite of this, spinning and weaving by the peasants have been so long maintained is because these converting enterprises were to a great extent capable of filling in profitably the time in the farming operations between the periods of field work, and therefore could only be eliminated when finally the advantages of capitalistic business became so great, as against the handicrafts which were the only possible form the peasants could use on the farm, that all other considerations were forced to give way before it. Even today in some remote mountain districts of Germany, where a severe climate limits work in the fields to a very short period of the year, we find the spinning-wheel and the loom as constituent parts of country households, at least on the small farms with their surpluses of labor. The milling enterprise very early disappeared from the small farm because it required comparatively expensive equipment the full utilization of which could be attained only by custom milling. Baking and butchering, however, have been maintained in many places, even up to the present time, as domestic or home industries. Both of these require but little investment, and relatively large transportation difficulties arise if they are discontinued. Only in districts with especially favorable transport conditions does the farmer in Germany leave these enterprises also to the industrial entrepreneur.

Of course, for obvious reasons, adherence to inherited customs plays a large rôle in the matter of self-sufficiency and this must not be overlooked. In contrast to the conditions in Germany, Backhaus reports with respect to America that the farmers there, except in emergency cases, do not think of butchering at home, but that instead they sell the fattened hogs and cattle to the packing plants many hundred of miles away and purchase from these their dressed meats.[11] They think the matter is most cheaply handled

[11] According to David, *Socialismus und Landwirtschaft*, S. 508.

that way and, since tradition and inherited customs do not bind them, they follow here the principle of economic rationalism.

The converting enterprises which produce the salable products, that is, the technical side lines in agriculture, individually behave very differently with respect to independence from the rest of the farm business.[12] To be sure, as a result of improvements in technique, and partly also on commercial grounds, these enterprises have, as a rule, come under influences that operate in the direction of large-scale development, but not all of them are thus influenced to an equal degree; so the incongruity between the size of business of the farm and the optimum size of the converting enterprise does not everywhere appear with the same distinctness. For example, the pressure for large-scale conversion of beets into sugar is much greater than that for a similar large-scale operation in the production of alcohol, and this pressure is greater in butter production than in cheese production. In addition, a varying resistance is opposed to the tendency to separate the individual converting enterprises from the farm. This factor is decisive above all others. The amount of resistance depends mainly upon the respective transportabilities of the finished product and the raw product. Furthermore, a rôle is played by the special aptitudes for using the by-products which originate in the processes of conversion. The lower the difference in value between the unit of weight of the raw product and that of the finished product, and further, the more unfavorable for technical reasons the conditions of transportability for the finished product, and finally, the more easily the by-products can be utilized by way of the trade (dehydration), the looser is the connection between the location of the production of the raw products and the location of their processing. The influence of the two first-named factors can be clearly recognized by comparing the relative conditions of brewing, on the one hand, and of the production of alcohol, on the other. In converting barley

[12] It should be stated that a sharp separation of the converting enterprises producing for sale and those producing for home use is, of course, not possible. Enterprises which today have only a domestic character formerly produced products for sale as well, and there are still other enterprises which produce mainly products for sale but which at the same time provide for home consumption.

and hops into beer, the loss in bulk and weight which the raw products undergo is more than offset by the addition of water.[18] Also beer is, for technical reasons, a product of not very great transportability. The conversion of barley and hops into beer at the place of production therefore does not offer any advantage at all in saving of transportation expenditures as against conversion at the place of beer consumption. The opposite is true in the production of alcohol, for which the raw material is the watery potato while the finished product can be shipped in highly concentrated form. In keeping with this is the fact that the development of modern large-scale technique has very quickly and completely taken from the brewery its original character as an agricultural side line and has made it an independent production enterprise oriented to consumption. The potato distillery, on the contrary, is still today usually connected with the farm. The grain distillery is undergoing a similar shift in location to that of the brewery. Although a much greater saving in transportation costs is made by the conversion of grain into alcohol than by its conversion into beer, this advantage is not so great that it could not be more and more overcome by the advantages of large-scale business which are oriented according to consumption. This is true at least for countries with a highly developed transportation system. The grain distillery is a distinctly agricultural enterprise only in some parts of Russia and in other countries which are distant from centers of trade.

Even though a given converting enterprise cannot be separated in space from the locality in which its raw materials are produced, because of resistance caused by limitations in transportability, we still cannot conclude that it must also, under all circumstances, remain a dependent part of the individual farm unit. There is in this respect only a difference in degree between the enterprises oriented according to consumption and those oriented according to raw materials. Also, those industries which do remain "out in the country" have more and more a tendency to become, through concentration of their raw materials, central converting places for a large number of farms. The only difference is that the independence of these organizations usually does not become so complete

[18] 100 kg. of barley yield about 480–600 liters of beer.

as that of the separated enterprises, which tend to pass over entirely into the field of money-making through private entrepreneurship. The former may well be, with respect to business organization and management, independent units, but may retain certain connections with the farms which deliver the raw materials. This happens when the owners of the farms appear at the same time as owners of the central business units which are founded on the basis of a society made up of farmers. Typical examples of this are to be found in the sugar factories founded by farmers as shareholders, more particularly in the coöperative creameries and cheese factories which have spread widely and with extreme rapidity since the eighties of the past century, and in the coöperative slaughterhouses of the Danish farmers. These are undertakings which in some respects occupy an intermediate position between the agricultural side lines, in the narrower sense, and the purely industrial converting enterprises for the raw products of agriculture. Since they are bound to the locations where their raw products are produced, they usually succeed better on a coöperative basis than in the form of private undertakings, and because of this they tend to occupy this semidependent position. It is not feasible to go into more detail here.[14]

Separation of the converting enterprises from the farm usually does not occur without having some reaction upon the locations of the branches of land utilization which supply the raw materials. Such a reaction is especially noticeable if the separation involves a shift of the conversion enterprise toward the places of consumption. When the spinning-wheel and the loom disappeared from the homes of the small farmers the cultivation of flax also tended to disappear from the fields. Flax, as a market crop which henceforth was to be marketed as fiber, and which has in this form a very low index of land rent, could no longer maintain its right to existence in vast areas in Germany. Only in recent times, when industry has begun also to take away from agriculture the manufacture of the fiber and to purchase the raw fiber, has the cultivation of flax begun to gain ground here and there, even gaining in the more favorable economic locations. Similar reactions resulting

[14] Cf. Brinkmann, *Die Dänische Landwirtschaft* (Jena, 1908).

from the industrialization of the brewing enterprise have influenced the location of the production of barley for brewing purposes. Barley has since that time continuously retreated to locations more favored by nature. Furthermore, separation of the converting enterprises from agriculture influences indirectly the utilization of the land through the fact that large quantities of labor are set free, and arrangements must therefore be made in some other way for the necessary balance in the use of labor. Such a reaction, of course, may take place also when the separated enterprise itself does not undergo a shift in location. The concentration of the preparation of milk and its resulting phenomena afford strong proof of this. The development of the creamery system has, no doubt, irrespective of the better utilization of milk which it provided, contributed greatly to liberating labor on the small farms and thus has enabled these farms to increase the intensity and extent of the live-stock enterprises and the feed bases on which these rested. The live-stock enterprises have usually been, in Germany, the principal means of restoring as far as possible the balance between summer and winter work, which was greatly upset when the work of conversion was taken from the farms.

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