

CHAPTER - IV

A THEORY OF AGRICULTURAL LOCATION

A normative economic model of agricultural location was first presented in 1826 in “Der Isolierate stat”. This book was written by John Heinrich Von Thunen who was a German economist and was a follower of Adam Smith, the renowned economist. The model presented by Von Thunen is based on an econometric analysis of the states in Mecklenburg near the city of Rostock, Germany, with their sod-podzolic soils of low fertility, where he farmed for forty years from 1810 until his death in 1850.

The core of Thunen’s mini-max model lies in the concept of economic rent which is inherent in farm-market distance relationship. The basic idea is that the form of agricultural landuse which produces the greatest rent will make the highest bid for the land, and thus, displaces all other uses of the land. The model is predominantly concerned with the agriculture, its types, and prosperity about an urban market. In order to design his theory of agricultural location, Thunen collected relevant data over a period of five years from his own state of Mecklenburg and analysed them. The data were pertaining to the cost of production of various agricultural produce, their yields, cost of transportation of the agricultural produce to the market, as well as, their market prices. On these bases he drew six concentric zones with different agricultural production. These zones were mainly determined by the transportation cost. For the purpose of model building Thunen postulates:

1. There was an isolated area/Isolated State, having least economic relations with the world outside. The Isolated State was having a city in its core, and agricultural hinterland around the city.
2. The city was the only market for the surplus agricultural produce.
3. The agricultural hinterland was homogeneous in physical conditions of climate, and physiography.
4. The hinterland was traversed by only one mode of land transportation-the horse and cart, with no navigable river.
5. The transportation cost identically was directly proportional to the distance covered.
6. The farmers of the agricultural hinterland were desirous of maximizing their profits and were capable of adjusting their types of farming to the market demand.
7. There was a state of free competition among the users of the land. On these assumptions Thunen postulated that, given this controlled laboratory system, the different types of agricultural land uses would develop around the city in six discrete concentric zonal rings of agricultural production.
8. Thunen assumed that each individual farmer has complete information and makes rational decision to maximise his profit in the light of his complete knowledge.

In fact Von Thunen was mainly concerned with the monetary return over and above monetary expenses incurred by different types of agriculture i.e., “The Economic Rent”, which decreases with the increasing distance and with the decreasing intensity of cultivation of a particular crop from the city market.

Von Thunen recognised following six concentric zonal rings of agricultural production (Fig. 4.1).

ZONE 1 : The land adjacent to the market would be used for free cash cropping i.e., market gardening and milk production, because of their high perishable nature, primitive type of time consuming transportation system and the absence of adequate techniques of food preservation like refrigeration and canning etc. The radius of this zone is directly proportional to the demand of these products in the city. Since a particular size of city population would require a certain volume of milk and vegetables, these urban consumers would be ready to pay higher prices for milk and vegetables. This would ultimately make it a more profitable venture for farmers in Zone-1 as compared to any other type of agricultural production. This type of agriculture yields a higher return but incurs heavy transportation costs; consequently its rent curve drops very steeply away from the urban centre.

ZONE 2 : In this zone the inhabitants specialise in producing wood, with fire-wood in much greater demand than lumber. From the modern view point this would appear a peculiar use for such an expensive land with second nearest location from the city. However, in Thunen’s time

this was quite logical. Being a principal fuel and exceedingly bulky, wood was costly to be shipped by the primitive transportation medium. The rent curve for this type of landuse dropped quickly away from the centre. Low production cost added further to the feasibility of free cash farming in this ring. That way, Von Thunen demonstrated that forestry yields greater returns to the farmer near the city than any other type of production except that of fluid milk and market gardening products. The outer limit of this zone was determined by the amount of wood demanded by the market.

ZONE 3, 4 AND 5 : These zones surround the woodland and are devoted mainly to the grain crops. The intensity of cultivation in these zones diminishes outwardly from the centre as indicated by :

- i. The proportion of fallow land, which is zero in zone 3, fourteen percent in zone 4, and thirty three percent in zone 5.
- ii. The corresponding drop in production cost per acre, especially in labour requirements, is thereby compensating for the additional burden of transport cost of these outlying areas. Hence, in Thunen's model, there is a cost substitution with transport costs replacing production costs.

ZONE 6 : This would be a region of live stock ranching. Marketed products would be of two types : live stock which could be driven to market, hence the transportation cost almost become zero; and by-products of milk like cheese, butter etc., which are not highly perishable and have a remarkable reduction in the volume resulting in lessening of the transportation cost.

On its outer extremity, this sixth zone was bounded by wilderness, a resource that could be exploited at some future time when the demand for agricultural commodities in the city would require an outward expansion of the productive area.

MODIFICATIONS TO THE CLASSICAL MODEL

Thunen himself considered the potentially distorting effect of improved transportation routes as navigable waterways, roads and railways on which transportation was speedier and costs only about one tenth (along waterway) that of land transportation. As important cities generally have access to a navigable waterway, Thunen introduced a stream into his “Isolated State” resulting in the elongation of production zone roughly along the stream. Zone-1 was least changed in shape; zone -2 extended in a narrow band for some distance in each direction from the city, but it was no longer an enclosed zone and instead of approaching close to the town it seems more likely that wood lands would have been situated at some distance up and down the stream. Since, the transportation cost of wood was very high vis a vis its value, the river-side location was a most favoured location for this form of production (Fig. 4.2).

The provision of only “one market” was also subsequently removed by Von Thunen. The consideration of a minor market centre with its own small tributary area apparently with the production of Zone-1 type, opens up the possibility of numerous towns of roughly equal importance with intermingled production zones which modify each other. This leads towards the extreme complexity in the real world where the zonation around the individual cities is rudimentary or indistinguishable

VON THUNEN'S SYSTEM OF AGRICULTURAL LANDUSE

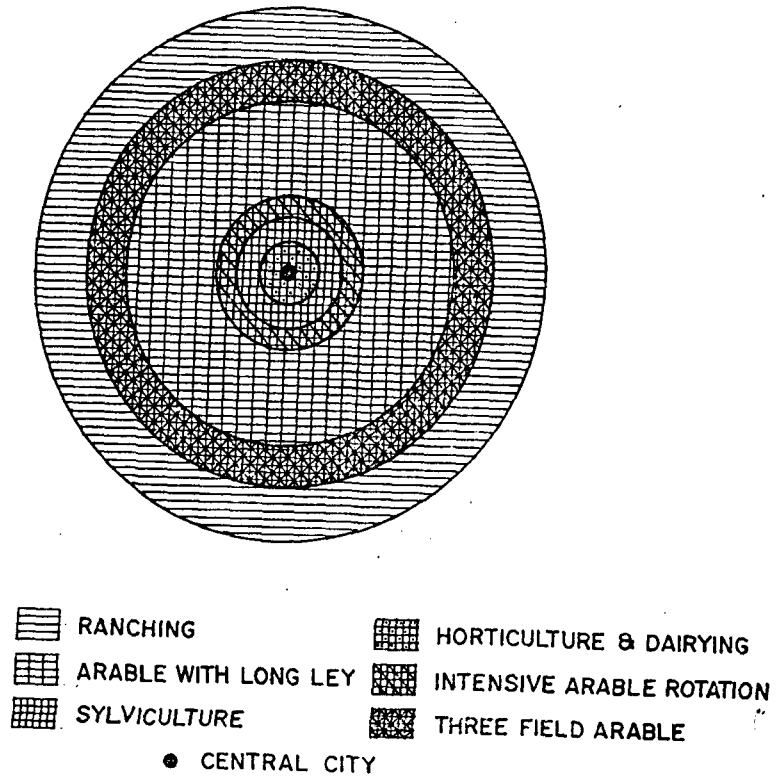


Fig.4.1

THUNEN'S ISOLATED STATE EFFECTS OF NAVIGABLE WATERWAY AND A SECONDARY CITY

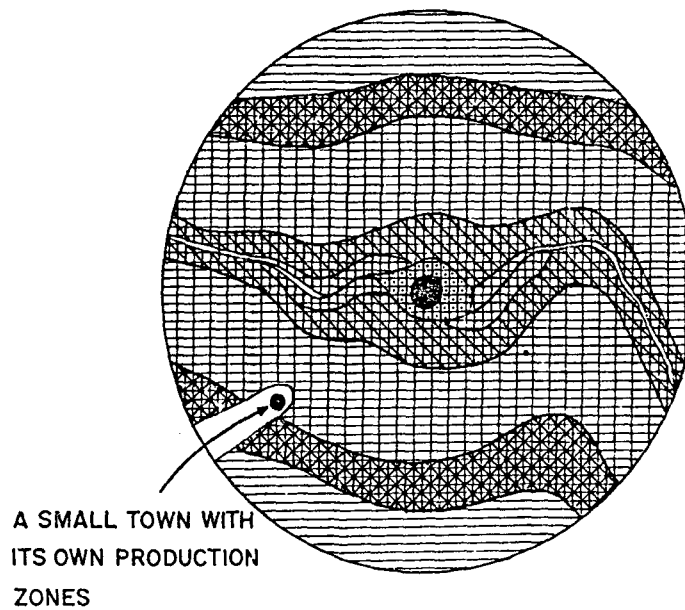


Fig.4.2

(Rakitnikov, A.N., 1978). Figure 4.3 shows a situation for a simple two market case. Both centres have the inner landuse zones organised in a concentric manner around them similar to that of a single market. However, the outer zones are displaced and take on an elliptical shape because of their orientation towards two markets rather than one. The line between them marks the boundary between the two competing supply areas. The existence of more than two markets (Fig. 4.4) produces a more complex picture. The products of the inner rings are oriented towards the individual towns, but those of the outer rings are oriented towards the entire cluster of centres. This complex graphical problem does not alter the conceptual framework of the analysis. The fundamental allocating mechanism of the bid-rent curve, based on location, remains the same.

VON THUNEN'S MODEL - AN ASSESSMENT OF ITS VALIDITY

The model presented by Von Thunen has evoked many discussions among the economists and social scientists. He developed two themes in his model of agricultural production : one, the theme of cropping intensity and the other that of crop landuse. However, the latter reflects upon the intensity of cultivation itself. The input cost increases and economic rent decreases with increasing distance from the market. The landuse or crop theory to correspond with spatial organisation of crop landuse around the market place is governed by the rationale of profit maximisation. Hence, it depends upon the yield of crops, money value of per unit of crops and the accrued transportation cost per unit of crop produced. The intensity theory states that cropping intensity decreases with increasing distance from the market place. It corresponds to the decreasing area of double cropping away from the market centre. Hence, intensity theory explains that intensity of agriculture depends on the farmgate price a farmer

EFFECTS OF TWO MARKET CENTRES ON
AGRICULTURAL LANDUSE ZONES

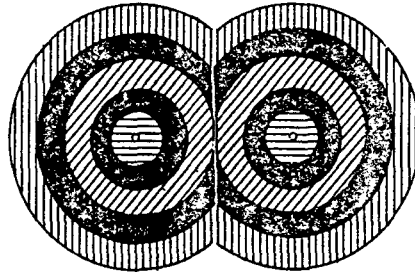


Fig.4.3

EFFECTS OF MULTIPLE MARKET CENTRES
AGRICULTURAL LANDUSE ZONES

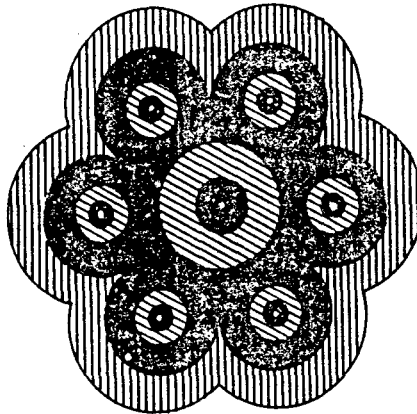


Fig.4.4

SOURCE : Lloyd, P.E. & Dicken, P. (1972). Location in space. A Theoretical Approach to Economic Geography. LONDON. P. 21 & 20.

receives for his agricultural produce minus the transportation cost, and the distance from the market. To compare the model of agricultural location put forward by Von Thunen with the present day agricultural systems of the world, it would not be out of place to mention those points which are the valid reasons for suggesting drastic changes in the whole body of the model, though, the efforts are not to reject the model altogether. The need of the reassessment of the validity of the Thunen's model arises out of the modern scientific, technological and social changes which are taking place gradually ever since Thunen put forward his hypothesis. These changes are dynamic and are actively engaged in redefining and reshaping the Thunen's model of agricultural location. Thunonian concentric zonal agricultural pattern is something rare in the context of the present day world. Such pattern was a dominant characteristic of agricultural production in the past, as in 1811 around London, despite the wide variety of soil types, agriculture was arranged in a series of concentric zones. This type of circular zonal agricultural pattern has been modified by the numerous complexities in the modern times, therefore, an assessment of both, the validity of the Thunen's model and the doubts about it, is essential. It is suggested that remains of pre-existing zonal pattern of agriculture can still be cited in the form of the inner most zone of agricultural production with intensive market gardening and liquid milk production around urban centres. Gottmann, found out that agriculture in megalopolis is highly specialized, with emphasis on market gardening, dairying, poultry and animal husbandry.

About the Thunonian zonal rings of agricultural production, Losch (1954) pointed out that in the two-product case, rings would occur in only ten out of twenty seven possible cases. Certainly a number of conditions

must be fulfilled for concentric land use rings to be evolved. Dunn (1954) further suggests that although the ring formation is clearly not visible in the two-product case, it almost certainly appears where multiple products are involved.

Some theoreticians feel that Thunonian approach regarding the distance to the market, as a basic factor in the analysis of spatial differentiations of the farm production systems is not altogether correct; because the locational patterns of the markets themselves need analysis. Distance may not be, therefore, fully responsible for the cropping systems and their patterns.

As far as the cost of transportation is concerned, Von Thunen does not limit himself to differences in transportability as well as to the effects of the length of haul on the transport rates in determining the location of farm production. The existence of long-haul economies in particular tends to encourage a greater volume of long distance movement with less emphasis upon short-distance movement. It makes sales and purchases possible at a greater distance and, therefore, extend market and supply areas of all types of products. In effect the price to the farmer declines more rapidly at distances near the market than at equal distances farther away.

These tapering freight charges transform the rent lines from a linear to a curvilinear shape, with the result of increasing spatial extent of market areas, also permitting to invade the market area of a competitor resulting in the larger market and supply areas with highly irregular boundaries which often overlap each other. However, this does not

necessarily destroy the zonal pattern of production. No doubt, the differential land rent, spatial differences in wage levels, and the prices of the means of production determine the locational patterns of the agricultural crops. But Von Thunen is quite logical to conclude the uniform real wages throughout the state and varying prices of the consumer goods in order to build up an ideal operation of the "law of value". Considering the "law of diminishing productivity of incremental outlays", the relationship between the levels of farming intensity and physio-economic factors set up by Von Thunen needs a reassessment, because he shows by his calculations that a relatively market oriented worse location is better for more extensive landuse, in which, soil nutrients are restored by natural processes, while a better transport-geographic situation is a justification for more intensive production systems. In this case, it is not the higher price received for grains but the prospect of driving higher yields from better soils that makes it economical to invest more inputs per unit area. Any decision to intensity the type of agricultural must be based upon the prospect of increasing yields as well as profitable operation in terms of costs and income. Preferable should be the one that would yield the maximum surplus value per unit of incremental outlays (Rakitnikov, A.N., 1978). Moreover the farming intensity is sometimes affected by religious taboos, distinction between rural-urban tastes, dietary habits, differences in income and level of development, enterprenurial skill their motivations and the extent of knowledge as well as governmental interference.

The optimal production system varies from place to place, and on the same place from time to time due to the fluctuations of demand and

other factors. Thus, the false law of “diminishing productivity of incremental out lays” is insufficient to justify the differences in agricultural intensity levels for different conditions of location and land quality. At the same time Thunen’s assumption that all the farmers in the ‘Isolated State’ were bent upon maximizing their income virtually does not hold good, because only the better trained, more highly motivated farm operators have such goals, many of the rest desire only to continue in their inherited way of life, satisfied with less than their full capabilities, and placing more importance to leisure.

Such farmers bank their decisions pertaining to the selection and location of crops upon the ever fluctuating prices, and costs in order to book maximum profits to the best of their guesswork. Hence, their decisions are based upon maximum likelihood rather than deterministic approach. It is therefore, imperative that farmer’s behaviour should also be examined related to normative economic model formulations.

As far as the relationship between the type of farming and technology of production is concerned, Von Thunen was able to highlight the differences in the technology of cropping and livestock management to objective economic conditions. Lastly, it can be argued that the patterns seen by Von Thunen about 170 years ago have been profoundly modified by the continuous improvements in technology, the transport technology in particular, such as refrigerated ships, trucks, railways, cars, etc., resulting in :

1. A long term persistent downward trend in transportation charges, reduced transit time, and more efficient handling methods. This

was aimed to level out regional differences, especially in the farmgate prices, received by the farmers. This proportionately reduced the force of the market attraction, and the role of distance friction for agricultural production, and brought about a corresponding drop in the slopes of rent-curves.

2. Easy and safe movement of perishables, like large scale export of butter, cheese, and chilled meat from New Zealand to the United Kingdom; similarly the increased speed and cargo carrying capacity of modern aircrafts have increased dramatically the transportation of range of flowers and small fruits safely to long distances, like the air lifting of California strawberries to New York, London, and Paris, as well as, transportation of rose buds and mangoes from India to several destinations in Europe.

In spite of all these modifications, concentric zonation of agricultural crops may still be recognized on a continental basis (Chisholm, M. 1962). However, no principle to determine the line of demarcation between the two forms of land uses has been elaborated by Thunen and his generalisations about the crop transition are inadequate. These inadequacies in his analysis can be attributed to his preoccupation with the empirical data gathered from his private estate.

Hence, in modern times the relevance of Von Thunen's hypothesis can be assessed only in the presence of laboratory conditions to be evolved in accordance with the existing socio-economic and technological conditions of his time.