CHAPTER- II:

THEORETICAL AND CONCEPTUAL ISSUES OF SPACE ECONOMY
AND SETTLEMENTS

2.1. Space and Region: - Space is defined as the geometric region occupied by resources, settlements, infrastructures and functions. The concepts of point, direction, distance and area are required for measurements and locations of objects and places in space. For example, a point which may be a farm, an industrial unit, a nuclear plant, a village, a city etc is just and exact indication of a location in space. Distance is a concept for describing the linearity of a space measured in metres, kilometers, etc., for instance, the length of a road, a conveyor, a tunnel, a river, a canal etc. If this is measured in terms of time consumption, then it is called a temporal distance. Area is a two-dimensional entity that can be measured in square metres, square kilometers etc., for instance the size of a village, a city, a playground, a farm, a reserved forest etc. Viewed from the planner’s approach, space can be conceptualized in two ways i.e as a linear entity and as well as an areal entity.

There exists a commonality in the concept of space. The concept of space conveys different meanings for different disciplines. Mathematicians conceptualize various kinds of spaces like metric space, Euclidean space, Banach space, Hubert space etc. Physicists speak of a space as that part of the boundless four-dimensional continuum in which matter is physically (rather than temporarily) extended. Mechanical and civil engineers view space as a geometric region occupied by bodies. The positions of bodies are described by linear and angular measurements relative to a coordinate system and thus the concepts of point, direction, length and displacement are required for measurements and locations in space. For example, a point is just an exact indication of a location in a space, requiring no space at all for itself. Length is conceptualized for describing the size of a body quantitatively by comparing it with a second body of known size. For two-dimensional problems, two independent co-ordinates are needed and for three-dimensional problems, three independent coordinates are required.
Geographers speak of the geographic space which is a natural space for describing man in his natural setting whereas economists speak of economic space by assigning some economic variables on a geographic space. Geographers and regional economists speak in common parlance of the action space. Geographers came up with the concept of action space which is nothing but a geographic space with emphasis on its relation to man’s actions in his daily life. Thus, Mayhew (1997:6) defines action space as “the area in which an individual moves and makes decisions about her or his daily life, including, for example, shopping, studying or working.” According to her, localities which are well known by individuals are more often chosen as the places to base their activities. The decision maker evaluates all the locations within the relevant action space by accrediting each with place utility but if none of these sites offers adequate utility, then that individual extends the action space by search behaviour. This means that a person will look for a suitable site for activity within the area best known to him or her. All possible sites are rated according to their degree of utility. If none of the sites within the action space comes up to scratch, the decision maker will widen the search area and in his process of doing that he becomes familiar with a new area and thus extends the action space. On the other hand, in describing the economic space, as quoted by Mukherjee *et al.*, (1990:8) Boudeville says, “An economic space is an application of economic variables in or on a geographic space through a mathematical transformation that describes an economic process”. Geographers theorized and deliberated on the concept and evolution of space and two approaches emerged viz (1) The Absolute and (2) The Relative Concept of Space. Munshi (1994:1) writes “There have been two distinctly different philosophical approaches to the concept of space in geography. One is the absolute concept of space in which it is a distinct, physical and empirical entity. This concept emphasizes spatial structure irrespective of process and is accordingly an essentially Kantian absolute conception of space. According to this viewpoint, geography turns out to be nothing but a study of geometry of space. Richard Hartshorne deals with space as an absolute entity – a historical, physical and empirical entity – and such unique and particular. He believes that geography is a science of
regions, studying regions in their uniqueness. This is an idiographic approach or the trade mark approach in which each region has its own private mark. Hartshorne, therefore, concludes that geography should be defined as a chorology i.e a science of geographical distribution rather than as a science of distribution and study of theories of location, that geographical studies should be directed to analysis of specific regions, to areal differentiation. Later, Hartshornian tradition is described as exceptionalism. The other view point holds that the structure of space at any given point of time can not be meaningfully studied without taking into account the time and the process. This imparts to space a relative rather than an absolute character”. Empirical evidences substantiate that even the two approaches of studying space evolved by geographers converge to the concept of a natural space. The definition and differentiation of a space and region is an exercise in delineating a particular area for specific planning purposes. Generally, planners differentiate space and region from homogeneity and continuity perspectives. An economic region is a localized continuous area whereas an economic space is a homogeneous area, not necessarily contiguous. Stilwell (1972:7-30) classifies regions into three types, viz. (i) Homogeneous spatial units; (ii) Polarised Unit and (iii) Programming unit. He advocates the essence of a spatial policy when the “take off” begins in the pre-industrial phase. On the other hand, he emphasizes that the transition from rural to industrial economy requires fundamental changes in spatial organization and even spatial spread of economic activities to minimise regional inequalities and to ensure resource-use efficiency. He identifies three types of problem areas viz. (1) underdeveloped, (2) depressed and (3) congested. Regional economists like Richardson et al, (1973:17) classify a region or space as homogeneous if it exhibits uniform characteristics or possesses similar economic parameters or i.e. when the production structures, occupational structure, consumption pattern, per capita income levels, population density, etc., are similar. So also when judged from geographic aspect, the topography, climatic condition, resources endowment etc., of a space or region are similar. Likewise, a region or a space can be considered as homogeneous when viewed from geopolitical aspects; it has similar geopolitical history,
cultural identity, party allegiance etc. Apparently, space and region are not amenable to interchangeable use since an economic region is a localized continuous area whereas an economic space is not. For example, in India, Punjab and Gujarat though they are not contiguous to each other but they form an economic space since they have relatively high per capita incomes and not a region whereas Punjab and Haryana though they have different levels of incomes, they constitute a region, say a wheat producing region as they form a contiguous area. The distinction of a space and a region can be understood better if they are explained in terms of set theory. That is to say a region is a sub-set and a space is a universal set with human beings, resources and other objects as elements. The definition of a region is derived fundamentally with reference to the purpose which warrants such classification and delineation of areas. In its abstract sense as conceptualized by the physicists, region is a part of space. A region may, therefore, be defined as the localized continuous area or a part of a space which contains resources that can be used for socio-economic development. Such development of a region can be induced through the application of proper planning techniques and appropriate technologies for the provision of functions in a desirable manner. Therefore, an aggregation of regions constitutes a space. Viewed from this aspect, the differentiation of the two entities i.e space and region converges to a common purpose with space assuming a larger dimension and region a smaller dimension.

The application of space in the day-to-day planning process, consciously or unconsciously, is already in existence. In agricultural production, space is one of the factors of production that enters as a biological input i.e a biochemical transformer involving the interplay of land, seed, manures and fertilizers. In industrial production, space enters as a distance or transport input for carrying the raw materials required for the production of a given output. In urban and regional planning, space plays the role of an essential commodity being demanded by people for multifarious uses like residential buildings, shopping complexes, recreations purposes, playgrounds, clubs, restaurants etc. Planners speak of segregated land use, mixed land use etc but in reality land uses exhibit a strong positive correlation with space only.

On the other side of a coin, space contains a friction to economic
development because it procreates varying transport costs due to the existence of a number of varying magnitudes of friction especially in hilly terrains. In this regard, Mahavir (2002:141) rightly put it “Space plays a twofold role: one hand, it is an input to production and a commodity demanded by private households for residential and recreational purposes; on the other, it is an obstacle to economic exchange, especially over long distance, since it gives rise to transport costs”. The above discussions point out the fact that there exists a relationship between spatial structure and spatial interaction.

Varied definitions of the term ‘spatial structure’ are available in books and articles, but the most commonly used definition is that ‘spatial structure’ refers to the locational arrangement of points in a spatial system. Some authors prefer to call it a ‘locational structure’. ‘Spatial interaction’ refers to the interdependence of a set of agents, e.g. firms and households in their process of exchanging goods, services and other information between settlements or points. Again some authors used the terms interconnectedness, connectivity, interrelatedness and linkages which are the synonyms of interdependence. This relationship is a focal point of attention in understanding the forces behind the spatial movement on a space. To distil the relationship among spatial structure, consumer preferences and spatial interaction, Lucia Lo (1991:132-145) presents a paper and argues for consideration of both locational and economic interdependence. In Section 1, he beautifully discusses the economics of spatial interaction as to how consumers reveal their preference in respect of the three commodities viz. bread, marmalade and strawberry jam and how they frequent to different stores to avail these consumers’ goods. He explains the preferences and trips generated by consumers with the help of indifference curves. In this Section, he illustrates four cases. In Case-1, he discusses the complementarity and perfect substitution, in Case-2 he discusses the imperfect substitution, in Case-3, he discusses the substitution of destination attributes and in Case-4 he discusses the locational substitutability. The above four cases shows how the two destinations are related in the sense that they can be independent, substitutable or complementary. In Section 2, he speaks of the destination
interdependence encompassing three aspects viz. (i) interdependence among destination goods, that is, strict economic interdependence based on preference towards various goods (ii) interdependence among destination qualities or relative attractiveness of destinations as measured, for example, in the case of shopping, by store size or inventory level and (iii) interdependence among destination locations, a measure of relative dispersion or concentration of destinations. In Section 3, he discusses the substitutability and spatial interaction. In spatial interaction modeling, the relation between trip frequencies and distance traveled is summarized by the distance decay function. In Section 4, he discusses the parameter variations in spatial interaction modeling. Though Lo’s theory relates to the spatial consumers’ behavior of commodities and their spatial interactions yet the summum bonum of his theory has great applications in functions-utility preference by the consumers. Kuenne et al, (1990) in their essays in honour of Walter Isard deliberate upon the essence of spatial structures, spatial markets, spatial price policies, spatial linkages etc.

Theories of decentralized planning and micro-level planning suggest that regionalization process or delineation/tessellation of region is important in identifying the thrust areas and local needs of the people for provision of functions. Some economists and planners delineate the regions into six categories, viz. a country as a whole is known as macro-region which breeds a national plan, a collection of several States as macro-meso region for a regional plan, a State as a whole as a meso region for a state plan, a District as a micro-region for a district plan and a C.D. Block as a super-micro region for a Block-level plan. They strongly advocate the essence of micro-level planning in a hilly terrain so as to ensure that benefits and other economic activities percolate down to rural masses. R.P. Mishra et al (1989:5-6) while emphasizing on the need to set up development centres in rural areas points out that in order to avoid congestion of economic activities and population in a few large towns, he propagates the setting up of service centres in small regions or designated areas. These service centres are the specially designed large villages or small towns which act as centres of development within small regions. They opine that with the transition of agricultural practice from mixed farming to specialized farming,
small centres may no longer meet the needs of the localities and thus centres might have to be functionally differentiated into various categories such as (a) the village-group centre, providing civic and economic services for four to eight villages, (b) the area centre, designed to serve ten to twenty five villages, providing services and facilities of a higher standard and scale, for example, cultural and social institutions and certain economic enterprises; (c) the inter-area centre containing mostly economic enterprises designed to serve a broad area comprising twenty five to fifty villages and (d) the regional centre in which the large scale enterprises are concentrated and shared by the whole region containing the village-group, area and inter-area centres and villages served by them.

From the above theoretical discussions, we find that the notion of a space and region is used in different disciplines viz., Mathematics, Physics, Geography, Regional Economics, Regional Science etc to convey different meanings. Though the two terms are well-knitted but they are not to be used interchangeably. Even within the domain of the same discipline, the above terms are used to connote two different things. Thus, different types of spaces viz. mathematical space, geographic space, economic space etc exist in varied disciplines. Generally, planners, geographers, regional economists, regional scientists, policy makers etc express their unanimity and define region as a space which is larger than a single urban area or a cluster of villages but smaller than a nation and thus has sub-national dimensions. Regional economists view a region or economic region as part of or a sub-set of space for both space and region. Planners infer that space and region are the two-dimensional entities. The concept of a region differs from country to country in terms of acreage and size. For instance, small countries like Israel, Greece and Kuwait etc., the size of a region may be equivalent to a District in India. For big countries like U.S.A, Canada, China, Russia etc, the concept of a region may possess similar attributes to that of the Indian context. A region may thus be classified in terms of its size as a large region, medium region, small region and a micro-region depending on the geographical space, human settlements, resources, institutional factors, consumers’ behaviour, etc.
2.2. Early Location Theories: - The incorporation of a space element in economic theories ignited the minds of economists to study the early location theories. It reveals the importance of those theories that led to the formulation of the General Theory of Location and Space Economy by Walter Isard (1949: 476-506). With the help of the above theory, space is expressed as a linear entity in the form of a distance input or transport input as Isard calls it latter and as well as an areal entity. This forms the basis of theoretical foundations to determine the transport rate structures and the optimum location of firms in a space. While measuring the magnitude of various economic variables moving in different directions, economic forces assume their own significant dimensions. Spatial dimensions have extensive use for the geographers in their analyses of human settlements, transport and other regional settings. Regional economists and later on, regional scientists as new comers, took a strong stand and recognized spatial dimensions as the major elements that interact or come into play in economic theories of production, supply, demand, consumption, distributions, trade etc.- in short, in the general equilibrium analysis.

Before 1950s, geographers, location theorists and economists like von Thunen, Weber, Englander, Ritschl, Christaller, Hoover and others had formulated various land use theories and incorporated space element for finding the location rent, optimum locations of industrial units, diffusion of functions, distance, labour, least transports costs, settlement patterns etc. It may perhaps be recalled that geographers and regional scientists define a settlement as a physical form of human habitation that exists in a space with economic activities. A location theorist studies settlements in terms of their locational existence in relation to human activities such as firms, agriculture, trade, factories, markets etc. To a common man, a village or a town or a city is recognised as a settlement or a place of dwelling. In view of the substantial contributions that von Thunen made in his land use theory relating to the determination of location rent, he is regarded as the father of the location theorists. However, despite such progress and tall achievements in location theory, no one had attempted to develop a systematic study for simultaneous integration of spatial and temporal dimensions into the general economic theories.
Von Thunen who is regarded as the father of the location theorist sought to explain the spatial organization through a formal model in relation to agricultural production. In his attempt to organize the society in the best interest of everyone, he developed his concentric ring model with the following assumptions.

1. He had two basic models.
2. Both were located in an isotropic plain where there was one market i.e the city for surplus agricultural production.
3. Only one form of transport was available.
4. Transport costs increased in direct proportion to distance.
5. No external trade took place.
6. Farmers acted as economic men.
7. All farmers received the same price for a particular crop at any one time.

The first model postulates that the intensity of production of a particular crop declines as distance from market increases because transport costs increase simultaneously and the locational rent is therefore lower. Intensive farming which demands costly inputs – is only profitable where locational rent is high to cover costs, so intensive farming takes place only near the city. The second model is concerned with the land use patterns. The model postulates the transport costs in terms of the bulkiness and perishability of the produce. A product A is costly to transport but has a high market price and is therefore farmed near the city. Product B sells for less but has lower transport costs. At a certain distance, B becomes more profitable than A because of its lower transport costs. Eventually, product C with still lower transports becomes the most profitable product. The changing pattern of the most profitable produce is therefore seen as a series of land use rings around the city. This phenomenon may be illustrated by a graph that shows the varying locational rent of three products, the most profitable product at each point and the land use pattern that results thereof. Figure 2.2.1 (p.40) shows von Thunen’s ring model. The model, therefore, postulates that horticulture and dairying are carried out by farmers at a nearest distance from the city. Economic activities namely silviculture, intensive arable rotation, arable with long key, three-
field arable and ranching follow in a consecutive pattern in terms of their respective distances from the city.

Figure 2.2.1: von Thunen’s Concentric Model of Land Use

In appreciating von Thunen’s theory in micro-level studies, as quoted by Barnes (1984:75-76) Schneider and Haggett write, “The importance of model construction for the understanding of reality is made evident with unsurpassable lucidity and forcefulness. The culmination, perhaps, that lucidity and forcefulness is von Thunen’s concentric ring model of agricultural land use, and which was later to connect directly to geography’s ‘neglected geometrical tradition’ of locational analysis.” But Barnes remarks, “How indubitable, though, are the methods used to derive such diagram? Following my earlier argument, I will suggest that von
Thunen’s work is intimately related to its local circumstances, and consequently undermining the idea of unfolding of a single abstract method that inexorably produced the concentric figure.” Bale (1986:46-65) discusses and reproduces Weber’s location theory and Losch’s Market Area Approaches in a simplified manner. Weber was the first geographer who had proposed the model of industrial location in the year 1909 that really got underway. The English version came out in the year 1929. Weber’s principle of transport costs is illustrated with the example given in figure 2.2.2. Considering the real world situation, he made the following simplifying assumptions:

1. Many raw materials are localized, i.e they are not found everywhere.
2. Some raw materials may be ubiquitous, i.e they are found everywhere e.g air & water.
3. Markets for finished products are fixed at certain specific points and do not consist of continuous areas.
4. Transport costs depend on the weight of the product and the distance which it has to be transported, i.e the cost of transporting a

*Figure 2.2.2: Weber’s Locational Triangle.*

- Many raw materials are *localized*, i.e they are not found everywhere.
- Some raw materials may be *ubiquitous*, i.e they are found everywhere e.g air & water.
- Markets for finished products are fixed at certain specific points and do not consist of continuous areas.
- Transport costs depend on the weight of the product and the distance which it has to be transported, i.e the cost of transporting a
raw material or finished product is proportionate to the distance transported.

5. Perfect competition exists, meaning that there are a very large number of buyers and sellers in an industry and therefore the individual buyers or sellers can not influence the price of the product by their own actions. For instance, the average national price of sweets would be unlikely to be affected if one small producer, serving a local market, started lowering his prices. The concept of perfect competition also assumes that, because the price of a product is unaffected by individual firms in the industry and because all goods they produce will be sold at the same price, revenue i.e price multiplied by quantity sold for a given volume of sales will not vary from one location to another. Therefore, if revenue is everywhere the same, the best location will be where costs of production are minimized. Thus the Weber model is called a ‘least-cost model’.

6. An industrialist is rational and is in command of all knowledge of all information about the conditions of a particular industry. Such a hypothetical animal is known as ‘economic man’ who attempts to maximize profits – in the case of the Weber model by seeking the location at which the lowest costs are incurred.

Based on the above assumptions, Weber set out to explain the best place for industry in a simplified world in the hope that the explanations aid industry in arriving at better locations of the world. Weber postulated that industrialists would set up their firms, i.e industrial units at the least-cost locations and such locations would be the optimum or best locations. According to him, three factors would influence costs and location and these factors were transports costs, labour costs and the cost savings from agglomeration or deglomeration. Weber’s locational triangle is shown in Figure 2.2.2 where M₁ and M₂ represent the sources of raw materials and C the market centre.

The application of Weber’s locational triangle is explained in figure 2.2.3 (Page 43) where C represents the market for 1 tone of product X which needs 3 tones of raw material from source M₁ and 2 tons of raw
material from source M₂. Assuming that all places within the triangle are equally accessible by transport and assuming that industrialists want to minimize the transport costs, depending upon the type of raw material (factor input) to be used, it would be more economical to place or locate the point of production (P) either nearer to the market centre C or to the sources of raw materials M₁ and M₂. His model indicates that, bearing in mind the assumptions, we can intuitively see that the pull of M₁ (3 tones) will influence the least transport cost location and that the plant i.e the location of a firm will gravitate towards the point M₁. The amount of water (i.e a ubiquitous material) as an input has a material index of only about 0.1, thereby suggesting strong market orientation.

**Figure 2.2.3: The Varignon Frame.**

A hardware model as shown in figure 2.2.3 called Varignon frame (named after its inventor, Pierre Varignon, an eighteen-century mathematician) can further illustrate this principle. The triangle consists of a string and pulley contraption with pulleys at each corner runs a length of
string. For the above example each piece of string will have one, two or three units of weight attached to it and will be passed through corners C, M₂ and M₁ respectively. The pieces of string are then knotted together so that the length between the knot and the weight on each is the same. Where the knot comes to rest it represents the optimum least transport costs location within the triangle. In this example, the production of the finished product is seen to be oriented towards M₁ that is, the industry is raw material oriented. Determination of the point of production i.e location of a firm (factory) with the help of Varignon frame is a cumbersome exercise. To simplify the matter, Weber then introduced the concept of a material index (MI) which would help to determine whether an industry would be market-oriented or raw material-oriented. He defines Material Index as the ratio of the weight of localized raw material inputs to the weight of the finished product and this is calculated as follows:

\[ M \text{I} = \frac{\text{Weight of localized raw material inputs}}{\text{weight of finished product}}. \tag{2.2.1} \]

If the index is more than 1, there is a weight loss in the production process and the industry is raw material-oriented. If the index is less than 1, the industry is market-oriented and if the index is exactly 1, the industry is located at either nearer to market or nearer to raw material or at an intermediate location. Thus, if for every 1 ton of pig iron produced at a blast furnace and about 4 tons of localized raw materials are used, the material index is \(4/1 = 4\). Such an industry is raw material-oriented i.e it locates nearer to the source of raw material. The brewing industry, however, which uses a large amount of water as an input i.e a ubiquitous raw material has a material index of only about 0.1 and thus suggests strong market orientations.

It is important to emphasize that not all raw materials are localized and that not all materials lose weight in the production process, for instance, the iron ore in the above example. Some materials, such as air and water are found everywhere i.e they are ubiquitous. Weber called materials with a heavy weight loss during the production process as gross materials and for those with little or no weight loss as pure materials and these are indicated in the Table 2.2.1 (Page 45).
Table 2.2.1: Weber’s Raw Materials Classification.

<table>
<thead>
<tr>
<th>Location</th>
<th>Weight Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gross</td>
</tr>
<tr>
<td>Localised or Sporadic</td>
<td>Coal, iron ore</td>
</tr>
<tr>
<td></td>
<td>Sand, gravel</td>
</tr>
<tr>
<td>Ubiquitous</td>
<td>Water for cooling</td>
</tr>
<tr>
<td></td>
<td>Water for brewing</td>
</tr>
</tbody>
</table>

(Source: John Bale’s The Location of Manufacturing Industry)

Weber also introduced another concept called isodapanes as shown in figure 2.2.4 (Page 46), for measuring spatial variation in transport costs in order to find the least cost location. Isodapanes are nothing but lines joining places, points or locations of equal transport costs which illustrate cost surfaces. In figure 2.2.4, N represents market and M the source of raw material for a simple industry with only one market and only one raw material. Assuming that it costs one money unit to transport the raw material per kilometer and ½ money units to transport the finished product per kilometer, the concentric rings around N represents lines of equal cost which are one money unit or 2 kms apart. Those around M, on the other hand, are closer together (the contour interval is still only one money unit) indicating that costs rise more steeply away from M than from N. These lines are called isotims. The isodapane is the line joining places of equal transport costs and is shown by the thicker line joining points A-F. At A, it is drawn where 2 cost units line around M intersects the 5 units line N. Thus the total transport costs at point A totals 7. At B, the 3 and 4 unit lines intersect, again producing a total of 7.

Labour costs lie at the heart of Weber model. Although Weber model is sometimes criticized for its over-emphasis on transport costs, it recognizes that the least transport cost location can be modified by the presence of a localized pool of cheaper labour. If the ratio of an industry’s labour costs to the combined weight of its material inputs and product outputs are high, a pool of cheap labour tends to attract that industry to a location different from the one resulting from calculations based on least
transport costs provided the savings from the cheaper labour exceeded the extra transport costs incurred in marketing the finished product. He uses the idea of the critical isodapane to illustrate the way industrial location might deviate from the point where total transport costs are minimized.

![Figure 2.2.4 Isodapanes](image)

**Figure 2.2.4 Isodapanes**

Lastly, Weber introduces the concept of agglomeration and deglomeration. He defines agglomeration as the ‘coming together’ of industrialists and industries. He points out that the least transport cost location can be deviated from if savings in costs can be achieved through agglomeration. While agglomeration produces benefits such as a reduction of the time taken up, and thus costs incurred, in visiting linked activities, the establishment of a pool of skilled labour or the generation of co-operation between plants, it is possible for the nucleus to grow too big for its own good. Congestion can develop and land prices can rise if too many industrialists are jammed together and firms may then benefit from deglomeration. The scattering of industries and industrialists is called deglomeration.
Thus a critical size of nucleus can develop after which benefits will be replaced by disadvantages. Such benefits and disadvantages which derive simply from the size of the nucleus e.g town or industrial area are called economies and diseconomies of scale. Since Weber model primarily applies to an industrialized economy, its details are not discussed here.

Figure 2.2.5: Losch’s Nested Central Place Hierarchy

In an attempt to rectify the weaknesses of Weber model viz., over-emphasis on transport costs, demand originates from one point (market), proportionate increase of transport costs with distance and weight, negligence of the type of transport used, unrealistic assumption i.e movement is equally easy over all forms of surfaces, existence of perfect competition, non-specification of the type of industries e.g light, medium, heavy etc., another German economist, namely August Losch came out with his model. Losch took a different stand from that of Weber. His theory does not help to explain the location of production but ventures to formulate the optimum market areas for firms in competing industries. As a locational
analyst he was able to integrate the various earlier [location] theories and provided a unified analytical structure. In particular, Lösch devised an integrative general equilibrium theory of the space economy, culminating in his mathematically derived generalized landscape of location of industry, and couched in terms of hexagon nets imposed on the landscape. Losch’s nested central place hierarchy is available in his book viz., the Economics of Location. The verbatim reproduction of the model is shown in Figure 2.2.5 (Page 47). The approach of Losch is best illustrated by considering the ideal supply area of a firm i.e something which Weber ignored. By ‘ideal’ Losh means the area which will provide the maximum profit. Assuming that farms are regularly spaced over a uniform surface and also assuming that one farmer decides to manufacture beer; then Losch discussed the extent of a trade area. To advance his theory, Losch constructed a Loschian demand cone as shown in Figure 2.2.6 (Page 48).

![Figure 2.2.6: Loschian Demand Cone](image)

P represents the point of production i.e the farm and PQ is the quantity which the farmer will obtain for his product at P. As we move further away from P along the PF axis, the price of beer will increase because of the costs of traveling to the farm to collect. Either way, the buyers will be paying more for it than if they live at P. At F no beer will be sold because the price is prohibitively high. Thus, QF represents the spatial demand curve for beer - sloping downward to the right showing that demand (not price) declines as distance increases. PF is therefore the distance supplied from P. If the demand curve is rotated through 360º, the demand cone is obtained and the market area is enclosed inside from P. QF is described as a space revenue curve. In other words, as we move further away from P, the revenue for the farmer gradually declines in
amount. Now if other farmers in the area start producing beer, they are most profitably able to serve the buyers outside the circular trade area centers on P as shown in Figure 2.2.7 (Page 49).

Thus a series of circular trade areas will grow up around the evenly distributed farms. Over time the trade areas shown in figure 2.2.7 may grow in size since some parts of the diagram are clearly unserved by any of the distributors of beer. Thus the stage might be reached as shown in figure 2.2.8 (Page 49) where circular trade areas touch each other with unserved areas in between. Because circles either leave spaces unserved or overlap each other, the most efficient shape of trade area for situation as shown in figure 2.2.8 is that of the hexagon. In the case of figure 2.2.9 (Page 49) each brewer has a monopoly over his hexagonal trade area. John Bale strongly criticizes both the Weber and the Losch model for being abstract from reality. He says “While the Weber model overstates least-cost location and geographical differences in costs, Losch appears to have been preoccupied with maximizing profits and spatial variations in revenue. Both Weber and Losch assumed decision makers to be rational and both produced models which are ‘non-operational’ in the sense that they deal with simple, abstract worlds inhabited by rational beings”. Similarly, Barness (1984:81) argued that Losch’s model is more complicated. Viewed from the agrarian and rural background of the present study, thus, von Thunen’s ring model has more applications.

**Figure 2.2.7**
Series of trade areas
Centered on points Of production

**Figure 2.2.8**
Series of circular trade areas with unserved areas shaded

**Figure 2.2.9**
Hexagons represent the most efficient shape of trade area
In spite of limitations and the non-operational nature of the models, the early location theories pioneered by the German school of location headed by geographers and economists help us to understand the importance of space and the nature of spatial organization. These theories stimulate geographers, sociologists, regional economists, transportation engineers, regional scientists, and planners to further their investigation and find out alternatives for the development new theories and models in the field of development planning. After the development of location theories by the German school of location during the period from 1826 to 1940, the American spatial science called Regional Science flourished in U.S.A from 1950 to 1970. The development of spatial science in America is mainly attributed to Walter Isard, an American regional economist - an MIT professor. The purpose of reviewing the early location theories is therefore not to integrate their whole sum and substance into the general economic theories but only the relevant part that relates to a spatial entity that help to widen and shape the acumen and insights of readers who undertake spatio-economic studies in a particular space or area.

2.3. Some Empirical Regularities of Space-Economy: - Isard (1956:55-76) presents the preliminary and cursory review of the works revealing the regularities associated with the distance variable. During the period between 1913 and 1936 i.e the time before his popularization of the theories, concepts and applications of the space-economy, authors like Auerbach, Lotka, Gibrat, Singer and others established some significant regularities associated with the variations in the distance factor. The rank-size rule for spacing of cities is claimed to have widespread validity at that time and is given by the equation:

\[ r.P^q = K \]  \hspace{1cm} (2.3.1)

Where q and K are constants for the given group of cities, r stands for the rank of a particular city in population and P its population. The above equation can be made linear in logarithmic terms as shown below,

\[ \log r + q\log P = \log K \]

Or \[ \log r = -q\log P + C \]  \hspace{1cm} (2.3.2)
Where \( C = \log K \).

Zipf, in his erudite work, presented the empirical findings on the rank and size of cities. Using the logarithmic scales for both the horizontal and vertical axes, he plotted the decennial data for the United States over the period 1790—1930 with rank along the horizontal axis and size along the vertical axis and found that the closest approximation to a linear distribution in terms of the equation (2.3.1) above seems to have reached in the year 1930 and the distributions for metropolitan districts of the United States for years 1940 and 1950 each show roughly as close an approximation to a straight line. Besides others, Christaller and Losch studied the spatial patterning of cities and recognized that resource inequalities tend to distort regularities inherent in the resistance of distance. Measuring the distance along the horizontal axis and the number of cities along the vertical axis, they show that as one proceeds from smaller to larger class sizes of cities, the distance separating cities of like class increases with considerable variation. Zipf measured the railway-express shipments of goods between 13 arbitrary cities in U.S in 1939 with the population-distance factor \( \frac{P_1 P_2}{D^{1/10^7}} \) along the horizontal axis and weight \( W \) in pounds along the vertical axis. Employing \( P_1 \) and \( P_2 \) as the population sizes of two cities and \( D \) as the distance between them he found that there exists a linear tendency of the data indicating a definite inverse relationship between tonnage of railway express and distance. He also found that the numbers of both telephone messages and bus passenger definitely fall off in linear fashion as the distance between any pair of cities increases. Using the data on internal migration within Cleveland, Zipf found that the number of families moving between separated areas varies inversely with distance. Ravenstein in his study of migration of people between settlements recognized the role that the distance variable plays in determining the intensity of migration. He supported his empirical findings with statistical data that “the extent of migration into a given centre of absorption from any given point, in general, varies inversely with the distance separating the two”. Stouffer in his attempt to generalize the relationship between migration and distance put forward his hypothesis. He assumes that there is no necessary relationship between mobility and distance. His hypothesis
states that “the number of persons going a given distance is directly proportional to the number of opportunities at that distance and inversely proportional to the number of intervening opportunities”. Mathematically, this is expressed as,
\[ \frac{\Delta y}{\Delta s} = a\frac{\Delta x}{x} \Delta s \]  
(2.3.3)

Where \( \Delta y \) equals the number of persons moving from an origin to a circular band of width \( \Delta s \), \( x \) equals the number of intervening opportunities i.e the cumulated number of opportunities between the origin and distances and \( \Delta s \) equals the number of opportunities within the band of width \( \Delta s \). Though Stouffer does not explicitly define the meaning of ‘opportunities’ and ‘intervening opportunities’ awaiting the migrants his hypothesis is claimed to have wide acceptance.

Heuristically, Stewart, following the Newtonian physics in his study of social physics formulated new concepts to observe the vital aspects of space-economy. He advanced his thesis (1) that the demographic (gravitational) force \( F \) of attraction between two groups of \( N_1 \) and \( N_2 \) average Americans separated by \( r \) distance is given by \( F = \frac{N_1 N_2}{r^2} \), where \( F \) acts along the line joining the two groups; (2) that accordingly their demographic energy by virtue of this force of field is given by \( E = \frac{G N_1 N_2}{r} \), where \( G \) is a constant; (3) that the potential which the group of \( N_1 \) individuals produces at the point where the second group is located is given by \( V_2 = \frac{G N_1}{r} \) and (4) that the potential at any point produced by the entire population of any given terrain is given by \( V = \int \frac{1}{r} D ds \), where \( D \) is the density of population over the infinitesimal element of area \( ds \), the integration being extended to all areas of the plane and \( D \) is not zero. Computing the potentials for rural areas in the U.S.A, Stewart claims that he obtains fairly good linear relations by plotting the data on potential for these areas against the data on each of the following; (1) density of rural population, (2) density of rural non-farm population, (3) rents of rural non-farm dwelling units, (4) value of farmland per acre, (5) rural road mileage per square mile and (6) railroad mileage per square mile. His finding for each case mentioned above is that, “as potential rises from area to area, each of these items tends to increase”. Similarly, human ecologists like McKenzie, Hawley, Bogue and others studied the spatial phenomena and
impact of distance in interrelations of human beings and environment. Among these, Bogue presented his summary findings in a forceful manner and neatly stated, “On the average, as the distance from the metropolis increases, the number of persons per square mile of land decreases. With increasing distance, each square mile of land area supports steadily decreasing average amounts of retail, trade, services, wholesale trade and manufacturing activities”. To demonstrate the existence of empirical regularities of a distance variable, Isard carried out the commodity-flow analysis of diverse commodities like cement, oranges, grapefruit etc by plotting the distance (in miles) along the horizontal axis and the weight (in tons) along the vertical axis and found that the data exhibit a linear pattern as he put it “Nonetheless, after an over-all view of the empirical material, it is undeniable that the friction of distance manifests itself in a number of important ways and markedly conditions the structure and functioning of critical sectors of the social system”. The above studies reveal that space can be analysed as a distance and as well as an areal concept.

Man requires resources for his sustenance on earth. Only few resources like air, sunshine, water, soils, human capital etc are ubiquitous with varying degree and extent of utilities. The distribution of other resources are uneven and discontinuous and in his efforts to ensure spatial mobility of these resources at some points (locations) to satisfy his wants, man has to employ various modes of transport which constitutes a complex system and forms a part of the general equilibrium analysis in the production and distribution of functions. This is mainly witnessed by the substitution effects. In order to overcome the effects of physical and locational separation of functions, transport geographers, transport economists, regional economists, regional scientists, planners and engineers collectively devise an efficient transport system for reducing economic distances by minimizing the varying magnitudes of friction on each route connecting the production points and the consumption points. Economic distance means the spatial or geographical distance covered in the movement of labour and good multiplied by the monetary cost involved in transportation. It is also defined as the distance that a commodity may travel before transport costs exceed the value of the freight. Any attempt to
ensure flows or spatial convergence of goods, services and information between production and consumption points warrants the study of time-space convergence. D. Janelle as quoted by Knowles et al (1976:36-37) formulated the theory relating to the time-space convergence. While measuring the extent of rapidness of places in converging each other, he used the following formula:

\[ \frac{TT_1 - TT_2}{Y_2 - Y_1} = \text{Rate at which places converge} \]  \hspace{1cm} (2.3.4)

Where \( TT_1 \) and \( TT_2 \) are travel times in different years and \( Y_2 \), and \( Y_1 \) are years in questions. He calculated the time-space convergence between London and Edinburgh. In the year 1776 it took approximately 5760 minutes (four days) to travel from London to Edinburgh, but in the year 1966 i.e 190 years later, it took only 180 minutes due to the improvements in transport network. Using this formula, the rate at which London and Edinburgh converges each other is easily found out as \( \frac{5760 - 180}{190} = 29.30 \) minutes. This formula provides an interesting method to show that the world shrinks temporally as transport technology improves. The formula can also be used to show that settlements rapidly converge between each other when transport system improves. On the other hand, places or settlements do not converge temporally if there are no developments in transport technology sector. On land, such improvements demand in automobile and transportation engineering sector, in sea, in ship building industry and in air, in aeronautical engineering.

According to E.L. Ullman as quoted by Tafee et al (1973:92-97), flows take place between regions induced by three basic factors namely complementarity, intervening opportunity and transferability. He identifies that supply of goods, persons and assets from one region to another exists due to the demand of that region. Secondly, this is backed by the ability of the demanding region to pay for the functions emanating from the supplying region. In this manner a two-way spatial mobility of materials and persons occurs between the two regions or places or points. Thus, regions are complementary to each other and this complementarity is the basis for interactions between them. If each region is self-sufficient, no flows take place between them. But this has never been the case in real world for no
area or region is self-sufficient in the endowment of resources. The Elysian world is excluded from our study.

In reviewing the above theories, we find that the authors did not explicitly elucidate about the meaning and concept of friction. On land, therefore, the state-of-art is to maintain the minimum economic distance which happens only if the angle of friction and the slope of gradient are reduced to the least possible. By angle of friction, we mean the angle of an inclined plane at which a body just begins to slide down the plane. It is nothing but the slope that a gradient makes with the horizontal ground. In applying the theories of spatial planning in any underdeveloped hill area, the role that friction plays cannot be underrated. In fact it is the frictional force that hinders accessibility of consumers to utilise the functions available at designated settlements or places. In hilly regions of underdeveloped countries, we visualize the existence of both vehicular and non-vehicular routes where persons, goods and other materials exhibit their mobility to and fro. In traversing a space on vehicular roads, the amount of friction can be measured in terms of transport cost i.e the amount of fuel consumption whereas traversing in non-vehicular routes, the amount of friction may be measured in terms of expenditures on foods, drinks, toiletries etc that a person or animals require in covering a particular distance.

2.4. The General Theory of Location and Space-Economy: - Walter Isard, an American economist, started the work of integrating the space element into the general economic theories in the year 1947. He (1949:476) thus, wrote “Theoreticians of today are chiefly preoccupied with introducing time element in full into their analyses, and the literature abounds with models of dynamic nature. Yet who can deny the spatial aspect of economic development: that all economic processes exist in space, as well as over time? Realistically, both time and space must be vital consideration in any theory of economics. Unfortunately, however, aside from those of the monopolistic competition school of thought, particularly Chamberlin, the architects of our finest theoretical structures have intensified the prejudice exhibited by Marshall. They continue to abstract from the element of space, and in doing so they are approaching a
position of great imbalance.” Isard vehemently criticized Hicks, Mosak, Lange, Samuelson and a host of other economists who ignored the essence of space element in economic analysis which, in reality, determines the production and distribution of goods and services of any given economy. Isard, (1949:477) also criticized Hicks as he put it “But actually he confines himself to a wonderland of no dimensions. Apparently, he assumes markets to be perfect, one price ruling throughout each of them. Or, otherwise expressed, transport costs and other costs involved in the movement within a “market” are assumed to be zero. In this sense the factor of space is repudiated everything within the economy is in effect compressed to a point, and all spatial distance disappears.” The Mosak’s work, *General Equilibrium Theory and International Economics* which he expanded Hick’s analysis to embrace an international economy but in his approach of doing so, he ignored space element. Thus judged from the spatial angle, Isard criticized Mosak that he also dwelt in a dimensionless habitat. Isard conceived the general theory of location and space-economy as the theory that comprehends economy in its totality. Isard did not only consider the mutual relations and interdependence of all economic elements both from the macro and micro aspects but also the spatial as well as the temporal (dynamic) character of the interrelated economic processes that enter into the picture. Viewing from the Isardian school of thought, even the Hicksian general equilibrium analysis is but a very special case of the general theory of location and space economy, because it concerns itself with the local distribution of factors and resources as well as with local variations in prices and thus with the immobility and spatial inelasticity of factors and goods. British authors and economists were influenced by the classical school and even while speaking of the international trade, they explicitly assumed away or relegated the spatial structure of the domestic economy to the background. On the other hand, it was the Lausanne school of thought i.e the German economics which resulted in the fusion of space with the general equilibrium analysis. Isard critically reviewed the contributions made by several authors prominently Alfred Weber, Von Thunen, Launhardt, Roscher, Schaffle, Englander, Ritschl and Predohl in respect of the general theories of location. This
stimulated Isard to present and lay down a heuristic principle by means of which he could order the spatial complexities involved in the location of economic activities. Though Von Thunen has been regarded as the father of the location theorists, yet the general theory of location, for a given stratum or a combination of strata, fails to get at the rule or rules governing structure and provides no common denominator in terms of which all the forces stemming from the various inter-relations can be expressed and evaluated, and by no means of which a net effect could perhaps be deduced. Such evolutionary approach helped in formation of the general theory of location and space-economy. He took into cognizance of the Predohl’s analysis on the location of a firm. According to Predohl, a shift of this enterprise toward the periphery implies that capital and labor outlays (including transport outlays) are substituted for land use outlays. The reverse takes place in a shift toward the central consumption point. Here an emphasis is given on the application of the substitution principle between transport outlays and local capital and labour outlays in locating a site of minimum cost by determining whether or not to process a product in order to reduce its weight or bulk. Within the category of transport outlay, there may be a substitution point involved in allocating a given portion between transporting a raw material lying at the periphery and transporting a raw material lying near the consumption centre. In this manner innumerable independent substitution points arise while determining the location of a given enterprise. The seed for developing the basic methodology is found in Thünen’s work. While reviewing Weber’s work, Isard opines that Weber does not develop an adequate technique or a heuristic principle which can order the spatial complexities to be involved in the total location of economic activities. The five strata model conceived by Weber simply records the interrelations of various strata and some of the reactions of one stratum upon another. Thus for any given stratum or combination of strata, it fails to get the rule or rules governing structure and it does not provide a common denominator in terms of which all forces stemming from the various interrelations can be expressed and evaluated to deduce a net effect. To remove such lacuna, Isard advocates the essence of the general theory of location and space-economy.
In order to strengthen the basis for an extensive use of the substitution principle in location analysis, Isard then constructed the general theory of location and space-economy which is an extension of Predöhl’s model. Isard distinguishes the two types of substitutions i.e distance inputs (later on known as transport inputs) and outlays. He identifies certain regularities in the variations of costs and prices over space because transport cost is a function of distance. Changes in transport costs are neither irregular nor unpredictable. Thus, as distance factor lies in the heart of locational analysis, obviously transport rates are the prices of the distance inputs. Unfortunately, location theorists shied themselves away from such concept. Hence production of goods is associated with the efficiency in choosing the right combination of the various types of capital, labour, land and distance inputs.

Isard unfolds the promising channels of exploration for further theoretical development. He recognizes the realistic economic theory which embraces the spatial structure of economic process, the spatial extent, bonds of markets and spatial interrelations of all economic quantities formulated by Weighmann. Considering the nature of obstacles to movement, whether they be economic, social, political or cultural; Weighmann advocates that the spatial mobility of factors and goods limits market competition. According to him, the existence of physical space implies immobility, limited competition and spatial inelasticity or negative spatial elasticity. He observes the space-economy (Gestalt whole) as a whole in its full array of spatial markets. In order to solve the problem of limited spatial market competition, he introduced the concept of “relative maximum” which states “As an increasing amount of physical space (therefore spatial resistance) is to be overcome in movement by an economic object, the time period necessary for such movement increases until it reaches a maximum-a maximum in the sense that given still more time a further spatial movement would be improbable because of the overpowering force of the countless obstacles”. When the time period reaches its maximum, competition ends and the competition field becomes bounded. In other words, the force of competition does not have the power to span a distance greater than the radius or axis of its field, irrespective of
the time factor for all practical purposes. Weighmann’s principle of relative maximum is closely related to the concept of friction in engineering mechanics and there is nothing vague in it if stated as a general law. The maximum principle concept has a strong application in the production and distribution of goods and functions in the hilly settlements because of the nature of their terrains. Isard also reminds the Weighmann’s forms of labour immobility and inelasticity. Analogous to the prominent Weberian technique, the long-run labour base is presented as a continually moving, organic process whereby labour step by step through varying intervals of time, gradually moves from farms or rural communities to giant metropolitan centres via towns and urban clusters of increasing size. The varying intervals of time are of three forms viz seasonal, cyclical and secular. The structural movement of labour is designated as one of the dynamic aspects of modern space-economy. With regard to the movement of capital goods, Weighmann distinguished between capital in substance and capital in title and obviously the former has limited mobility than the latter. He identified the variations in the spatial elasticity and marketability of capital goods. Isard felt the indispensable need to formulate a theory of space-economy than that of a traditional location theory. In sum, Isard criticized Weighmann’s presentation of the theory of space-economy as a rhythmic-moving Gestalt whole, lacks clarity and is merely a construction of imaginary model to support his argument. However, Isard concludes that Weighmann’s theory helps a researcher to obtain a penetrating insight into the subtle spatial relations of economic life that poses a challenging task for further investigation.

Isard then evolved a solvable system of equations for a space-economy. He recalled the contributions of Tord Palander who remarked that the Walras-Pareto-Casell general equilibrium theory in its present form is meaningful for a locational analysis only of an economic district where transports costs are zero, capital, labour are perfectly mobile and technical conditions of production are uniform throughout – in other words, where the district in question can be compressed into a point market. Palander contends that the deviations of a general equilibrium theory from reality by
neglecting freight costs on product based on distance and weight, transports costs for mobile production factors, equal real wages throughout the district, consumption as dependent upon location choice, etc., are severe. Censuring the general equilibrium analysis for its limitations as being static and urged with a sense of having a dynamic process, Palander forwent the Walrasian economics and opted for Launhardt-Weber tradition. Differing from Palander’s standpoint, August Losch presents succinctly a set of elementary equations representing a highly simplified static model of a space-economy operating under conditions of monopolistic competition. Based on his concept of a market, the Losch’s scheme of general equilibrium began by attacking the problem of location of the production of industrial goods alone. Losch put forth the following equations, either as given or unknown as shown in the Table 2.4.1 (Page 60). The position in the plain, of each production place of each commodity, is designated by a set of x, y coordinates; the boundary of the market area of each production place is described by a set of equations, each equation being represented by a corresponding Greek symbol in Table 2.4.1.

Table 2.4.1: Losch’s Spatial Model of General Equilibrium

I. Given:

- \( G \) = Total surface area
- \( m \) = Number of products
- \( r \) = Freight rate
- \( \sigma \) = Rural population per sq. km.
- \( \sigma^q \) = Population of the city \( P^m_q \)
- \( q^m \) = \( f^m (\bar{\kappa}) \) = individual demand for the good m.
- \( x^m_q = \psi^m (\bar{D}_q) \) = the factory price of the good m at place q as function of the total demand \( D^m_q = \psi \left( f^m, X^m_q, Y^m_q, \alpha^m_q, \beta^m_q, \ldots, \varepsilon^m_q, \sigma, \sigma^m \right) \)
- \( K^m_q = X^m (D_q) \) = the average production cost of the good m at place q as function of the total demand \( D^m_q = \psi \left( f^m, X^m_q, Y^m_q, \alpha^m_q, \beta^m_q, \ldots, \varepsilon^m_q, \sigma, \sigma^m \right) \)

II. To be sought:  

<table>
<thead>
<tr>
<th>No. of unknowns</th>
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</thead>
<tbody>
<tr>
<td>1. ( \bar{\kappa}^m_q ) = Factory price of the good m at location ( P^m_q )</td>
</tr>
</tbody>
</table>
2. $G_q^n = \text{Market areas of the location } P_q^n \text{ in sq. kilometers}$

3. $q_q^n = \text{The number of towns that produce good m}$

4. $X_q^n, Y_q^n = \text{Coordinate of the location } P_q^n$

5. $\alpha_q^n, \beta_q^n, ..., \varepsilon_q^n = \text{Equations of the market area’s boundary of } P_q^n$

Total: $4n + m + N$

(Source: - Walter Isard’s Theory of Location and Space Economy)

After spinning his web of general equilibrium, though his approach does not comprehend the space economy as a whole, yet Losh was the first theorist to encompass general spatial relations in a set of equations. Losch was able to accommodate Palander’s objections to spatial general equilibrium analysis. However, if Losh’s simple uniformity assumptions, which are basic to his model, are withdrawn and instead if inequality in the spatial pattern of inputs is introduced, then the entire analysis becomes complex. With regard to the Leontief’s input-output model, Isard remarked that by incorporating distance inputs to the Leontief model and by decomposing the nation into regions, the regions into states, the states into smaller geographic units, and so on, one can give an increasing amount of play to the spatial substitution operations. The model reflects to a large extent the inter-industrial relationships of space-economy. While discussing the interrelationships of trade theory and the general theory of location and space-economy, Isard recalled the contributions made by Weber who pointed out that classical trade theory ignored entirely the transport cost involved in traversing space. Weber criticized the classicists for overlooking the large portion of internationally distributed industry which is transport-oriented and which seeks the minimum transport cost with respect to raw materials and markets and for attributing to international division of labour and capital the international division of transport-oriented industry. Isard discussed the contributions made by Furlan, Englander, Ritschl, Weighmann, Ohlin and others in the field of international trade. He also discussed Ohlin’s interregional trade and inferred in terms of Weber’s criticism as the theory does not bridge the gap between interregional trade theory and general location theory because it does not incorporate
transport-oriented industry into its analytical framework and is thus inadequate for determining a policy. However, Isard maintains his stand that trade theory and the general theory of location and space-economy as synonymous because (1) location can not be explained without accounting trade and (2) trade can not be explained without determining the location. Trade theory is thus, regarded as a part of general theory of location and space-economy. During the period from 1953 to 1956, while working as the assistant professor of regional economics and as the Director, Urban and Regional Studies, MIT, Isard finished and published his path-breaking book *Location and Space Economy*, by which he integrated spatial economic theory with the body of neoclassical analysis along with the implied need to unify the existing location theories. The research in this direction relates to his early recognition of the need for a general equilibrium theory that includes space and time in its formulation.

Isard (1949:505) thus, infers “In summary, the general theory of location is conceived as embracing the total spatial array of economic activities, with attention paid to the geographic distribution of inputs and outputs and the geographic variations in prices and costs. Modern general equilibrium theory is a special case of this theory, in which transport costs are taken as zero and all inputs and outputs are viewed as perfectly mobile; international trade theory, in its traditional scope, is also a special case of this theory. One proceeds from the latter to the former by assuming a given locational structure of economic activities, by erecting appropriate barriers within the world economy to correspond to the boundaries of nations, and so forth. However, it is important to bear in mind that the distinction between trade theory and the general theory of location and space-economy is one of the definitions only. Trade theory can be redefined to be synonymous with the general theory of location and space-economy. And in a sense, too, because of the monopoly elements which almost invariably present in spatial relations, broadly defined general theory of monopolistic competition can be conceived as identical with the general theory of location and space-economy”. In view of his development of theory relating to space economy, thus, Isard became the first regional economist.
The essence of space element in the general theory of economics also stimulated another economist viz. Francois Perroux (1950:89-104) to delve deeper into the insights. He developed and invented various space concepts viz. the monetary space, the economic space, the abstract space, the Euclidian space, the political space, the human space, the banal space, the geonomic space, etc. as shown in the synoptical Table 2.4.2 (Page 64). The concept of a geonomic space and the relations between points, lines, surfaces and volumes is similar to the concepts developed in mechanics and physics. Economic space is important as it depicts the relations of economic units, prices, quantities etc. Thus, the present study is an attempt to synchronize, symphonize and configure both types of spaces i.e geonomic or spatial and economic spaces and translate them into real action for day-to-day application of planners, engineers, technologists, development strategists etc. Spaces which directly concern us are the economic spaces as defined by the economic relations that exist among economic elements. These economic spaces reduce to three forms: (i) Economic Space as defined by a plan; (ii) Economic Space as a field of forces, and (iii) Economic Space as a homogeneous aggregate. In real life both types of spaces (geonomic & economic) are equally important because movement or mobility of men, goods, services on various types of surfaces connecting one point to another such as one production centre to another, one consumption centre to another, one market centre to another etc exist. A focus is made on the application of geonomic space, banal space and economic space to prevent dissipation from economic analyses that centre around the localization of growth centres, market centres, service centres etc in the study area. In their discussions, Isard pointed out that some of the points expressed by F. Perroux had already captured by Losh. Perroux reserved that Losh’s fundamental visual angle differed from his approach and that the generalization in terms of “abstract space” is alien to Losh’s important contribution. Thus, he advocated another concept of space known as “monetary space”. He talked of the monetary space as defined by a plan for employment of money by this unit, plan for employment of money by individuals, money centres and states. He also emphasized on the dominance of gold standard, pound, sterling, etc in
<table>
<thead>
<tr>
<th>Space</th>
<th>Relations</th>
<th>Unit</th>
<th>Localization</th>
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</thead>
<tbody>
<tr>
<td>I. Geonomic Space (Eo)</td>
<td>Geonomic relations between: Points, Lines, Surfaces, Volumes</td>
<td>Men, Things</td>
<td>Geonomic</td>
</tr>
<tr>
<td>II. Economic Space (Ea)</td>
<td>Economic relations</td>
<td>Micro-Units of Production, Micro-quantities, Prices of micro-quantities</td>
<td>Economic</td>
</tr>
<tr>
<td>1) Space as defined by a plan (Ea₁)</td>
<td>Relation defining the plan of a unit. Relation defining the plans of the other units in the same set</td>
<td>Micro-units of consumption</td>
<td></td>
</tr>
<tr>
<td>2) Space as a field of forces (Ea₂)</td>
<td>Forces arising from a unit. Forces acting on a unit</td>
<td>Macro-Units of Production, Macro-quantities, Prices of macro-quantities</td>
<td></td>
</tr>
<tr>
<td>3) Space as a homogeneous aggregate (Ea₃)</td>
<td>Relations of homogeneity, relative to the units, relative to relations between these units.</td>
<td></td>
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</tbody>
</table>

**Table 2.4.2: Francois Perroux’s Space Concept.**

(Source: - F. Perroux’s Economic Space: Theory and Applications)

some national monetary spaces and their delocalization in the form of monetary flow towards international monetary spaces through banks and other financial institutions in which parties accepted convertibility and
multilateralism. As the present study relates to the micro-level analyses, further discussion on the role of monetary space is of no use because micro-level studies fall within the same currency system of the country. The present study is a humble attempt to configure the two types of spaces viz., geonomic and economic spaces and transform them into a single action space.

H.W. Richardson (1973:13) underscores the essence of studying regional economics or space-economy due to the conservatism that crept in the economic profession. He says “economists have been reluctant to accept that there is any regularity in the spatial organisation of the economy. The neo-classicists were steeped in marginalism and marginal analysis was frequently not applicable to the space dimension. They like smooth curves which were amendable to calculus, while distance function and other spatial parameters tend to exhibit inconvenient discontinuities. When they advanced beyond the static, spaceless world of their predecessors, they turned to dynamic problems, convinced that time was the crucial dimension (and after all it did raise fascinating problems). The analysis of distance and the spatial distribution of people and activities was felt to be the province of the geographers, a breed for whom economists have never had a high regard (quite unfairly, when we consider the advances in economic geography in the last decade or two) ... It is perhaps not surprising that the spatial distribution of activities was regarded as being determined primarily by non-economic factors, and that location was not considered as an important economic variable. These attitudes had serious results for the development of economic analysis; for instance, economists could confidently assume that international trade can be analyzed in a zero transport cost world”. He advocates the need to study, recognise and analyse the problems of location and space in their own right by regional economists and geographers. Similarly, Mennes et al. (1969:2-3) strongly recognizes the significance of space units while delineating the region or area for the purpose of developmental planning. Glasson (1974: 148-149) paraphrases the essence of spatial or regional models of planning by subdividing the spatial structure of a region into three basic elements viz. (a) grouping of tertiary services, (b) agglomeration of
industrial or manufacturing services and (c) development of transport links that gives rise to a linear pattern of settlement. He also quotes Garner’s six-ordered premises that form the basis of most models of regional spatial structure. However, he gets back himself to the well-known Christaller’s Central Place Theory who defines a central place as a settlement that provides services for the population of its hinterland. The above theoretical underpinnings and the works of erudite scholars helped us to deepen the insights of the theoretical bases. The objective of reviewing the literature in this regard enabled us to investigate the role of spatial inputs in micro-level planning especially in hilly terrains.

2.5. Distance Inputs and the Space Economy: - Isard (1951:188) recognizes the explicit fact that economic activities take place in a time-space continuum. To overcome the vague concepts like a land use unit, rent outlays at different sites, etc. utilized by Predohl and other inadequacies of location theorists, Isard came up with a definition and a simple common concept of distance input or transport input as he calls later on, as the movement of a unit weight over a unit distance e.g, pound-miles, ton-kilometers, etc. It is a movement concept, practically speaking, that takes place along a line, straight or otherwise. Thus distance input corresponds to exertions of efforts and other factor services required to overcome the resistance encountered in movement through space where friction is present. He demonstrates that practically speaking, no producer can concentrate only on labour, raw materials and cost of production by ignoring transport cost. Transport inputs are measured in terms of transport costs. One needs to understand the dynamics of agricultural landscape, the industrial and regional structure surrounding a settlement. In subsistence economy, a farmer with a given amount of capital and other resources chooses to apply his efforts at cultivating new land on the periphery of the hinterland of a growing town rather than cultivating intensively a more quantity of old land as he anticipates reaping greater returns because less quantity of labour is utilized and he is easily accessible to market. This is similar to the von Thünen model. He assigns some operational functions of transport inputs. He argues that if transport inputs are utilized profitably, an
assumption can be made that spatial extent of production is increased. This implies (1) spatial dimension of some production lines is lengthened e.g. extension of marketing and purchasing areas, (2) spatial dimensions of production lines are lengthened while those of others are shortened by an equal amount or (3) in case of two equally important groups of production lines, the increase in the spatial dimension of those lengthened is greater than the decrease of those shortened. Isard supports the theory puts forward by the psychologists and sociologists that man is social in nature and exhibits his propensity to associate with group of various sorts. Thus in their interactions with economic activities, some individuals exhibit positive space preference while others like hermits exhibit negative space preference. The hermits in general are ready to accept a lower productivity, a lower standard of living etc. to spatially set apart from the society. Similarly, the introverts exhibit a mild space preference because he is easily induced to lead a fairly isolated life. Contrarily, the extroverts exhibit a high space preference because the need for social interchange is acute.

Isard compares the spatial discounting as time discounting. The present value of a future product is equal to its expected future price discounting by the prevailing rate of interest. The discounting over space enables producers to compare the values of two or more goods, yields or inputs spatially separated and differently distant from any particular geographic point of reference. He calls this rate of discount over space as transport rate. He correlates the return or price corresponding to a distance input and the reply is the simple supply and demand approach conventionally used as is the case of supply and demand for a particular product by consumers. Therefore, the supply curve for distance inputs is positively inclined where transport rate is measured along the vertical axis and quantity along the horizontal axis. On the other hand, the expected demand curve for distance inputs is negatively inclined. Consumers anticipate that, given a state of technology, tastes and resources; as the spatial extent of production is continually lengthened through the application of more and more distance inputs, the additional product resulting from each successive lengthening, after a point, tends to fall off. Suppose an advance in the state of transport technology pushes the supply
curve of distance to the right and results in a lower price. For industrial production, both scale and substitution effect will take place. Historical evidences show that reduced transport rates tend (1) to transform a scattered and ubiquitous pattern of production into an increasingly concentrated one and (2) to effect progressive differentiation and selection between sites with superior and inferior resources and trade routes. As to the scale effect, the tremendous increase in output is engendered by the cheapening of transport. The fall in time and money cost of population movement can increase his level of social contact (space preference) and can consume more of other products. Due to the operation of the substitution effect, consumption of distance inputs is substitutable by the consumption of other commodities and services. Isard does not speak of a single transport rate only but cautions that in modern society there exists a multitude of transport rates that vary with the length of haul, nature of haul, type of commodity, degree of competition, character of topography, etc. He recognizes the prominent salient feature of distance input in its momentary character. A distance input is realized at a given time from the performance of various services. Thus, there can be no stock of distance input but only stock of services which can be used to yield distance inputs. For instance, an individual engaged solely in transporting goods represents a stock of potential labor services. It is misleading to conceive such individual as a stock of potential distance inputs. A locomotive should not be considered as a stock of distance inputs but a stock of services that can be utilized in combination with labour and other services to produce distance inputs.

Thus, going by the functional analysis of Marshallian approach, in a production process there are requirements for labour at a given place, capital at a given place, land services, organizing ability and finally distance inputs i.e the composite of services needed to move raw materials, equipment, labor and finished product to the appropriate places. Isard thus finally concludes that the important thing is to recognize the role that distance inputs do play in production and consumption processes.

2.6. The Locational Equilibrium of a Firm: - Isard does not only introduce the concept of distance input or transport input and integrates it in his
theory of space-economy but also formulated the General Theory on the Locational Equilibrium of the Firm. In demonstrating the utility of the concept of distance inputs in determining the firm’s geographical position, he fuses the traditional Weberian locational doctrine and the modern production theory. Using the locational triangle of Weberian scheme, he presents his demonstration as shown in the figure 2.6.1 (P. 69).

![Figure 2.6.1: Isard's Locational Triangle.](image)

Let M₁ and M₂ be the sources of two raw materials at eleven distance units apart and at twelve and ten distance units respectively from C where C is the consumption centre for a good produced with the help of these two materials only. Abiding by the Weberian scheme, he assumes that all labor and other services are available in the correct quantities everywhere on the plain at uniform costs. He posits that none of the quantities of the inputs and outputs embraced by transformation function changes as production moves from site to site on the plain except the distance inputs. He considers three variables viz. distance inputs in obtaining raw materials from M₁ and M₂ and distance inputs in transporting
the product to C. With a clear definition of weight units, distance inputs can be measured and variables become the actual distances.

Figure 2.6.2: Isard’s Transformation Curve (TS).

In illustrating graphically the equilibrium conditions between the quantities of any two commodities of the transformation function, he assumes a consistent set of quantities for all commodities as two. Assigning values to the variable distance inputs C, a TS curve is obtained as shown in figure 2.6.2 (Page 70). This is the locus of consistent production sites within the locational triangle CM\(_1\)M\(_2\). This locus of sites can be expressed in terms of quantities of distance inputs from M\(_1\) and distance inputs from M\(_2\). Thus, this locus yields for these two variables the transformation curve TS of Figure 2.6.2 which is convex to the origin Q. He also postulates that transport facilities of the same character radiate in all directions from all points in plain and that transport rates are proportional to weight and distance. Since the transport rate is the price of a distance input, relevant price ratios can be established and price-ratio lines can be constructed once the quantities of each raw material required per unit of product is known. For instance, if three tons of raw material from M\(_1\) and two tons of raw materials from M\(_2\) are required for one ton of product, then
each price-ratio line would have the same elevation lines AB and CD of figure 2.6.2. He presents his theory and interprets in the form of geometrical diagrams in order to visualize his theory and translate it into reality. In closing, Isard reiterated that with the concept of distance inputs he was able to extend modern production theory to cover spatial equilibrium of firm beyond the traditional Weberian doctrine. More important is that the concept of distance inputs or transport input is a common and operational one. Thus it facilitates the construction of a general theory to explain the intricately woven fabric of space-economy. However, it may be pointed out that Isard’s theory does not examine the role that varying magnitudes of friction exist in an activity space and act as determinants in the production and distribution of goods, etc in hilly terrains. Geographers recognise distance input as a friction that hinders spatial mobility of persons and goods. The present study advances its discussions and recognizes the role of friction in production and distribution of goods and information from one point to another in hilly terrains. The discussions relating to the applications of friction are made at Chapter 4.5. Such phenomenon affects the rate of investment, growth and development in a particular area.

While discussing the various development theories and strategies to be applied in an underdeveloped country or part of it, at the first instance, the characteristics of underdevelopment like low per capita income, low level of labour productivity, high level of unemployment, dominance of agriculture and petty services, low capital formation, lack of functions etc. as discussed in Chapter-I are also borne in mind. These altogether constitute the basic needs approach to study economic development. Such basic needs approach is recognized by development economists and planners. International financial institutions like the World Bank, IMF and ADB etc used to siphon off funds for creation of functions. It is in this direction that the development school of thought intensifies its theories and research works as Thirwall (2003:107) put it “The rationale of the approach was that direct provision of such good and services was likely to relieve absolute poverty more immediately than alternative strategies that would simply attempt to accelerate growth or would rely on raising the incomes
and productivity of the poor”. It is argued that based on some characteristics and developmental phases, one may obtain findings and might infer that a country or a particular region has reached a certain stage of development. Though the present study aims at investigating the role that an element of space plays and the necessity to provide functions at certain designated points, but it also threw light on the level of development that the study area has achieved so far. As such analyses are carried out with regard to subsistence farming, availability of functions in dispersed settlements as discussed in Chapter-IV.

The underlying principle for any country to make investments in different sectors is to alleviate people from the clutches of poverty. An underdeveloped country will set its objectives in mitigating such poverty corresponding to absolute poverty whereas a developed country makes such developmental efforts to alleviate people from relative poverty. To achieve such objectives, countries assign some development indicators at the macro perspectives and within the particular plan period a definite target of growth rate is proposed to be achieved. Based on the availability of natural resources, skill, managerial expertise, technology, existing capital and other factors that come into play during the production process, a country plans to produce some outputs for domestic consumption and as well as for exporting the same to other countries to enhance its export value at the international level.

2.7. Evolution and Concept of Production Functions:- The formulation of the law of diminishing marginal returns by Turgot the French physiocrat, the theory of population by Malthus, the works on the theory of distribution by Ricardo and other neoclassical economists ignited the minds of the latter economists who formulated the production function in the mathematical form. V.R Kata (1990) classified J.H von Thunen of Germany and Longfield of England as the older marginalists who independently broke up theoretically the combined dose of labour and capital and developed the marginal productivity theory of distribution to explain the relation between the marginal productivity theory of capital and profit. The physiocratic law of Diminishing Returns developed by Turgot mentioned
above operates on the principle of intensive margins. The Law of Variable Proportions formulated by the neoclassicists viz. Marshall, Wicksteed in England, J.B Clark in USA and Wicksell in Sweden and Walras in Switzerland by generalizing the Ricardian theory of rent is another maiden work that aided the modern economists to conceptualize the production function. Among the multifarious forms of production functions that are available in literature, Cobb-Douglas production function, C.E.S. production function and V.E.S production function are used world-wide.

The rationale of production economics is to present a comprehensive framework on various economic laws of production, factors of production, costs of production, marginal productivities of labour and capital, the forms of production functions etc. A firm or an industry will not produce any output unless the production system conforms to some economic laws and principles. Prominent economic laws that are widely used in the production system are (1) the law of diminishing marginal returns, (2) the law of variable proportions and others. Production economics enables an individual or a firm to manage things in an efficient manner and to ascertain that a production unit works within the economies of scale. This is called the optimum use of resources. In doing that, production economics extends to the application of ergonomics, managerial theories, land use planning, theory of demand, supply, cost etc. Production economics can thus be broadly classified into two categories viz (1) Agricultural productions and (2) industrial productions. All types of biological productions can be grouped under the former while all forms of non-biological productions including production of minerals, electronic goods, etc., come under the latter. Hence, the application of production economics in an underdeveloped area is also examined in the present study. Keeping in mind the objectives of the study, distance input or transport input is specified as one of the production factors. The purpose of estimating production function is to know the extent of influence of each variable including transport input on the output (Y).

2.8. Institutional Determinants of Development: - The study of integrated rural development in underdeveloped countries is not
commensurable without cognising the role of institutional determinants. However, before discussing the role of institutional factors, it is necessary to briefly discuss the role that varied cultures of the world play in the development process. It is delinquent to study development unless the role that institutions play is also referred to side by side. In economic parlance, institutions refer to norms, rules of conduct, and generally accepted ways of doing things, class system, private versus community ownership, educational system, political institutions etc. The culture of a man is shaped by the habitat and the environment he lives in. The cultures of many peoples around the world are influenced by geographical, biological, psychological, historical and economic forces. Overemphasis on any one of them may be misleading unless the role of each is properly investigated and weighted. Man can not exist unless he overcomes the frictions and challenges of his habitat. In this regard, Herskovits (1974) cited some examples. The aboriginal Australian has no hoe but his hunting techniques indicate great skill and resourcefulness. He kills a kangaroo with his traditional weapon and makes feasts and merriments. The pygmy Bushman of South Africa uses bow and arrows and moves cautiously toward the direction where ostriches live. He crawls on a space and imitates the movements of these great birds so cleverly that they do not suspect his presence until he approaches closer and shoots the bird. Kalahari Desert is one of the most uncongenial habitats in the world for man to live in. Applying his biological instinct, a pygmy uses ostrich-egg shells as container and fills them up with water during the season when water is available. He also finds out roots, bulbs and melon-like fruits containing moisture or store up liquids and consequently uses them as water to quench his dry throat and thirst. He also does not hesitate in sucking up water from a stagnant pool after fitting the hollow reeds with grass filters. The Eskimos who live in the Artic region reveal their finest adaptations of culture to habitat. Using the available resources at their disposal and their traditional technologies, they build dome-shaped snow houses called igloos. They use walrus ivory as eye-shields to protect them against the sun’s glare on the snow. In hunting walrus or whale, they use artifacts like detachable heads of spears for striking the prey by which
precious wooden handles are allowed to float unharmed and later on, they would always recover the same. They also efficiently make use of their dogs in pulling their sledges, the waterproof boats call kayaks. In Siberian Artic region which is inhabited by the Chukchi, the Koryak and Yukaghir tribes, we find that they adopt a different type of culture. Igloos are unknown to them. They make shelters out of skins that are sandwiched to wooden framework. The Siberians are herders rather than hunters. Reindeer is their economic mainstay. Besides these, we can also cite the examples of the Navaho and the Pueblo Indians of the southwest America, the Polynesians of the Pacific region etc on how a man adapts himself to a natural and cultural setting. Polynesians are the island dwellers. In order to gather foods and to have social and as well as economic interactions with other people, they become the expert navigators and sailors using their canoes as chief means of transport across the sea. For them, sea is the highway and is not a barrier. How many hours or days it will take to cross the sea is a question of overcoming the dynamic frictions like waves, wind force etc. The physical distance they actually travel is measured in nautical miles. This is a hydrous or aquatic space. The Polynesians developed a sea-culture or aquatic culture due to the influence of the habitat and the surroundings they live in. Anthropologists, geographers and biologists agree that habitat acts as a determining factor in shaping man’s way of life. Human geography or anthropogeography aids us in this regard. However, we shall not digress further. In the nascent stage i.e prior to the agglomeration process, space and environment do not allow the evolution of two or multi-culture of people or tribes living in the same habitat. Now-a-days, due to forces of attraction, varied cultures of different tribes and communities exist in towns and cities. Human settlements and cultures exist in an activity space only. For instance, starting from his abode, how many hours or days does it take for a hunter to arrive at a place of his prey is a question of space preference he reveals. It is in this direction, M.J Herskovits (1974:94) writes “Whether we study man or any other living creature, the dimension of space is no more to be disregarded than that of time. In the case of man, where culture, as Forde puts in, intervenes as a middle term...between the physical environment and human activity, the
problem becomes essentially one of assessing the interaction between the natural environment in which a people live and their culture. Human ecology has thus come to signify the study of this relation rather than the investigation of how man, the biological organism, has adapted himself to his geographical setting”. The influence of physical environment is so powerful in shaping man’s culture. The limited availability of space pushes up people’s activities towards the sky. On the vertical plane, to meet his needs using the advanced technology, man overcomes the friction of gravitational force. Settlers of Manhattan Island have developed a skyscraper culture. On the horizontal plane, it is connected to the mainland by bridges, tunnels and ferryboats for transshipping of persons, goods and other objects. Skyscraper culture is also seen in Chicago despite its clayey substratum, people built skyscrapers on piles and caisson foundations driven deep into the ground. This connotes the existence of civilization amongst the settlers in relation to their habitat. The cultures of these settlers are attuned to difficult habitats. The settlers use their sophisticated technologies to utilize the available resources optimally in achieving the state of advanced civilization. Coming to the Indian scenario, we find that people who live by the side of sea shores or big rivers viz., the Tamilians, the Kerelites, the Orriyas, the Bengalese, the Assamese etc., developed the aquatic culture of ferrying, boating and pisciculture. For them, in addition to agriculture, fishery is another important occupation because it remunerates an income in order to sustain their livelihood and they adapt themselves to the habitats they live in. This is how habitats influence peoples’ cultures.

The Ifugaos of Philippines grow rice in irrigated terraces. They grow rice at high lands with altitudes ranging from three to five thousand feet. They let water flows downwards from the highest point of terrace to the lower terraces and in this manner they water their paddy fields. These days, farmers of Philippines use the modern methods of farming in hilly terrains call the Sloping Agricultural Land Technology (SALT-1), the Small Agro-Livestock Technology (SALT-2) and the Sustainable Agroforest Land Technology (SALT-3). These simple methods of farming the hilly land without losing the soil are developed by the Mindanao Baptist Rural Life
Centre, Philippines. SALTs are simple, applicable, low-cost and timely methods of farming the uplands. The methods are suitable for controlling soil erosion and siltation. Hartshorn & Alexander (1988) discuss the various stages of primitive activity or subsistence activity that people in the world undertake. People are considered primitive when their material culture is simple in form and function. Despite the existence of the simple material culture, the non-material aspects of life like religion, language and social organization are extremely complex and even sophisticated. They identify four types of subsistence activity viz. primitive gathering, primitive hunting, primitive herding and primitive agriculture. Primitive gathering represents the lowest order of economic activity and experiences continual retreat as a way of life. This earliest form of subsistence activity persisted in some parts of the world viz., Amazon basin, the northern fringe of Australia, the interior of New Guinea, Burma, Thailand, Japan, etc. In primitive gathering, peoples sustain exclusively on the products supplied by nature. Gathering requires the least amount of capital investment and effort but extensive space is required to support each person. Yields per acre and yields per person are so low that surpluses are almost non-existent. Man-land ratio low comprises two persons per square mile. Health condition is generally poor and their life expectancy is short. Hunting occurs in high-latitudes zones especially in artic areas e.g. America, Southern Africa and in the interior parts of Australia. In this occupation, people share some common characteristics with the gatherers like fire making, food preparing, tools & manufacturing and shelters construction. Both groups have no domesticated food plants and animals except dogs and permanent settlements. Hunters learn the techniques of food gathering and prey capturing more. They invent a variety of traps, snares and lethal weapons such bows, arrows and spears. Interestingly, primitive hunters are credited with maintaining of a fine balance between the supply and the harvest of animal resources. Though hunters adopt the higher level of technology than the gatherers but food productivity is low and often life precariously closes to starvation. Next follows the primitive herding known as pastoral nomadism. This occupation involves domestication of animals like sheep, goats, cattle, horses, camels, reindeer and yaks. This is a more advanced
economic activity than the former two since herders make at least some investment to enhance natural production. In this form of occupation, labour becomes the major factor of production with traditional capital like sticks, ropes, daos etc. and animal as the product (output). Human beings are no longer the parasites. They do not depend anymore on the nature’s bounty but now they make investments of their own. However, this economic activity requires more space. The material culture of pastoralists is characterized specifically by a dependence on domesticated animals. The economic needs of nomadic herders are met by animals that feed on wild plants rather than on cultivated crops. Animals give them foods, clothing materials, shelters, excrement and tools. This economic activity is migratory in nature as herders live in a particular place or area only for a few months or years as long as the supply of forage and water suffice the need of their herds. Therefore, herdsmen practice transhumance by moving to places of higher altitudes to find forage for their animals and in this manner they recognize the influence of physical and climatic factors like seasonal variations, different elevations, precipitations, temperature, relative humidity etc. Some of the herdsmen after finding places that are suitable for agricultural undertakings they adopt agricultural techniques from their neighbors and coolly give up their herding habits. The casting off of pastoral nomadism by some herdsmen is the beginning of agricultural undertakings of human beings. In this connection, Hartshorn & Alexander (1988:32) rightly put it “On the margin of nomadic herding areas there frequently occurs a process that might be called cultural osmosis, whereby some nomads quietly shed their herding habits, settle down at the edge of agricultural areas, and adopt cultural techniques from the neighbors”.

Primitive agriculture in different parts of the world has different forms and is known by a variety of names like shifting cultivation or Jhum cultivation or slash-and-burn method of cultivation or rational bush-fallow cultivation. Now-a-days, this type of occupation is found mainly in the three broad regions of the world viz. (1) Central Africa, (2) South East Asian countries including Sumatra, Borneo, Papua-New Guinea, Burma, Thailand, Cambodia and adjacent portions of India and China and (3) the Amazon basins of Central America up to southern Mexico. The prime characteristic
of primitive agriculture is that farmers employ similar technology to prepare fields for planting. They continually clear land by felling down thick forests or overgrown savanna trees and employ primitive methods using digging sticks or a hoe for preparing the soil at the time of planting.

Thus, human beings undergo different stages of development from food gathering to hunting and then cattle rearing and finally agriculture. Such process of transformation is called cultural metamorphosis and it involves changes in both material and non-material culture. The rate of change of non-material culture is slower than that of the material culture as it involves social parameters viz. beliefs, social organizations, political institutions, folkways, marriage laws, land tenure system and other institutional factors. Some people are slow of heart to accept the latest innovations and to induce the latest technology in their agricultural undertakings due to the operation of the institutional factors. Thus it is comprehensible that development takes place through the interactions of economic and institutional variables that transforms the gathering economy to agricultural economy. Physical environment impinges on the kinship system, religious rituals, folksongs, folkdances, folk-music, folk-crafts, folk-arts, folkways, folk-customs, folk-society, political institutions, social structures etc., to a large extent. However, this is another area of study. Thus, besides capital, labour, technology etc one can infer that institutional factors determine the developmental process.

Technological progress is a sine qua non for resource augmentation in both agricultural and industrial production besides development of intangible human resources through trainings, researches etc. For example, advancement in irrigation technology viz. construction of dams, reservoirs, aqueducts, canals and other hydraulic structures enable farmers to exercise water-flow controls for timely supply of water to their fields to fetch the hungry crops. This helps to increase their returns. Similarly, invention of the latest machinery and equipments increases per capita output and ensures economies of scale to industrialists. Indisputably, investment in both tangible and intangible capital is a necessary and sufficient condition for economic development to take off. This improves the
efficiency of production of outputs and enhances economic values and boosts the gross national product (GNP) of a particular country.

However, it is a common experience that some peoples are slow and reluctant to adopt technology transfer in respect of agricultural production, creation of assets, human capacity building etc which ultimately retards the cycle of economic development and growth. One of the reasons for their declination to accept technology transfer is due to the operation of institutional forces. Institutional economics is a branch of economics that studies the role and effect of institutions in development. It is thus, necessary to briefly review its applications. One can not deny the fact that institutions and culture play their roles in the development process. Institutions are the major components of culture. They are embodied in the culture of any tribe and people and are inseparable. Institutions and culture are the components of the social system that exert significant influences on the economic system. In defining the meaning of social system, Todaro et al (2009: 48) writes “By social system we mean the interdependent relationships between so-called economic and non-economic factors. The latter includes attitude towards life, work, and authority; public and private bureaucratic, legal, and administrative structures; patterns of kinship and religion, cultural traditions, systems of land tenure, the authority and integrity of government agencies; the degree of popular participation in development decisions and activities; and the flexibility or rigidity of economic and social classes”. Obviously, as part of social system, institutions induce the process of decision makings. Besides prices and income, food habits, beliefs, social obligations, etc determine the consumption pattern of a particular family or community. Ethos and manners of people especially those who are greater in rank strongly determines their propensity to save. Consequently, such attitudes affect the saving-income ratio. Institutions are as rigid as human minds themselves. Thus resource endowments and the levels of acceptance of technology are conditioned by institutions and culture as Hayami (2008:11) rightly put it “The productivity of economic subsystem, is conditioned by culture and institutions in society. Broadly defined, institutions as well as technology are a part of culture. However, culture is here narrowly defined to imply the
value system of people in the society, while institutions are defined as ‘rules sanctioned by the members of the society’ including both formally stipulated laws and informal conventions. Cultures and institutions thus defined are inseparably related...It has been the tradition of modern neoclassical economics to analyse the workings of the economic subsystem under the assumption of fixed preferences. Such an approach would be effective for the analysis of a situation in which the upper subsystem was relatively constant. Yet, the approach would be grossly inadequate for dealing with the wide range of economic development within which major cultural and institutional changes inevitably occur.” Even modern education system has the least scope to change the ethos, age-old traditions, customs and usages of the people in totality. Inefficient institutions beget various traps viz. poverty traps, low productivity traps, Malthusian traps, child labour traps, etc. Institutions determine the levels of acceptance of changes by the people. Rigid institutions which are not compatible with technological progress continue at the expense of the overall welfare of the society. Institutions that heavily depend on the welfare society are nothing but inefficient institutions. Inefficient institutions are economic parasites that invite social forces which are opposite in reactions. In the long run, inefficient institutions will disappear and instead efficient institutions will occupy their place in the society. Thus, technical progress varies directly with the institutional changes. As the rate of change of institutions increases positively, technical progress also increases and vice versa. Therefore, institutional innovations in some areas of the society are essential for technological progress to follow suit. In this regard, Hayami (2008:28) also observes, “To exploit the great opportunities in technology borrowing, and adjust foreign technologies to the economic and social environment of developing economies, institutional innovations are called for in areas such as market structure, industrial organization, labour management and regulation, research, trainings and education systems. However, rapid adjustments to rapidly changing economic forces are not easy. Institutions are slow to change, as they are strongly constrained by cultural traditions and social customs”. Integration on the institutional plane involves stakeholders and agencies functioning in the fields of agriculture,
industries, roads, power, financial institutions, trade, research, education, public health, sports, tourism and others. Institutional innovations concomitant with the technical progress is a necessary condition to liberate economy from the dependency path and cobweb of poverty.

Some settlements are more active and the others remain less active to institutional changes towards growth and development. In this regard, Mishra (1980:63-64) observes that chronological age and size of settlements strongly affect development, innovation and new changes. According to him, old villages are more prone to be inactive and inoperative due to established norms, conventions, values, prejudices, inquisitiveness, orthodoxy, jealousy, enmity etc that work behind the attitudes of the settlers. On the contrary, new villages are more responsive to development opportunities. Inhabitants of new villages are more co-operative, more efficient, enthusiastic, risk taking and broad-minded. They are perceptive to new innovations and changes. Middle-aged villages are a mix of the characteristics described in the cases of old and new villages. The above discussions reveal the fact that institutional innovation is a necessary condition of growth and development.

2.9. Spatial planning: - Human activities take place in a space according to resources endowment. To ensure optimum resource use, a realistic planning exercise should contain the economic, social and spatial dimensions besides the technological dimension. Such planning strategy will induce all-round development to the people of a particular area or region. Spatial planning is generally associated with the identification of resources and choice of location for the provision of the demand-driven functions to a particular community in any area or settlement. In elucidating the meaning and concept of spatial planning, R.P. Misra et al (1998:223) writes “Spatial planning is the sum total of the concepts, approaches, methods and techniques of evolving a desired spatial organization and structure. It is often used as coterminous with regional planning. Theoretically speaking, space is a dynamic and open system. Unlike a region, it has no boundaries.” Thus space is a universal set whereas region is a sub-set as discussed in 2.1. Obviously, any planning exercise takes
place in an activity space. For all practical purposes, economic planning without spatial planning lacks locational guidance and is myopic of resources identification and therefore does not give good innings. In this regard, Mukherjee *et al.* (1991:249) writes “Spatial Planning implies a systematic effort to locate facilities (such as roads, schools, factories and houses) in relation to human settlements where all people can use them to maximum advantage. Unless this is deliberately done, infrastructural investments of sectoral programmes would be made in locations randomly determined which may not converge in desirable combination at the most optimal locations, which can affect economies of scale in movement of men materials and better utilization of facilities”. Spatial planning, in its broadest possible sense, may therefore be defined as a design for provision of the demand-driven functions at the accessible places or settlements by public or private authorities for optimum use of consumers. It is an act of representation of resources and functions in a space in accordance with the desires and aspirations of the settlers. This can be achieved by cognizing the economic distance and varying magnitudes of friction that are contained in a space connecting the two settlements. Spatial planning assures spatial mobility of labour, raw materials, resources, outputs and other objects from production centres to consumption centres and vice versa. A planning exercise is not pragmatic unless the spatial structure of a particular area is also reckoned. In reiterating the scope of spatial planning the Report of the Working Group on District Planning, Planning Commission, Government of India (1984:70), writes “In the fullest scope, spatial planning covers all spatial manifestations including those arising out of human activities, both economic and social. As such, a complete or comprehensive spatial planning exercise will take into consideration the physical resources, land-uses and all human settlements in a region right from the smallest settlement to the sprawling city. It also concerned with all types of flows of people, resources, communications and goods and services, which are relevant for planning the levels of economic and social activities in the region. Thus it will be seen that identification and choice of locations is just one among several concerns of spatial planning.” There are some theories and principles of spatial planning that are elusive,
abstract and inconclusive but there are also others which are of great use. The whole spectrum of human settlements ranging from a village to a metropolis needs to be strengthened and integrated into mutually sustainable networks of production, distribution and exchange centres. Thus spatial planning is an integral part of micro-level planning of a given area. Prioritization of development sectors is merely a necessary but not a sufficient condition of improving the living standards of the people. In attempting to alleviate people from the cobwebs of poverty and to reduce the economic disparities that exist between the under-privileged and the socially-privileged class of people in a society, an adequate spatial system should be evolved for diffusion of resources and functions. Since spatial planning concerns with the identification of resources and choice of location for effective provision of functions its role is always considered indispensable.

After delineating the planning area, a planner shall focus only a certain category of settlements in which relevant functions are to be provided. Planning Commission, Government of India, in its Report of Working Group on District Planning (1984), assigned some tasks to a spatial planner. These are (i) identification of supporting infrastructures for improvement of the quality of life and promoting the economic activities, (ii) identification and correction of the existing imbalances in the available infrastructural facilities for both the point-bound functions and as well as the connective functions and (iii) design of appropriate settlement patterns for promoting human activities in a given space. Based on the principle of functional interdependence and functional distribution of income, one of the objects of spatial planning is to identify economic linkages and social contacts among a group of settlements. Functional interdependence means the relationship between settlements and the available functions whereas functional distribution of income refers to distribution of income earned by factors of production disregarding who own these factors. Based on this classification income is divided into income earned by labour e.g salaries and wages, land e.g rents and capital e.g profits. It is possible that an individual obtains income from more than one source. Another type of income distribution is personal or size distribution of income. Settlements of
the given planning area require some functions for their consumption and the range of functions varies from one settlement to another. In extreme cases, some functions which are considered essential for production and consumption may be located in such settlements.

Demand-driven functions should be provided only in those settlements which have the threshold population. For instance, for locating a PHC (primary health centre), a population threshold of 30,000 persons for plain area and 20,000 persons for hill area may be needed so that the unit cost of service will not be unreasonably high. If a settlement does not possess the above population threshold, then despite the existence of the potential users, it does not qualify to have the PHC. To make the function cost-effective, a spatial planner needs to identify the peripheral settlements and applying the yardstick of a frictionless distance, threshold population etc., clustering of settlements to a particular central settlement shall be carried out to induce functional centripetalism in it. This implies that settlements of higher hierarchical order should possess higher functional hierarchy. This process is repeated for clustering of central settlements for the formation of a service centre or growth centre and so on.

Identification of functions and settlements is not a complete exercise unless the study is accompanied by fundamental maps viz., (1) base maps, (2) spot maps, (3) cross-hatched or shaded maps and (4) maps with graphic forms. Maps are the powerful tools in spatio-economic studies as they aid a planner in locating problems, verifying hypotheses, discovering data, depicting resources and portraying all natural and as well as artificial endowments of a given space. Among the above, base maps are most essential because they portray the physical, natural landscape and social environment of the study area. Thus, as quoted by P.V.Young, E.F. Young (1996:417-418) writes “Maps of this kind provide an important background or framework for primary data which are superimposed upon it, and in this way greatly elucidate as well as facilitate analysis of the spatial patterning of social phenomena”. Characteristics of physical environment viz., lakes, rivers, ravines, prominent hills, etc. are generally included in base maps. Other cultural entities like settlements, farmlands, market centres, growth centres, parks, schools, roads, boulevards, railroads, railway yards, canals,
industrial areas, cemeteries etc are portrayed in base maps. In India base maps are prepared from the latest topographic maps of the scales 1:50,000 and 1:2, 50,000 respectively. However, the final choice of the scale of map depends on the size of study area and the type of study one undertakes. Therefore, mapping of a given planning area or region indicating the settlement patterns, spatial distances from service centres, market centres etc. is a desirable condition for a particular object of study. This aids a spatial planner to visualize the ground realities and evolve a suitable action plan for developing a particular area.

2.10. Meaning and Concept of Settlements: - Geographers are the precursors in dealing with settlements with regional scientists as the late comers. Settlement is defined as any form of more or less permanent human habituation in a space with economic activities. A settlement may be a village or a town or a city. Settlement connotes the basic arrangement of houses and footpaths or roads. Incipiently, it may begin from a single house and with the passage of time, it transforms to a city. Explicitly, settlement indicates the relationship of man and environment in a given space over a period of time. Under the present study area, any place of human dwelling which has ten households and above is regarded and recognized by the traditional institutions viz. Syiemships and Sirdarships as a settlement. Settlements are broadly classified as rural settlements and urban settlements. Rural settlements are those settlements where people are mostly engaged in agriculture and allied activities with lesser population sizes. On the other hand, urban settlements are those settlements where residents are mostly engaged in non-farm activities such as business, industrial activities, teaching, services, etc with higher population sizes. Social bonds in rural settlements are more or less homogeneous whereas in urban settlements they are heterogeneous.

The terms pattern, form and type have been used differently by different geographers. E. Ahmad (1962:5-15) writes, “Villages in India, where there seems to have been nothing like a planned rural settlement, are a sort of natural growth in their physical and cultural setting”. According to him, Indian settlements are of different patterns viz., (1) Rectangular
pattern, (2) Checkerboard pattern, (3) Square pattern, (4) Hollow Rectangle pattern, (5) Elongated pattern and (6) Herringbone pattern. The other forms akin to the Rectangular Pattern that do not fall under any of the above mentioned patterns are (1) L-pattern, (2) T-pattern, (3) Fan pattern, (4) Circular pattern, (5) Radial Plan pattern, (6) Hollow Circular pattern, (7) Polygonal pattern, (8) Horse-Shoe pattern, (9) Double – Nucleation, (10) Irregular Cluster pattern, (11) Amorphous pattern, (12) String pattern or Linear pattern, (13) Contour pattern and (14) Regular Distribution pattern. Physical factors, cultural factors, etc. attribute to the evolution of varied settlement patterns. However, this falls under another area of study. In general Nongtrai settlements belong to the irregular cluster pattern.

Settlements are grouped into two broad categories viz., (i) nucleated or agglomerated and (ii) dispersed or scattered. In the former case, all houses and streets are well-knit. The street system does not only constitute as a conspicuous element of settlement but it exerts a centripetal influence beyond the boundaries whereas in the latter case, family residence is the core and stand isolated from the others. Settlements are further classified into five types viz., (i) nucleated settlements, (ii) semi-compact or hamletted clusters, (iii) hamlets, (iv) semi-sprinkled or partially agglomerated settlements and (v) sprinkled or dispersed or disseminated settlements. In Nongtrai area, most of the settlements belong to the first type.

2.11. Hierarchy of Settlements: - A central settlement can at least provide the basic activities or primary functions either in terms of in-kind benefits or in-cash benefits or both to the recipients or consumers of the dependent settlements or hinterlands or umlands as Godlund call them. Dependent settlement is a tributary or a peripheral settlement that derives its demand-driven functions from the supply made by a central settlement. That means when a dependant settlement does not contain such functions, consumers travel some distance and avail them from a particular central settlement. The density of functions in some settlements is higher than the others. While availing the functions, people from the neighbouring settlements come in contact with people from other neighbourhoods for their cultural exchanges, economic transactions, sharing of innovative ideas, etc. mostly
at the central settlements. The expected frequency of interactions is more at the central settlements than between the peripheral settlements. As the distance between peripheral settlements increases, the frequency of interactions diminishes. Since higher level functions are available at the central settlements, the frequency of commutation between the peripheral settlements is low and thus people consume less quantity of distance inputs. Viewed from this angle, therefore, central settlements act as the fields of intervening opportunities for the people of peripheral settlements. A field of intervening opportunities means a functional area or settlement that offers some interjacent functions or opportunities to the consumers hailing from tributary settlements or hinterlands before they reach the market centres, growth centres and other central places of higher orders. Central settlements also act as the fields of influence upon all the hinterlands or neighbouring villages in terms of growth development, urbanization, innovation, enhancing the economic power of the people etc.

Following the Newtonian physics and using the gravity model as shown in equation 2.11.1 below, empirical tests in measuring the expected interaction between places i and j are already carried out by geographers and regional scientists. Stouffer as quoted by Isard (1956:64-65) argued that the number of migrants from any point within the city to a zone at the periphery of the city is directly related to the number of opportunities or vacancies in that zone and inversely related to the number of opportunities between the originating point within the city and the zone at that periphery. The gravity model that represents the basic flow model is given as:

$$ I_{ij} = \frac{kP_i P_j}{d_{ij}^\alpha} \quad (2.11.1) $$

The model assumes that flows between centres i and j is directly proportional to the product of their populations ($P_i P_j$) and inversely proportional to the distance between them $d_{ij}^\alpha$ where k is the proportionality constant.

Before determining the hierarchy of settlements, one should be able to perceive the spatial organization of the study area. Spatial organization refers to the arrangements of functions in various settlements and areas in a space. At some altitudes in the sky, one can take a panoramic view of a number of nodes like cities, towns, villages, etc. and networks like railways,
highways, roads, paths, etc. that are visible on the space. Spatial flows of people, materials and commodities take place between the nodes through networks. The frequency of interactions among various nodes depends on their relative potentials e.g resources and proactive capacities they have. Evidently, nodes with low productive capacities have lower degree of reaction and vice versa. Thus, nodes with lower level of functions are designated as the dependent settlements and nodes with higher level of functions as the central settlements. Identification of settlements in terms of population sizes and functional hierarchies is a sine qua non for ranking of settlements. Once this is done a scientific base can be assigned to them. There is no standard formula for measuring the centrality or the functional importance of a settlement over the others. Christaller who is regarded as the main architect of the Central Place Theory used telephone calls and weighted their density and as such he did not base on any purely objective method of ranking. Davies observes as quoted by Maithani (1986:80), “The final grouping of centres tended to rest upon a subjective demarcation of grades in what seems from his results to have been continuum of values”. Maithani also reviews the adequacies and inadequacies of various methods of ranking of settlements adopted by researchers such as Bracey, Wanmali, Green, Sen and others. Among these, the most commonly used methods employed for such purposes are (1) Population as a Centrality Index, (2) the Guttman Scalogram Technique, (3) the Weighting Method and (4) the Composite Functional Index (CFI) method. Based on our finding of a frictionless distance, clustering of settlements is also carried out.

Therefore, broadly speaking two common approaches of settlement ranking are used. These are (i) Measurement of centrality through the study of central functions performed by a particular settlement and (ii) Study of the spatial behaviour of consumers through functional linkages between settlements. Bearing in mind the role of institutional determinants, population sizes and the availability of the demand-driven functions; the determination of the hierarchy of functions and settlements under the study area is carried out. Based on the above parameters, the present study classified settlements into three categories viz., (i) peripheral settlements (ii) central settlements and (3) service centres.
CHAPTER-II

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