CHAPTER III

IDENTIFICATION OF SERVICE CENTRES IN THE
TRANS-GHAGHARA PLAIN

The hierarchical work is only one aspect of research dealing with Christaller’s central place theory. Researchers having interest in this general field are at work to examine different aspects of the central place model. Undoubtedly, this spatial model of central place has given rise to a variety of researches in the field of urban geography. The core theme of the present work is to test the validity of the hierarchical concept of centres, i.e., whether human settlements serving their surrounding regions can be classified in grades according to a logical scheme. Basically the study is intended to discover the hierarchy of service centres in the study area.

Since the origin of Christaller’s concept of hierarchy, a theoretical base, a great deal of empirical work has been done on this aspect in this country as well as in other lands. Though the concept of hierarchical grades or classes is much criticised by authors, such as Vining, believing that “instead of class-system there only exists differentiation along a continuum”, yet the concept has gained much popularity and rests as a recognized phenomenon. Some of the work done to

1. Vining, op. cit., p.146.
test Christaller's findings did not conform his results. Most of the work, however, consists simply of identifications and investigation of centres as central places or service centres.

The author purposes to classify the settlements of the Trans-Ghaghara plain in different grades in order of importance on the basis of central functions existing in them. The hierarchy of central functions should subsequently lead to the formation of settlement hierarchy as stated earlier. For this purpose, the task is first to investigate the degree of provision of central services in each centre by official records and through personal visits to the area under investigation. Then, the next step is to prepare a scale (on the basis of the methodology to be evolved) to grade the selected central functions in different orders on the basis of their importance as well as incidence. Subsequently the functional hierarchy would be incorporated with the levels of corresponding settlements. Consequently, this amalgamation would lead to the ranking of settlements as central places or service centres.

The hierarchical classification of settlements can be determined through the employment of criteria. The application of various methodologies and approaches on central place concept has increased rapidly since World War II. Christaller's hypothesis on the degree of 'centrality' of a centre was based on the incidence of telephone connections at a place as the prime criterion for the respective importance of the centre. As it has turned out, this is only one of the
possibilities for determination of centrality of places and the categorizing of their functional importance. But prior to the adoption of an appropriate model for the study, it would be worthwhile to present a brief review of the previous techniques used for the same purpose.

Approaches to Hierarchy Research

Since the emergence of Christaller's classic study, several approaches have been developed and various techniques have been used by different persons in different regions to identify the hierarchy of service centres. It can be undoubtedly stated that each person has produced hierarchical grades through the approach developed at his own discretion. In other words, one can assert that hierarchical researches have been handicapped due to the lack of any widely acceptable formula or largely used technique in this field. The plea of Davies for the use of a common criterion and a single technique for the sake of maintaining comparability is, however, impracticable owing to the very fact that the different regions are associated with widely varying socio-economic settings with different historical and cultural backgrounds along with distinct stages of economy. In support of this, Amailes is of the view that there is little point in seeking common criteria for establishing the ranks of the urban hierarchies.

2 Davies, op. cit., p.51-65.
in two systems as distinct as those of Britain and France far less in respect of those of the United States and India. 3

Despite the above statement, the ranking techniques which have been used in this field can be broadly categorized into two groups according to their basic method of approach, as also pointed out by Davies.

These approaches are:

(1) The Direct Measurement
(2) The Indirect Measurement.

Here an attempt has been made to throw light on merits and demerits of each broad group of techniques. In the present context, effort is made to see whether the methods used for the identification of hierarchy in different parts of the world were applicable in India generally and in the study region particularly. Finally, an appropriate methodology will be evolved for the application in the study region.

The Direct Measurement

In this method assessment of centralized services is taken into consideration. Functions of a place are added together and each function is awarded some weightage according to its importance. The total score of the place determines

its status in the ladder of hierarchy. Higher the score, higher the status of the centre. Although this technique is not complicated but it is not accepted as a standard technique. Perhaps this is so that Davies calls it as "the simplest, and probably the crudest, measure of the importance of any centre". The technique has been criticised by Davies on the ground that "if all the functions are added together and each functional unit is given equal weight, a small grocer would become equivalent to a jeweller or a large furniture store, an obvious imprecision". Many notable workers like Bracey adopted this method in the study of Somerset. But the criticism was so logical that the functions were started to be differentiated. Consequently the recognition of the differential functional status has led to the origin of a series of more sophisticated studies. This method is so popular that a number of scholars has used this. Dickinson adopted in the study of East Anglia, Smailes in England and Wales, Brush in Southwestern Wisconsin and so on. An

4 Davies, op.cit., pp.52-53.
6 Dickinson, op.cit., 1932.
7 Smailes, op. cit., 1944.
8 Brush, op. cit.
outstanding work in this field was accomplished in the United States by Berry and Garrison.\textsuperscript{9}

The major drawback of the present technique is that it is useful for the smaller places where the number of functions are not too much and the direct count of functions is possible. When one moves upward in the scale of big urban centres functions are in abundance and they increasingly become differentiated and complicated. At this stage, obviously, the accurate count of functions seems to be difficult. In spite of the fact, the technique has been employed in case of big urban centres also. Amongst other weaknesses existing in this broad group of technique, attention has been paid from time to time to the point where researchers apply their own discretion in awarding the weightage to the individual functions.

The Indirect Measurement

This method derives its nomenclature from the fact that the central functions are not counted directly. In this method attempts have been made to measure the power of centres in two different ways: (i) either by reference to the dominance of each focal point in the area it serves, or (ii) by some measurement of the linkage which takes place

between the centre and its complementary regions. In both the cases the count of functions does not take place. However, the assessment of functions is implied in each case. The first case generally includes a set of questions. The questionnaires are sent to the selected persons like teachers, and other responsible and educated folk of the society of the area which the focal point serves. They are particularly asked where they usually go to meet the demand of certain centralized services.

The functions are given points and the scores of points lead to the importance of a place. Bracey worked on similar lines. The criticisms are more or less the same as involved in the 'direct method'.

The next approach in this broad group is purely based upon the actual linkage between a service centre and the surrounding area which it serves. The consumers reach the centre to satisfy their requirement and then come back to their places. The movement of consumers with goods between the centre and its hinterland takes place through means of transportation. Amongst them public transport is frequently used. Hence the workers adopted the 'frequency of bus service' as an avenue of approach to measure the catchment area of the centre. The longer it serves the area, the higher is the

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status of the centre. A number of workers has applied this method in their individual studies. The first best known study in this field is that of Green who graded the centres by reference to their bus services. The application of bus service by Godlund in Scania, Sweden and in England and Wales by Carruthers are notable works of this field. This technique is reasonably applicable in a country with relatively uniform socio-economic pattern, Davies pointed out Britain and Sweden as the examples of the case in point. India and United States of America are good examples in this case. In the former case people are poor and they do not use bus service for shorter distances, in the latter case people are affluent and they use private vehicles. Thus it is a matter of consideration in the use of bus service technique. The major limitation of this method is the use of absence or presence of the service rather than the use of incidence of transported consumers. This technique has also been criticized as it gives


14 Davies, op. cit., p. 57.
a biased view of the nature of the status of a centre.

At this point it is important to mention that the measurement of linkage dates back to the use of telephone index by Christaller, the pioneer of the concept. He used telephone in southern Germany in the late 1920's, simply because of their significance at that time and in that country as business links. Ullman has commented that such a measure would not seem to be valid for a country where telephones are used extensively for non-central functions. Obviously, with the induction of private subscribers, the telephone has ceased to be merely a business tool. Christaller's theory of central places and also his method of determining centrality of places have been criticized by several workers. His system is regarded as purely theoretical and a priori rather than empirical and practical, and his method is also said to be inadequate, as telephones are utilized for non-central purposes also, and also as some of the central institutions do not make use of telephones. A number of the smaller places do not avail telephone facility at all. Above all, the incidence of telephone connections in large centres also hardly corresponds to the size and efficiency of central institutions.

Like other developing countries, India is passing through a transitional stage of economy moving from a

15 Ullman, op. cit., p. 859.
predominantly agrarian economy to an industrial one. One of the consequences of such a transition, as stated by Bulsara, is a deterioration in the standards of social facilities due to the attendant process of rapid urbanization. The distribution of central place functions in accordance with the proportion of population is highly erratic in case of India. Consequently, regional planning in India should aim at creating a spatial or organizational framework which would be capable of sustaining the strains of transition. The country is experiencing frequent situations where some regions or some areas within a region tend to develop at the cost of other regions or areas within a region.

Thus, the purpose of this study is to examine the distribution of central place functions over the region under study and to investigate how an improved organizational form can be evolved for the provision of social facilities in this area particularly and in the country generally. The author intends to make an attempt within the theoretical framework of the central place concepts developed by Christaller, as it is felt that the study of hierarchy of service centres is a fundamental basis to the formulation of sound policy in the field of regional planning. The building of social


infrastructure for the development of and investment in economic activities and creation of employment opportunities is the major task of regional planning in India.

Selection of Methodology

Ideas for the selection of methodology vary as to how the centrality of a place can be measured. What constitute centrality, must be defined in relation to the conditions prevailing in the area under study along with the purpose of study. According to Abiodun 'the idea of assessing centrality by the number of a particular single service, e.g., the number of telephones installed (Christaller), bus service frequency, if applied to a developing country, could lead only to unrealistic conclusions'. Reviews of different techniques described above has led the present writer to select the 'method of direct measurements'. Methods of indirect measurements do not seem reasonable in the Indian context, as it is based on the accessibility of the area. In India, both mobility and purchasing power are low. Peasants are not able to travel freely to urban areas. Travel by ox-cart or, more often on foot is still the rule in India. Poverty rules out the use of bus service for shorter distance connections. There are many sizeable villages which are not

connected even with a metalled road. The area under study, visited by floods and droughts, is characterized by abandoned channels, ox-bow lakes, sandy pockets, elevated points, depressions and so on. This results in inadequate transportation linkages in the region. In India and particularly in the Trans-Ghaghara Plain, which is less developed part of the country, telephone connections are mostly confined to larger cities and town. Thus, the avoiding of indirect measurements can safely be justified on these grounds.

Direct method of measurement includes direct counting of functions. Obviously, it is possible in smaller places where complexity of functions is less. India is predominantly an agrarian country having 80.09 per cent rural population living in 575,840 villages. Majority of villages belongs to smaller size category. In the area under study about 95.01 per cent of the rural population lives in 19,293 villages against only 18 urban centres with 4.99 per cent urban population. In India, a large number of population is dependent on primary activities and traditionally institutionalized services. Obviously, tertiary sector is less in quantity and thus the direct count of functions is possible. In view of the above, the writer preferred 'direct method' of measurements.

Works on hierarchy research, in India, are quite few. These works widely differ in their purpose, methodology and areal coverage ranging from district level, to state level. As regards the methodologies in the field of hierarchy, a large number of studies belongs to the method of direct measurement. These techniques have followed qualitative approach of assigning weightage to different services considered to be significant, and have summed them up to produce a centrality index for each centre.

Hierarchy of centres is based on the centrality. The centrality is the question of quality and quantity of central functions existing in the respective centre. It is so because all the centres do not discharge all the functions in the same magnitude, similarly not all the centres perform all the functions of the same quality. Above all, when more than one centre perform the same magnitude of functions, it has to be examined whether all these centres lie in the same grade. They may or may not be. For instance, two centres have identical number of persons employed in educational services, say 200, but one centre performs education at primary and high school level while the other avails the services of an intermediate and a degree college. Obviously, the latter enjoys a higher position. A place which is offering functions at high quality level will tend to have a wider complementary region as compared with a place which offers lower quality functions.
Selection of Centres

The study area for this analysis is the Trans-Ghaghara Plain, the most north-easterly part of the state of Uttar Pradesh, India. The region comprises five districts with 19,311 inhabited settlements including 18 urban centres ranging in size of population from two persons (Ashapur, Bahraich) to 230,911 (Gorakhpur city). Without any pre-assumption of rural and urban, the present study tends to include maximum possible number of settlements which act as service centres. For this purpose the criterion of trade and commerce has been used. Because this function is the essence of central place work. As trade and commerce is the most ubiquitously diffused function of Indian towns and villages it offers an unbiased equal opportunity to all the centres to appear in the centrality test. So in addition to the towns, the author has included all the villages in the study which were registered for commercial establishments. First of all, a list of centres was prepared. It included 137 places in the entire area. Fig. 20 illustrates the location of these centres in the study area. Hence, 137 settlements ranging in population size from 582 (Fakhurpur, Bahraich) to 230,911 (Gorakhpur) were studied under the present scheme. Population size of a place is an indicator of its social importance. However, any hierarchical classification of centres based exclusively on population can only be a purely arbitrary and crude measure of their relative importance. It is, therefore essential to consider centralized services
performed by each centre. For an adequate measuring, attempts should be made to include all the central place functions rather than a selected number of limited services.

Selection of Variables

The types of central services that determine hierarchy of centres depend a good deal on the degree of economic development in the area. Moreover, administrative, cultural and social, as well as the entertainment habits of population, would also influence the type of data chosen. For instance, in a developed country, three or more banks may be a good indicator of an urban centre but in a developing country, even one bank may serve the same purpose. Information regarding the availability of central functions in 137 centres was collected both through personal visits to the settlements and from the official records, 1971.

A set of 54 variables covering all branches of life was selected. These variables comprise 17 broad classes of functions, namely: administration, internal security, health, education, technical education, trade and commerce, finance, rural development, animal welfare, postal communication, telegraphic communication, telephonic communication, culture, recreation, roadways bus service, private bus service and train service. A close examination of these classes reveals that these classes include both functional variables and linkage.

23 Smiles, 1944, op. cit., p. 42.
variables. It is so because flow of central good and services from centre to complementary region and vice versa, is not possible without means of conveyance and transportation. Both are complementary to each other. This is implied in the definition of centrality also. Obviously, centrality must include linkage variables along with functional variables.

Central place studies in developed countries, generally are based on single indicator of centrality such as bus service, range of retail shopping, telephone densities and so on. The use of single function, if applied to the Indian scene, is likely to give a false picture of centrality and thus of the settlement hierarchy. The author holds that centrality in the area under study must depend on the maximum possible functions instead of a single indicator.

Keeping in view the rural character of the area, such functions were selected which were not restricted to big cities and towns only. Newspaper, which is necessarily centrally produced but it is usually offered at every suitable place. It means the production is central but offering is non-central. It is the offering of goods and rendering services which is bound to the central places. Hence, exclusion of newspapers can safely be justified. In the present study shops have not been taken into consideration. Firstly, because

21 Baskin, op. cit., p. 20.
complete and satisfactory data in respect of shops are not available. Secondly, the problem of weightage is also insoluble. Thirdly, intra-varying nature of shop is also a debatable question. A shop which discharges the services for grocery also provides some specialized items. Under these circumstances the awarding of weightage for such shops is difficult. The varying nature of shops is a common practice in the area. A distinction needs to be made, however, between periodic markets and daily markets. Markets, designated as 'daily' are those which have daily transaction of grains, vegetables and fruits with surrounding settlements. From a local knowledge of the area, the author knows that these markets work as central place functions, rural folk from distant surrounding villages reach there to satisfy their demands. There is no exaggeration to say that these markets play vital role in serving the villagers. People sell their farm produce like grains, vegetables, fruits, seeds, handicrafts, animals and so on, in turn they avail the services of doctor, barber, tailor, washerman and the like. These markets are periodic in the sense that they take place once or twice a week but they are permanent because they regularly discharge their services. Hence, the exclusion of such markets, would be unrealistic. It is worth mentioning, however, that services such as piped water and electricity do not come under the category of central functions. They are
the indicative of the local importance of a place.

The Weightage of Variables

Perhaps the most serious weakness in hierarchy research is the lack of a common denominator which may be used to award weightage of different functions according to their importance. Hierarchy is positively affected by the status of functions. If the functions are not given their due weightage, the centres graded so will not be indication of adequate status. Among Indian geographers, Singh on this point has awarded the functions arbitrarily in the order of 1, 2, 3, 4, 5, .... In this scheme a primary school and a police station have been given identical values, i.e. one. Obviously, police station is a function of higher order. Hence the given value is not adequate. Among foreign geographers, Grove and Huszar argued that the status of a town is indicated by the presence or absence of certain 'key' facilities; they applied a 'points' scoring system, whereby each facility is awarded like the previous one as 1, 2, and 3 points and so on. Abiodun

24 Abiodun, op. cit., p.353.
awarded the values in the progression of 1, 5 and 10, ... This system appears comparatively better as compared to the former. But she did not discuss the base of the system. Sharma has tried to tackle the problem in a more refined way. He worked out a statistical formula for the same purpose. The formula was based on the principle that greater the scarcity of functions greater its importance in terms of centrality and, therefore, higher the weightage. But this principle does not hold good in any area and in each function class. In the area under study, there are some functions which shows less frequency but their actual importance is also less. If this formula is applied it will give higher weightage to a function having far less importance.

It is possible to allot weightage among similar type of functions. But when different types of functions are performed, the weightage may be of equal importance. For example, one can say that a degree college is more important than an intermediate college in an area or vice-versa. But one cannot say that a bank is more valuable than a hospital. The consumer may need both the services the same time. A person may draw money from the bank and then avail the facility.

a doctor. Thus, if on this basis functional hierarchy is derived carefully then a hierarchy of settlements may emerge. To give proper and due weightage to the levels of function, 'population threshold' is adopted here as a measure of approach. King has pointed out that arising out of many of the analyses of population size/number of functions/number of functional units relationships have been attempted to identify hierarchies of functions and urban places. In ranking the central functions, either with respect to the associated number of functional units or some computed threshold value, breaks are identified that separate the levels of the hierarchy. It means if the classification of functions is possible, the classification of places is also possible. Berry and Garrison in a study of Snohomish County, Washington, are amongst others who used 'threshold requirements' in the central place studies.

The threshold population is defined as the minimum level of support, as measured by number of persons required to support a function in a particular place. Only two formulas are known to compute the threshold values. One is given by Hagget and Gunawardena and the other by Berry and Garrison. Both these methods have their own merits and limitations. For instance, Hagget's formula is applicable where the functional

26 King, op. cit., p.123.
occurrence ranges from zero per cent to 100 per cent in all the group of settlements under study. In the present study except a few, majority of the functional variables occurs in all the groups of settlements. It is common practice in low order functions. Hence its avoidance in the present work may be justified. The most common and traditional method for calculating threshold values is the means of statistical average,

\[ \bar{X} = \frac{X}{N} \]

where,

- \( \bar{X} \) = threshold value
- \( X \) = total population of the given centre
- \( N \) = total number of the functional outlets of the centre in question.

The author has made the use of this formula and where the irregularities occur, they have been adjusted through arithmetic average or 'ratio' device with the help of preceding and succeeding values.

Thus, the threshold values have been computed separately for 54 functions. (Appendix V). Taking the lowest value as a common denominator, all the values have been divided by the common denominator and a progression of uniform weightages

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28 Quoted by Prabha, K., Towns: A Structural Analysis (Delhi, 1979), p.172.
for all the functions was obtained. Each broad functional class thus has been carefully differentiated into its sub-levels. In this way first of all a functional hierarchy is prepared. The selected 54 functions have been awarded the following values:

**TABLE XIII**

Trans-Ghaghara Plain

Functional Hierarchy and Weightage (1971)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Functional Class</th>
<th>Levels</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Administration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Lower Court</td>
<td>11.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Upper Court</td>
<td>33.38</td>
</tr>
<tr>
<td>2.</td>
<td>Internal Security</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Choki*</td>
<td>1.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Thana*</td>
<td>5.24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Kotwali*</td>
<td>24.06</td>
</tr>
<tr>
<td>3.</td>
<td>Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Primary Health Centre</td>
<td>2.34</td>
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<tr>
<td></td>
<td></td>
<td>7. Dispensary</td>
<td>2.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Hospital</td>
<td>2.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. Specialized Hospital</td>
<td>14.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10. Civil Hospital</td>
<td>33.38</td>
</tr>
</tbody>
</table>

* Choki, Thana and Kotwali are police stations in that ascending order of importance.
Contd.

4. Education:

11. Junior Basic School 1.0
12. Senior Basic School 2.39
13. High School 2.80
14. Pre-Degree College 3.24
15. Degree College 11.45
16. Post Degree College 3.42
17. University 86.53

5. Technical Education:

18. Technical School 5.49
19. Technical Institute 29.78
20. Technical College 43.26

6. Trade and Commerce:

21. Market Once a Week 2.08
22. Market Twice a Week 2.14
23. Market Thrice a Week 2.76
24. Market Four Times in a Week 3.49
25. Daily Market 12.10

7. Finance:

26. Co-operative Bank 3.96
27. Bank other than Co-operative and State 7.47

Contd..
Contd.

8. Rural Development:
   
<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>29.</td>
<td>Block Development Office</td>
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</tbody>
</table>

9. Animal Welfare:
   
<p>| | |</p>
<table>
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<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>30.</td>
<td>Veterinary Hospital</td>
</tr>
</tbody>
</table>

10. Postal Communication:
    
    |   |                                               |
    |---|-----------------------------------------------|
    | 31. | Branch Post Office                           | 2.62  |
    | 32. | Sub Post Office                              | 3.50  |
    | 33. | Head Post Office                             | 14.80 |
    | 34. | Superintendent Post Office                  | 20.08 |
    | 35. | Senior Superintendent Post Office            | 86.53 |

11. Telegraphic Communication:
    
    |   |                                               |
    |---|-----------------------------------------------|
    | 36. | Telegraphic Facility                         | 6.93  |
    | 37. | Departmental Telegraph Centre                | 16.45 |
    | 38. | Central Telegraph Centre                     | 86.53 |

12. Telegraphic Communication:
    
    |   |                                               |
    |---|-----------------------------------------------|
    | 39. | Telephone Call Box                          | 3.1   |
    | 40. | Telephone Exchange other than MX-1 and MX-2 | 4.64  |
    | 41. | Telephone Exchange MX-2                     | 20.10 |
    | 42. | Telephone Exchange MX-1                     | 86.53 |

Contd....
The relevance of this scheme lies in the fact that the weightage system is purely objective and the size of establishment has also been considered.

The Scale of Functional Hierarchy

The above mentioned scale of functional hierarchy is interpreted in terms of the relative importance of services.
A high school is relatively of higher importance than a primary school, and a degree college is of higher importance than an intermediate college. Therefore, the higher the level of functional hierarchy, the higher would be the centrality of the place performing that function. The importance of a central place is also affected by the number of central functions. A place which is discharging a large number of functions will tend to have a higher importance as compared to a place which offers a limited number of functions. But if the two settlements have same magnitude of function, then the level of functional hierarchy becomes the decisive part of centrality.

Functional Index

The technique devised by Davies, to test the validity of hierarchic concept, is a an important approach in this field. It assumes that the degree of centrality of a function varies with the total number of outlets of that particular type of function in the study area. It, follows, therefore, that the greater the total number of establishments of any particular function the lower will be the degree of focality (or centrality) of each individual establishment, since satisfaction of demand

is spread over a number of outlets and vice-versa. To calculate the centrality of each type of function (termed the location co-efficient) he used the following formula:

\[ C = \frac{t}{T} \times 100 \]

where

- \( C \) = location co-efficient of function \( t \),
- \( t \) = one outlet of function \( t \),
- \( T \) = total number of outlets of function \( t \) in the study area.

To produce a measure of functional importance the derived location co-efficients are allocated to each centre. Thus, multiplication of the relevant location co-efficient by the number of outlets of each functional type present in a settlement gives the degree of centrality (centrality value) imparted to each settlement for every different type of function. Finally, a functional index is derived by the addition of all centrality values attained by any settlement.

In the list of data collected for the study, there are many functions which show less frequency according to Davies's formula and it would have higher location coefficient. But in practice, this function has a lesser utility. Choki is

30 ibid., p. 63.
31 ibid., p. 63.
a case in point. It has 17 outlets while Thana has 43 outlets. If Davies' formula is applied Choki will get higher weightage, an obvious imprecision. Hence, adequate weightages for each function were derived by using population threshold which are equivalent to Davies's location coefficient of function. Later, a functional index or centrality index has been derived as suggested by Davies. In this way, a functional index of centrality score for 137 centres, has been worked out (Appendix VI). But one thing is remarkable here that though each function is awarded a fixed weightage value; each function has major variation in terms of the degree of attracting power to the consumers. For instance, the value for a primary school is 1.0, but one unit of this function caters for the need of 100 students while the other unit is serving only 15 students. In such a situation to award one value to each unit irrespective of its actual power, does not seem realistic. However, it is accepted that the criticism raised by Davies may be removed apparently by using calculated weightage to each function. However, while considering the weightage to the respective functions if the consumer size of population supported by individual unit is also taken into account, the limitation in the calculated weightage to each function is further reduced.

32 Davies, op. cit., 1966, pp. 52-53.
The Classification

The centrality indices of the individual centres of the Trans-Ghaghara Plain are plotted on a score card (Appendix II). They range between five and 1691. The total score will go to determine hierarchy of centres in the area. Using population and centrality index as two parameters, it was proposed to plot all the 137 centres on a graph paper to test:

(i) Whether there were any natural break points on the graph that could be used as reference points for classifying the various service centres into separate classes, and
(ii) Whether there was any correlation between the population size of a centre and its centrality index.

As the centres vary in population size from 230,911 (Gorakhpur) to 589 (Fakkurpur), it was possible to plot the centres only on a semi-logarithmic graph paper. The population was plotted on the ordinate while the centrality index on Abscissa.

Levels of Hierarchy

It was found, as clearly visible on the scatter diagram (Fig. 21), that there occur four distinct breaks in progression of the slope resulting in the separation of five separate grades or classes. On the diagram the first and second breaks are more conspicuous while the third and fourth breaks are less
obvious. A close scrutiny of Appendix II reveals the fact more explicitly. Thus, all the 137 service centres in the Trans-Ghaghara Plain have been categorized into five different orders. Fig. 22 illustrates the spatial distribution of different order centres in the region. In a hierarchical importance they are as first order service centres, second order service centres, third order service centres, fourth order service centres and the fifth order service centres. The places distinguished on the above basis are real service centres as their centrality index depends entirely upon the hierarchy of the services located in them. To test it further we have used following approach.

Centrality Test

Trade and commerce is the most ubiquitously diffused central function, Ullman has suggested that if one knew the average number of customers required to support certain specialty functions in various regions, the excess of these functions over the normal required population would be a measure of centrality.33 Accordingly, the first step towards estimating centrality indices was to find out how many persons engaged in trade and commerce at each place are required for serving the focal population of the centre itself and also as to how many

33 Ullman, op. cit., 1941, p. 859.
are extra who could be taken as being engaged in catering to the needs of the people of surrounding areas. Among Indian Geographers, Jayaswal, Singh and others have used this method. But this method, as obvious, is purely based on the size of population engaged in trade and commerce, while the consideration of quality is inevitable in a hierarchy scheme. Hence, it has not been adopted to classify the centres but to testify the selection of settlements as service centres. In order to get the average number of persons in the region that are served by one person engaged in trade and commerce, the total population of the region was divided by the total number of workers engaged in that activity in the whole region. The resultant figure was 510. It is important to note that the figure for Uttar Pradesh is only 80. It clearly reveals that the area is extremely slender in trade and commerce. Now by dividing the total population of each centre by this quotient the number of persons engaged in trade and commerce normally required to serve the particular settlement was worked out and subtracted from the total commercial population of each centre and thus the excess commercial population of each centre was obtained.

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Appendix VIII shows that all the centres have excessive commercial population and their designation as service centres may be justified.

Nomenclature of the Service Centres

Different persons have given different designation to the centres evolved in their schemes. Smailes recognized six grades in his hierarchy which are as follows: Major Cities; Cities; Minor Cities or Major Towns; Towns; Sub-Towns; and Urban Villages or Villages. Among Indian geographers, Singh has designated four level hierarchy as: Regional Cities; Cities; Major Towns; and Minor Towns. Smith is of the opinion that while classifying the centres, one should take into account the purpose of the classification as the hierarchical classification plays a vital role in regional and national planning, hence, examining the practical role of service centres in the areal context, they may be designated as Regional centre; Sub-Regional centre; Intermediate centre; Small centre; and Local Centre. The brief statement of the five level hierarchy which has been evolved in the present scheme is mentioned in the following tables.

35 Smailes, op. cit., 1944.
36 Singh, op. cit., p. 323.
### Table XIV

Trans-Ghaghara Plain

Hierarchy of Service Centres (1971)

<table>
<thead>
<tr>
<th>Hierarchical Order</th>
<th>Category</th>
<th>Centrality Range</th>
<th>No. of Centres</th>
<th>No. of Towns</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Regional Centre</td>
<td>1691-89</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Sub-Regional Centres</td>
<td>495.6-582.32</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>Intermediary Centres</td>
<td>130.0-291.98</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>IV</td>
<td>Small Centres</td>
<td>61.0-99.0</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Local Centres</td>
<td>5.0-49.0</td>
<td>93</td>
<td>-</td>
</tr>
</tbody>
</table>

### Table XV

Trans-Ghaghara Plain

Types and Frequencies of Functions Associated with each Hierarchical Class (1971)

<table>
<thead>
<tr>
<th>Order</th>
<th>Hierarchical Class</th>
<th>Population</th>
<th>Functional Outlets</th>
<th>Functional Variables</th>
<th>Functional Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Regional Centre</td>
<td>230,911</td>
<td>265</td>
<td>38</td>
<td>18</td>
</tr>
<tr>
<td>II</td>
<td>Sub-Regional Centres</td>
<td>38161-73931</td>
<td>103-126</td>
<td>30-32</td>
<td>17-18</td>
</tr>
<tr>
<td>III</td>
<td>Intermediary Centres</td>
<td>9247-36191</td>
<td>33-79</td>
<td>12-25</td>
<td>13-17</td>
</tr>
<tr>
<td>IV</td>
<td>Small Centres</td>
<td>1036-14654</td>
<td>13-24</td>
<td>12-17</td>
<td>11-13</td>
</tr>
<tr>
<td>V</td>
<td>Local Centres</td>
<td>589-126681</td>
<td>4-13</td>
<td>2-11</td>
<td>2-1</td>
</tr>
</tbody>
</table>
Thus on the basis of functional index, contributed by central place functions alone, a five level hierarchy of the service centres in the Trans-Ghaghara plain has been identified. Table XIV defines that the numbers of service centres falling in the first order, second order, third order, fourth order and fifth order appear to follow the norm of 1, 4, 9, 30 and 93. It is evident that these numbers do not strictly conform to any of the three principles advocated by Christaller. Christaller's principles were as follows: \( k_3 \) (marketing) = 1, 2, 6, 18, 54, 162, 486; \( k_4 \) (transport) = 1, 3, 12, 48, 192, 768, 3072; and \( k_7 \) (administrative) = 1, 6, 42, 294, 2058, 14406, 100842. The successive numbers show deviation from the demand of administrative principle, because there is not much relationship between the location of social services and administrative centres below the sub-regional centres. However, most of the administrative places enjoy the concentration of marketing and economic functions. The divisional headquarters and district headquarters have been placed in the first and second grade respectively, while the tahsil headquarters find location in the third as well as forth class. Linear distribution of different order centres, particularly that of big centres suggests the effect of axial routes, while far flung villages in the region are deprived of transport facilities. Thus, the number of centres particularly at the lower successive levels fall much short.

* Administrative hq's. lower in rank to district hqs.
of expectation on the basis of traffic principle. They appear nearest to the marketing principle, but the number exceeds at all levels. This suggests that the identified hierarchy is affected by the combined effect of all the three principles but mainly contributed by marketing principle.

Order of Functions and Grade of Centres

In order to define functions characteristically associated with the identified levels of hierarchy it would be better to classify the 54 functions into different orders in accordance with their importance. For this purpose threshold values have been calculated. These calculated values range between 2668 and 230,911 in a progression of variation. These values have been arranged in a descending order in Appendix 1. Further, based on scaling technique as adopted by the Indian census, functions were identified under five different orders. Here functions under different orders reveal the minimum population required for their existence. Only two functions, i.e., police choki and primary school fall outside the network of five orders. But as in the present scheme five levels of hierarchy are discernable, in order to maintain a consistency in comparison between the groups of centres and groups of functions, these two functions, too, have been included under the fifth order of functions. Six functions fall under the first order where threshold value is as high as 230,911 with an exception of

* Police Station of small status.
only one value, i.e., 115,455 for a technical college. It is followed by the functions of second order where threshold values range between 53,597 to 92,842. Such functions are eight in number. Threshold value decreases for the function of lower order importance. Thirteen functions characterize the third order, whereas ten central place functions are there in the fourth. The fifth and the last order of central place functions include 17 services. Table A VI defines the ordering of central place functions selected for the present scheme of hierarchy. Further, to examine the spatial distribution of these functions in different centres the centrality index for each order of functions has been computed (Appendix VI) and scores have been plotted on maps. Fig. 23, 24 and 25 illustrate the spatial pattern of these functions in the Trans-Shajhara plain.

The first order of functions includes the services of university, regional bus junction, senior superintendent post office, central telegraph centre, telephone exchange and technical college. All these services are concentrated in the first order centre, Gorakhpur. Obviously, there is a close relationship between the first group of functions as well the first group of centres. Out of the seven second order functions, six exist in the sub-regional centres and the remaining one (technical institute), lies in Gorakhpur. The other six functions are also variably distributed. Post-graduate college
<table>
<thead>
<tr>
<th>First Order Function</th>
<th>Second Order Function</th>
<th>Third Order Function</th>
<th>Fourth Order Function</th>
<th>Fifth Order Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional Bus Junction</td>
<td>2. Civil Hospital</td>
<td>2. Departmental Telegraph Centre</td>
<td>2. Telegraph Facility</td>
<td>2. Market four times in a week</td>
</tr>
<tr>
<td>Telephone Exchange MX-1</td>
<td>5. Technical Institute</td>
<td>5. Specialized Hospital</td>
<td>5. Govt. Bus Station</td>
<td>5. Hospital</td>
</tr>
</tbody>
</table>

*Choki, Thana and Kotwali are police stations in that ascending order of importance.*
is only at Deoria. While the remaining three centres, namely Bahraich, Gonda and Basti in spite of their being district headquarters, are deprived of this function. Balrampur and padrauna which are third order centres possess this facility. Superintendent post office at Bahraich is replaced by senior superintendent post office, a first order function. With the exception of two functions (post graduate college and technical institute) all the second order functions are associated with second order centres. Head post office which is a third order function, is found at only one place (Balrampur) in the third order of centres. Cinema is a fourth order function, no centre of the corresponding group contains this facility. All the cinemas are concentrated in the three upper strata of hierarchy. This analysis suggests that significant differences exist both between groups of functions and grade of centres. If some significant correlation occurs it is only in the higher group of centres. Downward the hierarchy this relationship becomes sparse or negligible. Appendix VII and Table XVII show that in every successive level of hierarchy there is overlapping of functional character and that there is a lack of specialization in functions from one group of centres to another group of centres. Overlapping clearly indicates that functions which are located at a particular group of centres also exist at some centres of different groups. This short description does not support the propositions that order of goods and order of centres display a structured arrangement in the ladder of hierarchy. It is true only at the two higher
strata of hierarchy. It is not well articulated with respect to functional distinctiveness below the sub-regional service centre level. It should be further examined through the detail analysis of functional structure.

TABLE XVII

Trans-Ghaghara Plain

Number of Service Centres Having Different Order of Functions (1971)

<table>
<thead>
<tr>
<th>Functions</th>
<th>No. of Centres in Hierarchical Class</th>
<th>Total No. of Centres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>from I to V</td>
<td>I       II    III   IV   V</td>
</tr>
<tr>
<td>First Order Functions</td>
<td>1  -  -  -  -</td>
<td>1</td>
</tr>
<tr>
<td>Second Order Functions</td>
<td>1  4  4  -  -</td>
<td>9</td>
</tr>
<tr>
<td>Third Order Functions</td>
<td>1  4  9  27  3</td>
<td>44</td>
</tr>
<tr>
<td>Fourth Order Functions</td>
<td>1  4  9  30  37</td>
<td>81</td>
</tr>
<tr>
<td>Fifth Order Functions</td>
<td>1  4  9  30  93</td>
<td>137</td>
</tr>
</tbody>
</table>

Functional Structure

Five levels of hierarchy has been identified in the Trans-Ghaghara Plain. Literally, hierarchy or classification means
that 'similar things are grouped together'. Now to examine the intra-group similarity, description of functional structure is imperative. In order to identify functions characteristically associated with these levels of hierarchy, it is desirable to examine the salient features functionally associated with each group and full detail of services existing in a top higher order centre of each group.

Regional Service Centre

Only one centre in the entire region has got the level of regional centre (Fig. 22). It is Gorakhpur, there the centrality score is maximum, i.e., 1691.89. Gorakhpur is the functional metropolis of the region and also the regional headquarters. It has not only high level functions in all facilities but also high volume in all the functions. It is a terminal of the regional transport authorities. Beside regional bus-junction the centre has also other bus junction at Birdghat Depot. Two railway stations including one junction are the busiest concentration of passengers and goods. The centre has also a big private bus-station plying the buses to Deoria, Basti and other adjoining rural and urban areas. The place has facilities of lower court as well as upper court. There are four Choki*, two thana* and one kotwali*. As regards

* Choki, thana and Kotwali are police stations in that ascending order of importance.
health facilities, the centre has full range of functions. There are 22 dispensaries including family planning clinics and the centres of maternity and child welfare. There are 11 hospitals having the facilities of more than two doctors. The civil hospital is equipped with full range facilities. There are three specialized hospitals discharging the services for eye, leprosy and tuberculosis. In the field of education there are 40 primary schools and 20 junior basic schools. It is important to note that high school is only one while there are twenty intermediate colleges. With some intermediate colleges, high schools are also attached. There are five degree colleges and a post graduate college. Gorakhpur University is a big regional centre of education. Above all, 11 technical schools, two technical institutes and two technical colleges including one medical college and one engineering college are found here. It is a place of daily market where wholesale transaction of grains, fruits and vegetables is existing. Thirteen branches of different banks including State Bank of India are working here. Circle of postal communication is also very wide. There are 30 sub-post offices, one head post office and one senior superintendent post office. In telegraphic communication, three centres provide the facility of this functions, in addition to this, there is a central telegraph centre. Thirty centres in the city are associated with telephonic facility and one telephone exchange with 'X-1' range, covering the entire region. In the cultural and recreational field, seven
libraries, 10 cinemas as well as 5 stadia and auditoria are functioning. For the animal welfare, the centre has one veterinary hospital equipped with modern devices of reproduction.

Alongside with the high quality and quantity of professional services, the centre possesses other specialized retail services like, establishments of watch, radio, cyclo, sewing machine, tractor, pumping sets, refrigerator, television and jewellery. Gorakhpur, being the regional headquarters, attracts consumers from the entire region. Besides, many a surrounding cities like Faizabad, Azamgarh, Sultanpur and Barabanki fall under its influence.

Sub-Regional Service Centres

The cities of Basti, Bahraich, Gonda and Deoria have been identified as the second order centres in the hierarchical ladder (Fig. 22). All these four cities are district headquarters and characterized by a wide range of services, but all the centres lack the first order functions (Appendix VII). They integrate the services of a number of towns around them. Centrality score of these centres ranges between 495 to 582 and the population from 38,161 to 73,931. Appendix III indicates that all the four centres except one have the identical values of second order functions. Bahraich has a lower concentration of these functions and enjoys a much better position in fourth order functions. Both maximum concentration
and variety of functions have characterized the towns of the second order. All the towns have shops of specialized goods like watch, radio, cycle, sewing machine, tractor, pumping sets, refrigerator, television and jewellery.

Basti is on the peak of second order towns. Both lower court as well as upper court are found here. There are three choki* and one kotwali*. The function of health covers the entire range. There are six dispensaries including family planning clinics as well as maternity and child welfare centres, five hospitals, one specialized eye hospital and one civil hospital. In the field of education, 39 primary schools, nine junior basic schools, four high schools, five intermediate colleges and two degree colleges are functioning here. Besides, the centre has four technical institutes. A Daily market with regular supply of grains, vegetables and fruits is functioning at this centre. There are three branches of different banks including one State Bank. For animal welfare one veterinary hospital exists here. In the field of postal communication, Basti has considerable functions, like seven sub-post offices, one head post office and one superintendent post office, a telegraphic section which includes the facility of transmission of telegrammes and a separate departmental telegraph centre covering a wide range of area. This factor has caused a rapid

* Police station of small status; * Police station of higher status.
increase in the centrality score of this place as compared to the three counterparts. Telephonic communication has also wide range covering seven establishments of call box and one telephone exchange centre of M4-2 range. As far as cultural and recreational aspects are concerned, there are two cinemas, one stadium, one reading room and two libraries. Linkage variables are also potential in terms of two roadways bus stations, one of which serves as junction point. Besides, private bus service also functions. Basti also enjoys the facility of railway junction.

Intermediary Service Centre

Third order centres are nine in number, namely, Balrampur, Padrauna, Nanpara, Khalilabad, Gaura Barhaj, Bansi, Barhalganj, Colonelganj and Tulsipur. All these centres are defined by the census authorities as 'towns'. These are also tahsil headquarters except Gaura Barhaj, Barhalganj, Colonelganj and Tulsipur. The centrality score of this class ranges from 130.0 (Tulsipur) to 291.98 (Balrampur). Below the level of district headquarters these are large market towns. Hence they play an intermediary role in serving their complementary regions. They are not evenly distributed in terms of administration as the case is in the first and second order towns. Only four centres of this class have second order functions (Appendix VII). Centres falling in this class, show complete absence of
the establishments involving specialized goods. Only a few centres like Balrampur, Padrauna and Nanpara have facilities of selling watch, cycle and radio but these items are provided from repairing establishments. Further all the centres have facility of repairing agricultural implements like tractor, threshor, pumping sets.

Balrampur has got the upper position in the ladder of centrality score amongst the third order centres. The functional quantity as well as the quality is relatively high of this centre, and has 29 points more than that of the next lower centre, Padrauna. There is one lower court, one kotwali*, one dispensary and one hospital. In the field of education it has wide range of function in terms of 35 primary schools, 6 senior basic schools, 2 high schools, 2 intermediate colleges and one post-graduate college. Two shorthand and typing establishments were recognized here as technical schools. It also avail the facility of daily market. In the field of finance, the centre has four banks including one branch of State Bank. It is important to note that from this centre downward, there is an occurrence of such functional variables which are generally associated with rural character, for example the centre has got one co-operative bank, while all the centres upward do not have this variable. In addition to this, block development office is also found here. For animal welfare, one veterinary hospital provides the facilities for treatment as well as the synthetic device of reproduction. In the field of postal communication,

* Police station of higher status.
there is one branch post office, two sub-post offices and one head post office. Telegraphic facility is found only at one place. In addition to a telephone exchange centre, one more establishment discharges the services of a telephone call box. There is no establishment in the field of culture. Recreation is provided through two cinemas, and one auditorium. In the category of linkage variables, roadways bus station, private bus station, railway station each with one unit serves the centre as well as the environs.

Small Service Centre

The fourth order centres, 30 in number, are primarily small size service centres. Amongst them typical ones are Anand Nagar, Nawabganj, Nautanwa, Utraula, Siswa Bazar, Bhinga, Banaganv, Captainganj, Gola Bazar Ekona Khas and Hata (Fig. 21). The centrality score of this class ranges between 61.0 (Belsar) to 99.0 (Anandnagar), while the population of this class falls within the level of 1036 (Qaisarganj) and 14,654 (Mehdaval). The centres are unevenly distributed in the rural and urban sectors as well as in administrative status. Out of 30 centres, only four centres qualify for the urban status. These too, are small towns. Nine centres possess tahsil* headquarters while 11 centres are the block development centres. Owing to these factors the corresponding centres have attained this status of hierarchy. However, those centres which possess none of these factors, enter into this class because of their location

* Administrative hqs. lower in rank to district hqs.
on good nodal points. The centres of this group show complete absence of first and second order functions, which all of them, except three namely, Ramkola, Rudoli Kalan and Lar, possess, third fourth and fifth order functions (Appendix VII; Fig. 23, 24 and 25). Intra-order functional variations are also common. For instance, thana* is a fourth order functions, four centres out of 30 lack this facility. However, in retail services, all the centres possess chemist, doctor, blacksmith, carpenter, cycle repairer, hardware dealer, and of grocery dealers.

Anand Nagar is the top centre of this class. It is also known as Pharenda. The centre has a total absence in the first and second order functions (Fig. 23 and App. II). The functions of administration and internal security comprise one lower court and one thana.* In the field of health, four dispensaries including a family planning clinic and a child and maternity welfare centre and a T.B. centre exist. Educational services are also of limited magnitude consisting of three primary schools, one junior high school and three intermediate colleges. Market once a week occurs inviting consumers from peripheral villages. Activities relating to finance are carried out through two banks including one branch of State Bank of India. Animal husbandry includes one veterinary hospital. Postal and telegraphic communication has one establishment at the sub-post office level and another with telegraphic facility. Apart from one telephone call box, the

* Police station of medium status.
place enjoys the status of a telephone exchange centre. In addition to a railway junction, the services of rail lines and private bus stations are also available at the centre.

Local Service Centres

The fifth order of centres, 93 in number, are primarily of local importance serving an area of about 5 km. The centrality index of this class ranges between 5.6 (Mir ragnat Mustagil) to 49.0 (Risia), while the population range of this class is from 589 to 8839. First and second order functions are completely absent. Even the third order functions are found in few centres. The majority of centres of this class comprises only fourth and fifth order functions (Fig. 24 and 25; A. p. VII). The centres of this group are rural service centres which have the status of village markets. As they are large in number, there are large variations in their functional structure. 56 centres have only fifth order functions. There are even more intra-order functional variations. For instance, fifth order includes 17 functions (Table XVI), Risia which enjoys top status possesses six functions of this group (dispensary, primary school, senior primary school, market twice a week, bus stop, sub-post office) while, Mir ragnat Mustagil which lies at the bottom of 'local centres' has only two functions (primary school, Choki). In retail services, which include establishments of food like flour, salt, pulses, edible oil, species, kerosene, vegetables, meat, confectionary, and tailoring, all
the centres share this function consistently. Other retail services of higher order like that of doctor, chemist, repairer of agricultural implements are restricted to larger size population centres.

Risia tops the class of fifth order service centres. There is a complete absence of establishments relating to the field of administration and internal security. In the matter of health there is only one dispensary. There are two primary schools and one junior high school so far as educational activities are concerned. In trading activities, a market of small size occurs twice a week. Co-operative bank, block development office and veterinary hospital each has one unit. The facility of telegraph and telephonic communication are found at the lowest level of the hierarchy with a single unit of establishment. There is one sub-post office. Recreational and cultural services are also absent. In addition to a private bus-stop. However, the centre, due to its location near railway line, avails the facility of a railway station.

This discussion on the functional structure associated with the identified groups of service centres shows that intra-group functional variations are pronounced. Centres falling within the same group are not strictly similar to each other in functional character. Moreover, inter-group functional anomalies also occur. A centre without functional specialization qualifies the centrality test with more points and enters into
higher grade. This is a reflection of the general poverty of the region and the low purchasing power of the people and hence the less functional interaction. The same feature is reflected in the fact that successive higher order centres are distinguished from the lower ones more with respect to functional magnitude* and less in relation to functional distinctiveness*. It is also a manifestation of limited demand for higher order goods and services. The functional structure of different grades of centres is so overlapping that a particular grade can not be applied with a rigid structure. According to Christaller, the lower level centre furnishes certain central goods which are limited in number and variety. A centre of next higher order performs all the functions and services of the lower order centre plus a group of additional central functions. This principle does not apply in the area of study. Specialization of functions occurs only at the upper strata of the hierarchy. It is evident that superiority of successive higher order centres is established more by their functional quantity than by their functional quality.

In the above mentioned functional structure, primacy of Gorakhpur is evidently identified both in terms of functional distinctiveness as well as functional magnitude. It is distinguished from its successive group, sub-regional centres by the seven additional first order functions (Tab. XVI).

* Number of functions.
* Types of functions.
The sub-regional centres are also clearly distinct from both the higher order centres and lower order centres. They are closer to Gorakhpur, however, in the variety of functions as compared to the lower order centres. They have four additional types of function distinctly absent in the intermediary centres, viz., civil hospital, upper court, telephone exchange MX-2, and general post office (superintendent or senior superintendent post office). In addition to professional services, there are some commercial establishments of specialized goods which do not exist with next subordinate group of centres. There are selling centres of sewing machine, tractor, pumping sets, refrigerator, television, sports goods, furnishing materials and sanitary wares. Further, cycle, radio and watch are also distinguished items of these centres but some of the intermediary centres also possess them. Next follow the 'intermediary centres which are distinguished from the lower ranking 'small centres' more in terms of functional magnitude rather than distinctiveness. For instance, some of the centres of this group possess kotwali* but none of the centres of the next group possess this function. Establishment dealing in wool may be said to be another example in commercial services. Small centres are differentiated from the local centres, mainly by functional magnitude. Intermediary centres generally have repairing establishments of agricultural implements like tractor, thresher, and pumping set along with

* Police station of higher status.
establishments of utensil, footwear, while doctor chemist and persons dealing in hoisery, stationery and cosmetics are common features of small centres. Local centres consistently share in full range grocery. Again, cases overlapping in terms of variety of functions with regard to successive rank centres are not exception, which indicates that different functions at these levels do not show discrete level of occurrence. It clearly underlines the weak functional structure and lack of distinctiveness at successive higher levels, particularly downward from intermediary centres. Small centres and local centres are thus exposed by their weakest functional structure claiming hardly any function as characteristic of their level. Intermediary centres stand in the middle position. When functions are grouped with regard to most frequent level of occurrence, functions of commercial nature are ubiquitously distributed while professional services are not so distributed.

**Relationship Between Centrality and Population**

Relationship between the status of a place and its population size is an important aspect in the field of hierarchical research. It tells about the distribution of services with respect to the distribution of population in space.

As stated earlier, all the 137 centres with their respective centrality score and population size, were plotted
on a graph to examine whether there was any correlation between these two parameters. Fig. 21 shows that centres of large population size possess higher centrality score while small size population centres indicate low centrality score. To find out an accurate picture, Karl Pearson's correlation coefficient was worked out. The analysis shows positive correlation between centrality score and population size. The value of r in the sub-regional centres is +0.271. The intermediary centres which are nine in number have +0.832 degree of correlation. Among the fourth order centres the correlation comes to +0.29 while the service centres of local importance have much more weakened the closeness of centrality and population so much so that the value of r is +0.21. Thus, except intermediary centres, the centres both having larger size of population as well as smaller size of population display little correlation between their respective centrality indices and population size. It may thus be concluded that hierarchical levels based on the population size are seriously altered by our scheme of assessment. Only a few centres, especially intermediary ones, have got their position at the same level where they stand in the population hierarchy (Appendix VI and VIII). Gorakhpur, Deoria, Balrampur, Padrauna and Nanpara are the typical centres enjoying such position. The degree of centrality usually depends on the functional character of the centres. Qaisarganj which shows 135th place in the population hierarchy has got
27th place in the central place functional hierarchy (Appendix VI and VIII). This place comprises very small population, say, 1,026, but being a tahsil* headquarters, it has acquired large size not only in lower order functions but in some higher order functions also (Appendix VII). Conversely, Ghazpur Grant which is a village of growing population, i.e., 8571, has got 25th level in the population hierarchy, but so far as the central place hierarchy is concerned it stands on the margin, i.e., 136th level.

It will thus be seen that the distribution of central place functions and services is very erratic. A place with smaller size population enjoys a good position while other larger size place is either suffering or declining. A careful examination of the figures and facts, related with the settlements under study, discloses that the centrality of a place is largely affected by three factors, first urban influence, second administrative status, and thirdly the location on better nodal points, in that order.

Fig. 26 shows the correlation of functional hierarchy with population hierarchy. It will be seen from the figure that even if the size of settlements is same there is much variation in centrality index. Only two first grades of hierarchy maintain this correlation, while there are also

* Administrative hqs. lower in rank to district hqs.
TRANSGHAGHARA PLAIN
FUNCTIONAL MAGNITUDE OF SERVICE CENTRES

RANKS OF CENTRES BY SIZE OF POPULATION
NUMBERING OF CENTRES IS IN THE SAME ORDER AS SHOWN IN THE APPENDIX VIII

SOURCE: FIELD WORK

FIG. 26
intra-group variation. Bahraich (73,931) possesses low centrality index as compared to Basti (49,635) (Appendix VI and VII).

In individual functions, the distribution is also erratic. Only some higher order professional services and retail services are restricted to higher order centres. Some of the smaller centres also reveal specialized shops. For instance, Mehdaval and Tulsipur are prominent centres for brass utensils. Teaching institutions like degree college and post graduate colleges show most erratic distribution with regard to population size of centres. It is an expression of local political influence. Balrampur (36,191) and Padrauna (18,732) have post graduate colleges while Bahraich (73,931) and Gonda (52,662) being district headquarters are deprived of this function. Services for the provision of agricultural inputs like seeds and fertilizers are invariably associated with block and tahsil headquarters. Such centres have been chosen on grounds of administrative convenience without much regard to population size of the settlements. The limited variety in the demand for consumer goods, owing to the general poverty, is in itself a great constraint in the adequate distribution of services. Most of the functions are not distributed commensurate with the population size of centre.
Functional Occurrence

Christaller's work has also based on the premise that lower order functions have wide occurrence while the higher order functions show limited incidence. Apparently it seems to conform to reality. But the analysis of the present study does not uphold his argument fully. Many a functions of lesser importance also show lesser occurrence. Appendix IX which presents the frequency of centres associated with different functions throws light on such exception (Fig. 27). Choki, a police station of lesser importance, is found only in 17 centres, while Thana, a police station of higher importance takes place in 43 centres. There are other functions of this nature. For instance, primary health centres occur in nine centres, while dispensary which is a unit with wide areal coverage, is availed in 65 centres. Bus-stop is also a case in point. It will be seen this along with functional structure, occurrence of different functional variables cannot be explained rigidly. There are various causes behind this phenomenon. The foremost is the level of the study at which it is being conducted. In the present study attempts have been made to deal with only those settlements which function as service centres. Obviously, they should have higher order functions with large frequency. If the study had covered all the settlements in the territory then it would have got higher frequency of primary health centres than that of dispensary. There are numerous places with primary health centres but they
are not marketing centres. The occurrence of functional variables depends upon the definition of 'functional unit'. For instance, in the present study all the medical units dealing with only one disease have been designated as 'specialized hospitals'. There are ten service centres having facilities of specialized hospital, like that of T.B. centre, eye hospital, and leprosy hospital dealing with one disease separately. Conversely, civil hospitals which are equipped with departments of almost each disease have been considered of higher importance. They exist only at five district headquarters centres, namely, Bahraich, Gonda, Basti, Gorakhpur and Deoria. Despite at district headquarters, the specialized hospital also take place at some lower order centres like Pandrauna (T.B. centre) and Khalilabad (T.B. Centre). That is why civil hospital has been grouped in the second order functions. Here specialized hospital is not considered in a very special sense like that of sophisticated 'heart' hospital or 'cancer' hospital. However, in general it cannot be denied that lower order services have wide occurrence and higher order functions show restricted occurrence. In the present scheme, junior basic school is the function of lowest importance because it has lowest threshold value. None of the service centre in the present scheme is deprived of this function.
Inter-relationship of Functional Variables

To examine the inter-relationship of functional variables a correlation matrix of 54 x 54 was prepared. But from the analysis no healthy inference could be derived. There is a negligible correlation among lower levels of functional hierarchy. A substantial degree of correlation was found only among the functions of first order, i.e., variable of regional importance. University, senior superintendent post office, central telegraph centre and telephone exchange MX-1 concentrate altogether at the same centre. Further, those functions which are tied to administrative set up show high correlation. Each sub-regional centre has a civil hospital but where there is a civil hospital there will not necessarily be a specialized hospital. Deoria has a civil hospital but it does not have any specialized hospital. Similarly, there are places where specialized hospitals exist but those places have no civil hospital. There are five centres namely, Bahraich, Gonda, Basti, Gorakhpur and Deoria which possess a civil hospital and four of them are associated with specialized hospital, while there are ten centres having the facility of specialized hospitals, but only five of them have civil hospitals. Same position can be witnessed in other functions also. Each place having sub-post office has a primary school but the converse is not true. It may thus be concluded that services tend to cluster around certain levels of functional hierarchy only at the upper strata of
hierarchy and hence a place having a civil hospital is the likely place to have a superintendent post office (general post office). At the lower levels of the functional hierarchy one will encounter difficulty in identifying the clustering of central functions.

Functional Classification of Centres

Functional classification is different from the hierarchical classification. It does not conform Christaller's hierarchic concept. But in a sense, both may be deemed to be functional classification because both the types involve functions. In order to analyse whether any relationship occurs between the two and examine the functional structure of the centres more explicitly, 137 service centres were classified functionally.

Towns have been classified by social scientists such as geographers, economists, sociologists and others, each adopting different criteria of classification.

At the earliest stage, towns were classified qualitatively. These include the work done by Aurousseau (1921), Mckenize (1925), Hall (1934), Ogburn (1937) and several others. Later on, statistical classification on the basis of functional specialization were attempted by several geographers such as Harris, Kneedler, Pownall, Hart, Duncan,
The purpose of these classification was to determine the intensity of specialization of the various functions of a city. The earlier methods of classification of cities (Harris, Kneedler, Jones, Hart) were based on a chosen percentage above which a city was considered to be specializing in a particular function. The later methods (e.g., Pownall, Nelson) gave more precise measure to determine the degree of specialization in a function. Pownall followed the simple deviation formula to measure the intensity of specialization in a function. Nelson's formula got much popularity due to its greater precision. He raised the question: "How large a percentage of labour force must be employed in a particular function to make the performance of the function far enough above normal to warrant separate classification". He explains 'normal' as mean for the whole country and the degree above normal is defined by standard deviation.


39 Nelson, op. cit., p.194.
In India, one of the earliest workers regarding the functional classification of cities is that of Lal, who in his doctoral thesis followed an approach similar to that of Duncan and Reiss. He however, followed a different method which involved the determination of functional specialization of cities on the basis of "Location Quotient (LQ). The LQ for city X in industry Y is

\[
\text{percent of all workers in city X in industry Y} \\
\text{The median percent of all workers in industry X in all cities.}
\]

The cities with LQ value between 90-109 in any industry or service is considered a 'normal' specialization in that function. Thus, there are four arbitrary positive values which are derived with reference to the median for measuring the specialization in major industry groups, while the minor values are classified into normal and above normal intensity classes. Ahmad classified the Indian cities on the basis of multifactor or multivariable deriving the result through the use of multivariate statistical technique. He argued that


41 Quoted by Ahmad J., Indian Cities: Characteristics and Correlates (Chicago, 1965), p.15.
this method could minimize the area of judgement and decision and may guarantee the use of standard measures and help in comparing results obtained at two different points in time.42

Among, other Indian geographers and scholars who have made a few attempts towards the problem of classification are Janki, Prakasa Rao, Rafiullah, Mukherjee and Singh. Janki classified towns of Kerala, showing the impact of physical and economic factor on their functions and growth.43 Prakasa Rao criticized the method of Nelson which he considered unsuitable for towns having a large range of population size. He, however, suggested a least square linear regression method in which the two axes respectively show population size of the towns and proportion of persons to total in a particular function and a line of central value is determined.44 Rafiullah modified Weaver's formula and developed a new technique for the functional classification of towns which he applied to the towns of the Upper Ganga Yamuna Doab.45

42 ibid., p.16.


Mukherjee followed Webb's method and devised statistically a functional index and a specialization index for all the towns of Bihar, although she combined the two methods, i.e., the 'surplus' method of Mattila and Thomson and the functional index of specialization index method of Webb.46

In India, distribution of working force is very erratic involving much variation and 'mean' cannot be a true representative. The towns of the region like other hundreds of Indian towns are very much rural or agrovill® centres bearing their own typical functions. Moreover, out of 137 centres under study 119 are rural settlements. To work out the specialization of functions at this stage seems to be merely a quantification exercise. It may be more meaningful to find out a centre is monofunctional, or bifunctional or trifunctional and so on to develop in a more planned basis. For this purpose, the author has made the use of the formula as suggested by Rafiullah.

\[ O = \frac{D_p^2 - D_n^2}{N^2} \]

Where \( O \) is the deviation; \( D_p \) is the positive difference; \( D_n \) is the negative difference, and \( N \) is the number of functions.

The results we have thus obtained for the functional

classification of the service centres of the Trans-Ghaghara Plain are as follows:

First Order Service Centres

Gorakhpur which is the first order centre in our hierarchical classification is the quadrifunctional city. Dominance of functions is as follows: services, transport, commerce and manufacturing in that order.

Second Order Service Centres

Basti, Bahraich, Gonda and Deoria are the second order service centres in the hierarchical ladder. Bahraich and Gonda are quadrifunctional centres. Dominance of functions in these centres is as follows: services, trade and commerce, transport and manufacturing. Bahraich in place of transport has dominance in primary activities (agriculture). Basti and Deoria are trifunctional cities. Both have same kind of specialization, i.e., services, trade and commerce, and primary activities (agriculture).

Third Order Service Centres

Nine centres are included in this class of hierarchy. All the centres except three are quadrifunctional ones. Balrampur, Gaura Barhaj and Colonelganj are trifunctional
in character. Six places show higher intensity in commerce, while there possess specialization in services.

Fourth Order Service Centres

These are thirty in number, ten are bifunctional, eight trifunctional, and twelve are quadrifunctional. Agricultural population in all the centres dominate the other kind of working population.

Fifth Order Centres

Majority of this class, i.e., 77 centres out of 93, falls under bifunctional category with the dominance of agricultural population. Tables given below present a detailed picture of the relationship between functional classification and hierarchical classification of 137 identified service centres.

**TABLE XVIII**

Trans-Ghaghara Plain

Functional Composition of Service Centres (1971)

<table>
<thead>
<tr>
<th>Hierarchical Order</th>
<th>Monofunctional</th>
<th>Bifunctional</th>
<th>Trifunctional</th>
<th>Quadrifunctional</th>
<th>Total No. of centres</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td>2</td>
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<tr>
<td>V</td>
<td>77</td>
<td>15</td>
<td>1</td>
<td></td>
<td>93</td>
</tr>
</tbody>
</table>
### TABLE XIX
Trans-Ghaghara Plain
Number of Service Centres with Functional Specialization (1971)

<table>
<thead>
<tr>
<th>Hierarchical Order</th>
<th>Primary Function</th>
<th>Secondary Function</th>
<th>Tertiary Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>III</td>
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<td></td>
<td>9</td>
</tr>
<tr>
<td>IV</td>
<td>28</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>93</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

**NOTE:** Categories have been assigned according to the first level of intensity.

The results we have thus obtained for the functional classification of 18 urban centres of the Trans-Ghaghara Plain are tabulated below:

### TABLE XX
Trans-Ghaghara Plain
Functional Classification of Urban Centres (1971)


5. Deoria - (Trifunctional): Services, Trade and Commerce, Primary Activities (agriculture)
6. Balrampur-(Trifunctional): Services, Trade and Commerce, Primary Activities (agriculture)
7. Padrauna-(Quadrifunctional): Trade and Commerce, Services, Manufacturing, Primary Activities (agriculture).
15. Tulsipur-(Quadrifunctional): Services, Trade and Commerce, Manufacturing, Primary Activities (agriculture).


It may thus be concluded:

1. Higher the grade of hierarchy, larger the number of service centres with high complexity in its functional structure.

2. Lower the status of a hierarchical class, larger the number of centres with less functional complexity.

3. Intermediary service centres stand in the midst of the above mentioned positions.

4. only higher order centres are associated with tertiary activities. This indicates the overdominance of agricultural sector in the region.

5. No centre has got first preference with specialization in secondary activities. It reveals that the region is
extremely slender in industrial sphere. Only seven out of 18 urban centres show manufacturing at the third or fourth level of specialization.

6. It is important to note that even some of the towns, seven in number, have the highest percentage of population in agriculture (Table XX).

7. On the basis of above functional classification the service centres may be further classified into two groups:
   1. Urban service centres, where tertiary activities dominate;
   2. Rural service centres, where primary activities (agriculture) dominate. Upper three stratum of hierarchy, regional, sub-regional and intermediary classes comprise 'urban service centres', while the lower two stratum of hierarchy, i.e., 'small' and 'local' classes consist of rural service centres. Only two 'small' service centres namely Utrala and Siwarhi are urban service centres because they show first intensity in services and trade and commerce respectively. The ratio of urban service centres and rural service centres comes to 16:121, a drastic situation. Thus, it can be said that the urban hierarchy has not been adequately developed in the region to serve the population properly.

The identified pattern of hierarchy does not fit in with the theoretical pattern described by Christaller because of administrative, transport and economic limitation as also
the influence of centres lying outside the area. Above all, the specific topographic features of the area pose limitations on the development of centres.

The towns generally occupy a higher place in the hierarchical ladder and all the service centres in the first three orders are cities and towns. In the fourth order, out of 30 only four centres are urban. On the other hand, 93 centres of the fifth class are all rural settlements. The four towns falling in the fourth group, namely, Utraula, Bhinga, Siwarhi and Nawabganj have been defined so by the census authorities. Actually, these places are urban centres or overgrowing villages, working as a village market centres. In the overall scheme, 121 service centres function as rural market centres.

The region does not possess any rich physical resources, which could encourage the growth of towns as specialized centres. Owing to the absence of mineral wealth the region does not have any significant industrial growth. Only two cities of Gorakhpur and Deoria have emerged as industrial nodes of the region. But their functional and occupational character clearly shows that diversity in functions prevails and specialization in manufacturing is absent (Table XX). Moreover, towns and cities do not work as transport foci and break of bulk points. It is because the mode of transport does not change in the region as the areas has an interior location. Most of the water channels
cannot be used for transport because of unfavourable conditions. Thus, the only mode of transport available for the movement of goods and services are roads and railways. In spite of the above facts conducive to the development of service centres, the identified hierarchy is distorted in nature. The small service centres have not developed in required number. Their number has affected their spatial distributional pattern. The higher order centres are lesser in occurrence while lower ones have widespread occurrence.

Christaller postulates that centres of the same order provide similar goods. Losch allows for specialization among centres of the same order. In Christaller's system the higher order centres offer all goods and services provided by lower order ones. In Loschian system it is not necessarily so. The present findings, in this respect are much closer to that of Losch. As it has already been found out that successive higher order centres are distinguished from the lower order ones more with respect to functional magnitude and less in relation to functional distinctiveness.

The other most important feature in the pattern of hierarchy in this region is a long hiatus separating the big centres from lower order centres. There is a big gap between sub-regional centres and the regional centre. The big centre of Gorakhpur seems to dominate as a 'primate city' the entire
area of Trans-Ghaghara Plain and also the surroundings outside area. The findings in the Trans-Ghaghara Plain evidently corroborate the evidences found in other developing countries. "The urban hierarchy in most of the smaller countries of Asia is much more sharply contrasting than in the West where the hierarchy is gradual. Often there is a primate or prime city 5 to 10 times greater than the second city in contrast to an even system of cities in the West" (UNESCO, 1956).

The theoretical proposition of Christaller is that centres of each higher order possess all the functions of lower order centres, and they offer a set of central functions which differentiates them from the lower order centres. In general, this is not the situation in the study area. It is evident from the foregoing analysis that although a discernable hierarchy in terms of functional magnitude is identified, it is not well articulated with respect to functional distinctiveness below sub-regional centres and intermediary centres. The small service centres and local service centres are thus exposed by their weakest functional structure claiming hardly any function.

as characteristic of their level.

Thus, a five level hierarchy in the Trans-Ghaghara Plain has been identified. The study presents evidence which supports the proposition of hierarchy of service centres. Again, however, there is nothing approaching the regularity in the strict hierarchical sequence as anticipated by Christaller. Christaller's propositions rest on certain simplifying assumptions which are not found in the area under study.