CHAPTER - III

CENTRALITY AND HIERARCHY OF SERVICE CENTRES

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PART - I : MEASUREMENTS OF CENTRALITY

- Methods of centrality measurement
- Choice of method for calculating centrality
- Selection of central functions
- New method for calculating centrality
- Regional analysis of centrality

PART - II : HIERARCHY OF SERVICE CENTRES

- Methodology
- Hierarchic order of service centres
- Determination of 'K' value for Hierarchy
- Spatial distribution of service centres in different order of hierarchy

In this chapter an attempt has been made to study the centrality and hierarchy of service centres in the region under study. The present chapter is divided into two parts. Part first deals with the measurements of the service centres and in the second part hierarchy of the service centres has been established.

PART - I : MEASUREMENTS OF CENTRALITY

The concept of centrality as developed in recent years is one of the aspects of the geographic interpritation of the central places i.e. service centres. Centrality may defined as the essence of the point of focus and is the measure of importance of a place in terms of its functional capacity to serve the needs of people in the surrounding area. The centrality of a place is totally depend upon the central functions performed by a place. Centrality can be expressed qualitatively such as low and high as well as quantitatively by centrality values which can be obtained by converting functional base of a place into scores on the basis of importance and frequency of the functions available at a place. According to Christaller (1933) 'A service centre refers to any permanent settlement which caters to the socio-economic needs of its tributory area through a number of services which it houses by virtue of its central location and functional distinctiveness.

METHODS OF CENTRALITY MEASUREMENT

Various methodological studies have been completed and number of methods have been evolved during the last forty years

to calculate the centrality of settlements. The centrality of a place epitomises its relative importance with regard to its regional framework. It is the outcome of quality and quantity of central functions performed by a place. Centrality of a place can be measured in several ways. The single function index has been used by many researchers. The number of telephone connections was used by Christaller in 1933 in his original work. Smailes (1944) has used bus service frequency for measuring the centrality of urban places of England and Wales.

Multifunction index has been very frequently used in this regard. Dickinson 1937 has considered wholesale trade of cities as an indicator of centrality. Berry and Garrison in 1958 have considered all central functions existed in a place for calculating centrality. Davies (1967) has pointed out that consideration of all retail establishments for calculating centrality poses a problem of equivalence, therefore, due weightage should be given to each settlement in respect of floorspace and turnover. He used simple method for measuring the centrality in South Wales. He has calculated the location quotient for the functions available in the area. This functional index gives the agreegate importance of a place. Brush (1953) has pointed out that the status of the trade centre was determined by the functions they performed by a combination or association of distinctive sets of functional units (The study of Urban Geography, Herold Carter, p.94). John E. Brush studied the hierarchy of central functions in South Western Wisconsin (Geographical Review, 43), Godlund (1956)

has worked out the centrality of Swedish settlement. He has used the total population in a settlement and number of persons employed in a retail trade and services.

Among the Indian Geographers Prof.K.N.Singh and O.P.Singh have evolved a methodological device in the study of centrality and hierarchy of the settlements. K.N.Singh (1966) has studied spatial pattern of central places in the Middle Ganga Valley. Central places of Utter Pradesh have been studied by O.P.Singh in 1969. P.W.Deshmukh (1979) has studied the central places of Upper Krishna Valley.

CHOICE OF METHODS FOR CALCULATING CENTRALITY

In the present study the centrality of the service centres has been calculated by using Location Quotient Method (Davies 1966). The Godlund's Method has used to obtain the functional index. The results obtained by these two methods have been compared with the method evolved by author in which centrality index is calculated in terms of excess population served.

SELECTION OF CENTRAL FUNCTIONS

Considering the developing nature of the study region care has been taken in the selection of functions. In all 10 central functions have been selected for the measurement of centrality (Table 3.1).

In the selection of functions due care has been taken and their service capacity for a single functional unit has been

considered. Fig.3.1 indicates the service capacity of a single unit of the selected functions in the study region. The minimum requirement of the population to serve telephone connection is the lowest (500 persons), on the other hand saw mill depot has a large threshold requirement. From the figure one can easily group the lower order and higher order functions and the individual service capacity of the function. The lower order of the function includes telephone connections, wood depot, banks highschool. The medium order functions include fertilizer suppliers, bakery establishment and veternary dispensaries. Higher order functions comprises market, saw mills, taluka headquarter administration and taluka judicial court.

TABLE 3.1 : List of central functions and service selected for measuring the centrality.

Sr.No.	Central functions/Services
1	Weekly market
2	Highschool
3	Primary health centre
4	Veternary dispensary
5	Banks
6	Telephone connections
7	Wood Depot
8	Saw mills
9	Seeds and fertilizers suppliers
10	Number of bakeries

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THRESHOLD POPULATION OF A SINGLE FUCTIONAL UNIT.

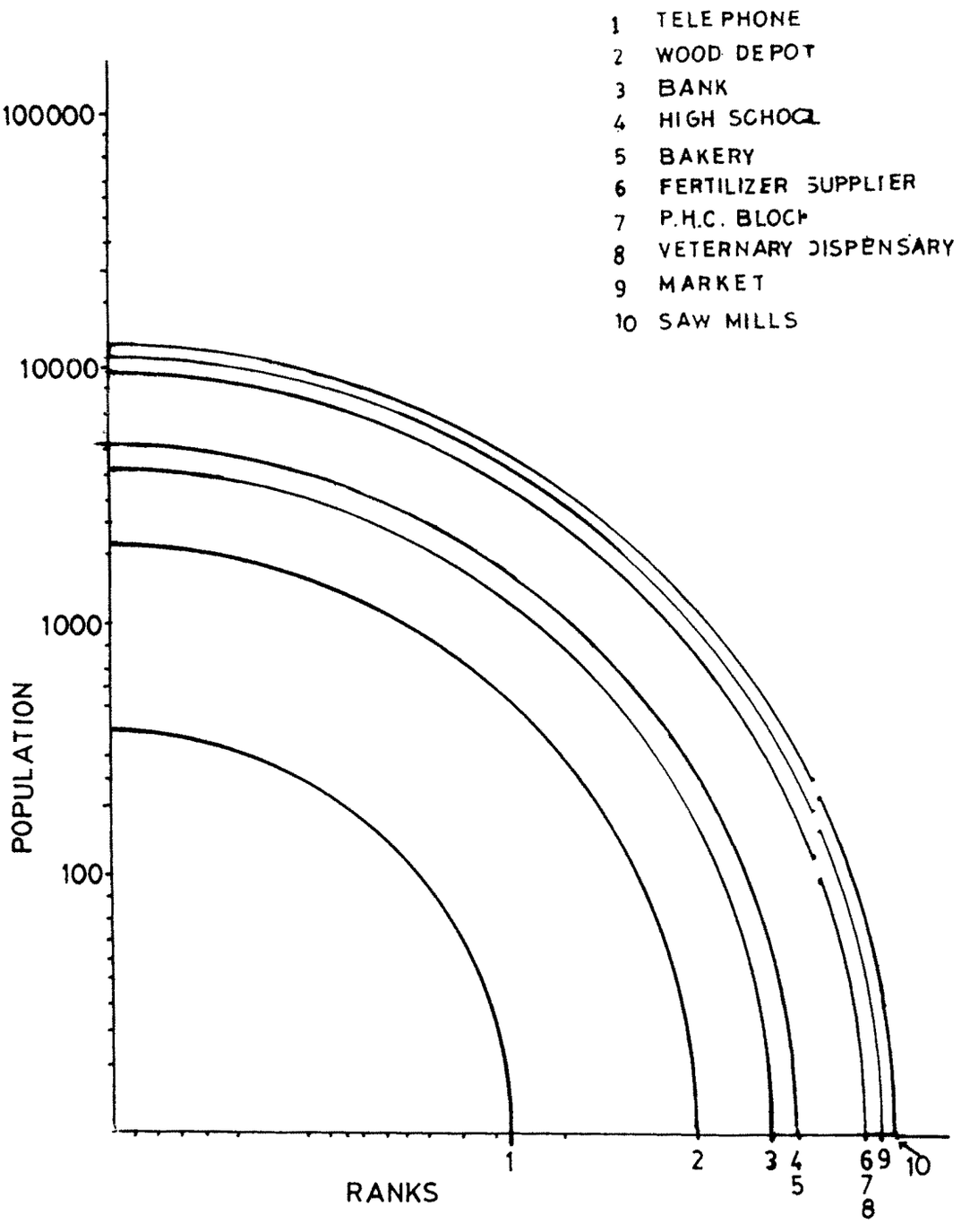


Fig 3·1

NEW METHOD FOR CALCULATING CENTRALITY

With the application of the data pertaining to the aforesaid central functions and services the centrality of the service centres has been measured by a new method. For comparison and justification for the choice of new methods the centrality score of all the service centres have been calculated by the traditional Godlund's and Davies method.

The new method is designated as "Excess population served by surplus functions". This is a simple method but it has its own merits. In this method, the mean population served by single functional unit in the entire region is calculated and with this mean value the total population served by the number of functional units of any function available at service centre is calculated. The total population served by particular function of a service centre is the total service capacity. The population of a service centre when substracted, we get the excess population servicing capacity of that function. Thus excess population servicing capacity is calculated for all the 10 central functions. The summation of all excess population values gives the excess population served by central functions of a place. For convienience all summation values of excess population are put under squareroot.

The following equation gives the excess population index.

$$Ft = \frac{P}{F + i} \qquad \ldots \quad I$$

Where, 'Ft' is the mean functional values for the function

'F' in terms of population (mean population served by a single functional unit)

'P' is the total population of the study area

'Fti' is the total functional units of the function 't' in the study area

$$FP = ct \times Ft \quad \ldots \text{ II}$$

Where 'Ft' is the total functional value of function 't' at service centre (in terms of population)

'ct' is the number of units of function 'ct' at the service centre

$$EP = FP - UP \quad \ldots \text{ III}$$

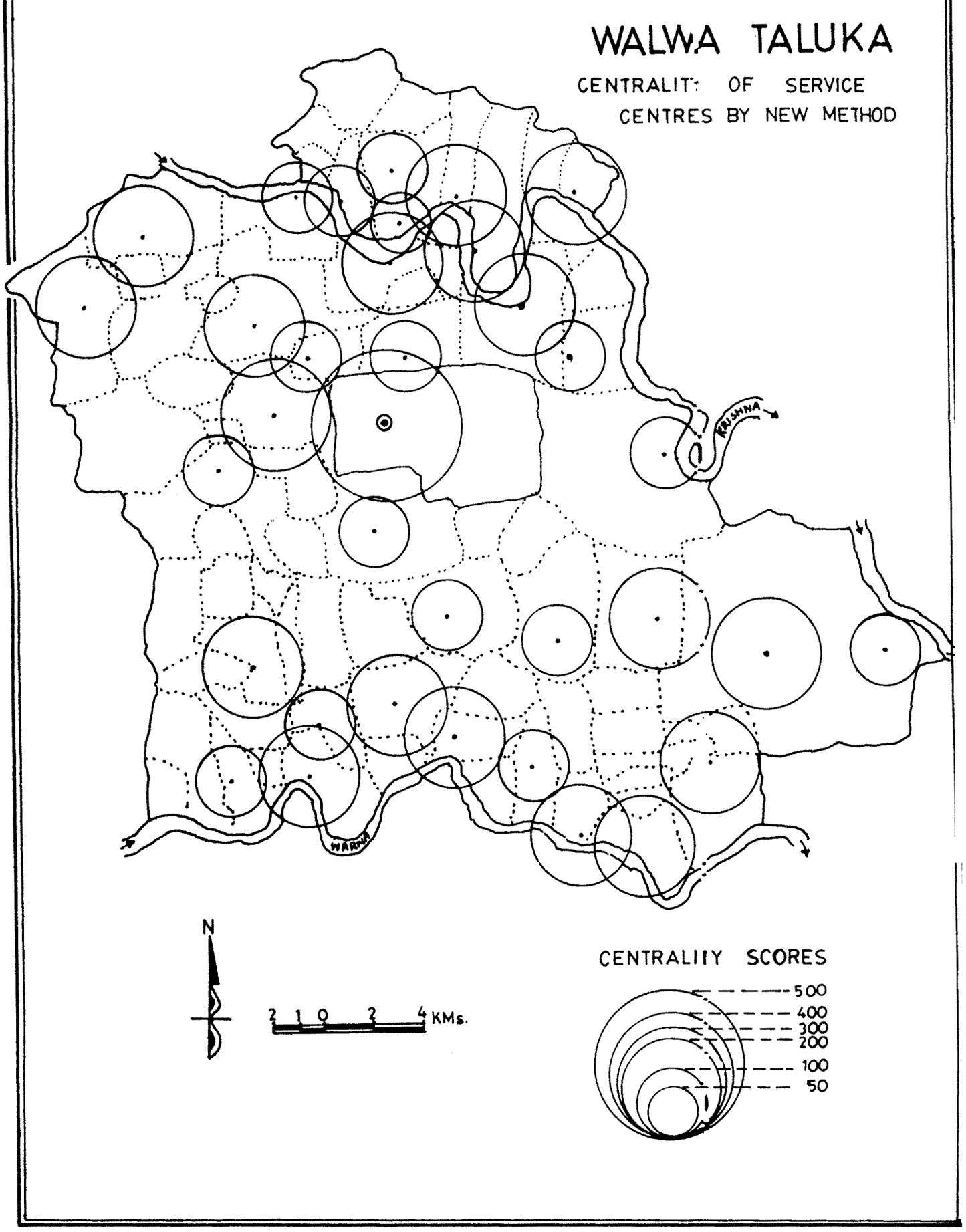
Where, 'EP' is the excess capacity of the central place for any function 't' (in terms of population number

'UP' is the population of service centre

$$Epi = EP_1 + EP_2 + EP_3 + \ldots + EPn \quad \ldots \text{ IV}$$

Where, 'EPi' is the total centrality value of a service centre (measured in terms of population)

The calculated centrality scores for all service centres in the study area are given in Table 3.2 and shown in Fig.3.2 . This table also includes the centrality scores calculated by Davies method and Godlund's method.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CENTRALITY OF SERVICE
CENTRES BY NEW METHOD
KRUSHNA
WARNA
N
2 1 0 2 4 KMs.
CENTRALITY SCORES
500
400
300
200
100
50

Fig. 3·2

MEASUREMENT OF CENTRALITY BY DAVIES METHOD

Davies W.K.D. in 1966 has used his method for South Wales. In his method a score for any single unit of function is calculated by following formula.

$$C = \frac{t}{T} \times 100$$

Where, 'C' is score for any function 't'

't' is one unit of function 't'

'T' is the total number of functional units of function 't' within the area

With the application of this method centrality score for selected ten functions have been calculated and sum of individual centrality score of all functions at the service centre gives composite locational index. Thus, calculated centrality scores are given in Table 3.2, and their spatial distribution has shown in Fig.3.3.

CENTRALITY BY GODLUND'S METHOD

Godlund has selected retail trade as an index of centrality. He used the relationship between the number of persons employed in retail trade and services. To the total population of the region with the help of following equation.

$$C = \frac{TC}{P} \times 100$$

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CENTRALITY OF SERVICE CENTRES
BY DAVIES METHOD

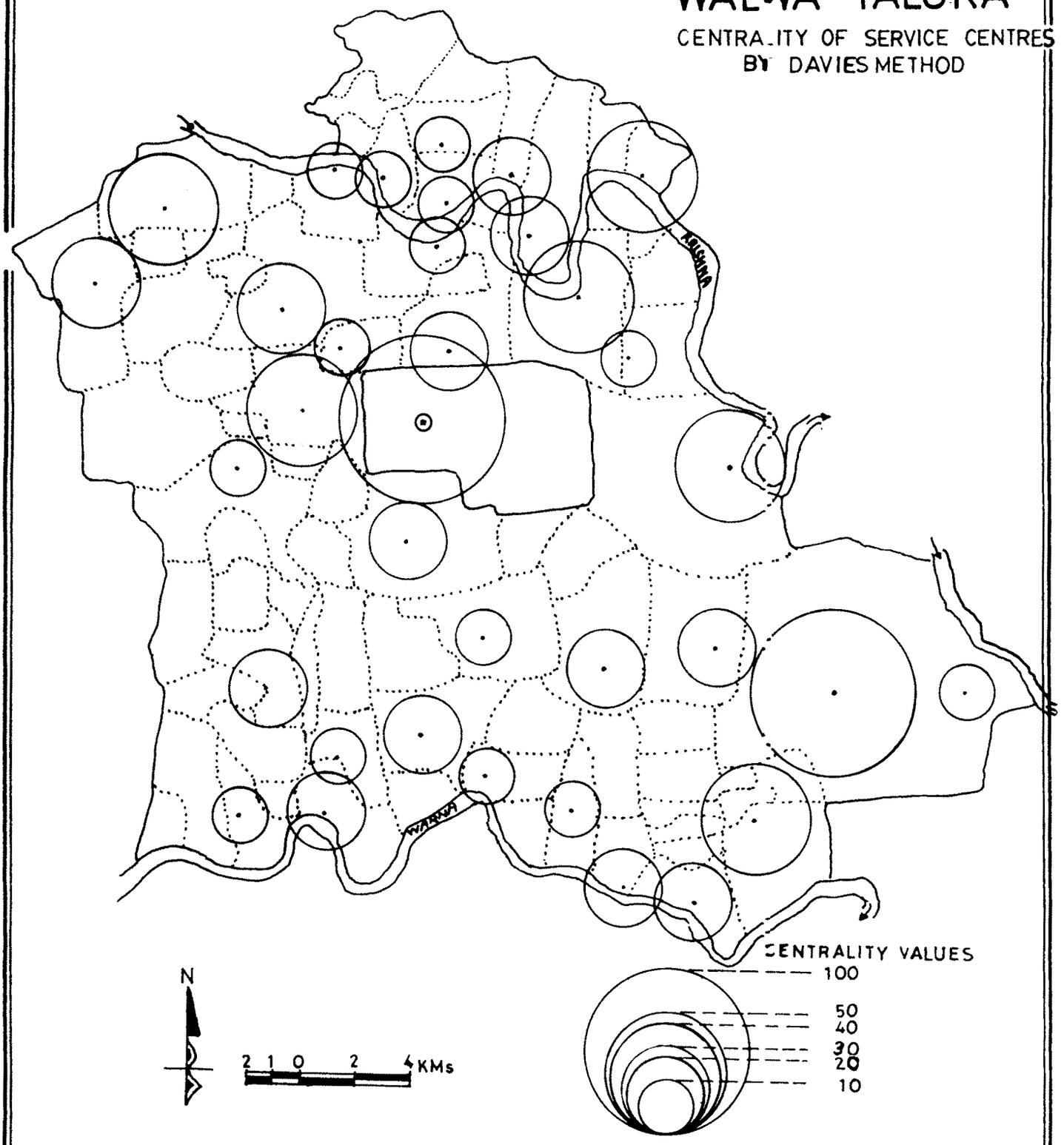


Fig 3·3

Where, C = Centrality

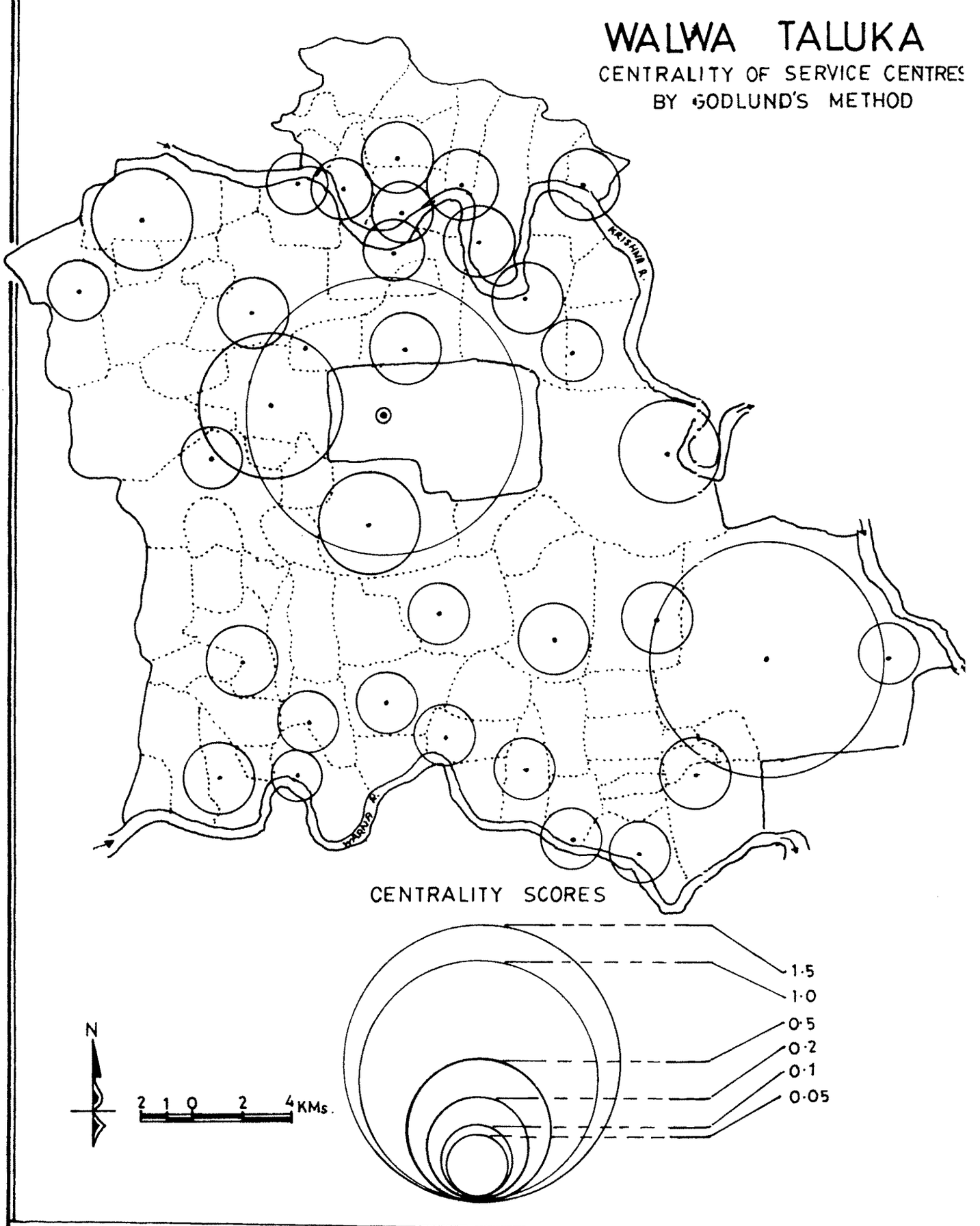
TC = Number of persons employed in retail trade, commerce and other services in study area

P = Total population of the study area

In this way the centrality of every service centre in study area has determined. Centrality scores calculated by this method also shown in Table 3.2 and depicted in Fig.3.4 for the comparison purpose.

REGIONAL ANALYSIS OF CENTRALITY

Centrality values calculated by three different methods have been represent in Fig.3.2, 3.3 and 3.4. A comparative and analytical study of these three methods indicate the superiority of the new method. The centrality score based on Godlund's method gives diceptive picture of the area. A very small centres like Takari, Kameri scores high centrality values by this method. Sakharale being a sugar factory site and a recent in origin scores more centrality value by the Godlund's method. On the other hand large service centres like Peth, Walwa and Bagani have a comparatively lower values of 0.268, 0.215 and 0.142 respectively. In fact these service centres are large in population size but their lower percentage of population is in a tertiary sector and hence they are characterised with comparatively lower centrality scores.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CENTRALITY OF SERVICE CENTRES
BY GODLUND'S METHOD
KRISHNA R.
WARNA R.
CENTRALITY SCORES
1·5
1·0
0·5
0·2
0·1
0·05
N
2 1 0 2 4 KMs.

Fig 3·4

Out of the total service centres only 8 percent service centres have large centrality score ranging between 0.5 to 1.5, 49 percent service centres are with medium centrality values in between 0.1 to 0.2 and 43 percent service centres have low centrality values below the 0.1 (Table 3.2).

The centrality results calculated by Davies method simply suggest the overall functional importance of the service centre. In this method excess service capacity of the service centres cannot be found out. In the study area Kameri ranks 30th according to new method on the other hand by Location Quotient Method it ranks on 14th. This method gives only the nodal importance of the centres and some times places which serves very little area and population indicate high centrality values. For example Walwa, which ranks 25th according to new method but by the Davies method it stands at the 6th rank.

The centrality index obtained by new method shows appropriate and correct centrality values of the service centres since they are directly related to the excess population serving capacity of the respective service centre. The regional distribution of centrality values of service centres within the study area indicates that Islampur has scored the highest centrality value (555.43) and tops the list, whereas Shirate at the least (16.64) (Table 3.2). Islampur is followed by Ashta, Peth, Takari and Borgaon with 2nd, 3rd, 4th and 5th ranks respectively.

Service centres with high centrality values by and large concentrated in the vicinity of river Krishna. It is noteworthy that service centres with lower centrality values are distributed in a Doab region of study area except Islampur and Peth. Smaller to medium centrality scores have been observed in the service centres dotted on left bank of the river Warna (Fig.3.2).

In the study area very high centrality value (555.43) observed on at Islampur service centres. High centrality values ranging between 200 to 300 is found in the service centres like Ashta, Kasegaon, Borgaon, Peth, Wategaon, Bagani, Bichud, Koregaon and Takari. Moderate centrality scores category (100 to 200) includes 20 service centres of the region. Centres like Ashta, Kasegaon, Borgaon, Peth, Wategaon, Bagani, Bichuc, Koregaon and Takari. (Moderate centrality scores category (10C to 200) includes 20 service centres of the region.) Centres like Karndwadi, Chikurde and Nave Khed have low centrality scores and these centres stands at the ranks of 31st , 32nd, 33rd and 34th respectively. Very low centrality score is observed in Shirate service centre obviously it is at the end of the hierarchy of service centres.

PART - II : HIERARCHY OF SERVICE CENTRES

Hierarchical class system is very important part of spatial model of service centres. An excellent explanation of hierarchy of central places is given by Berry and Garison (1958) and pointed out three types of class orders of central places

(Hamlet, Village and Town). Green (1950) and Carruther (1957) have distinguish five orders of central places. In India Datta and Banerjee (1970) have classified central places of West Bengal into 6 classes. Diddee (1978) has classified the central places of Upper Bhima basin into 6 classes. Six folds classification of central places of Upper Krishna Valley has been proposed by P.W.Deshmukh (1979).

The review of the various studies of hierarchic class order indicates that there is no uniform scale for classification of service centres.

METHODOLOGY

In the present work centrality scores have been calculated with the help of new method. For classifying service centres into different orders of hierarchy the centrality values obtained by new method are used. All the service centres are ranked in order of their centrality values and ranks are plotted on log-log scale. The plotting of service on a graph (Fig.3.5) clearly indicates different slopes grouping service centres of different orders having different levels of functional magnitude.

Islampur occupies the highest centrality and it stands high above all the service centres in the study region and hence classified as a first order service centres of the taluka. The second order comprises 9 service centres viz. Ashta, Peth, Takari, Borgaon, Bagani, Bichud, Kasegaon, Koregaon and Nategaon. These

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HIERARCHIC ORDER OF SERVICE CENTRES 1981

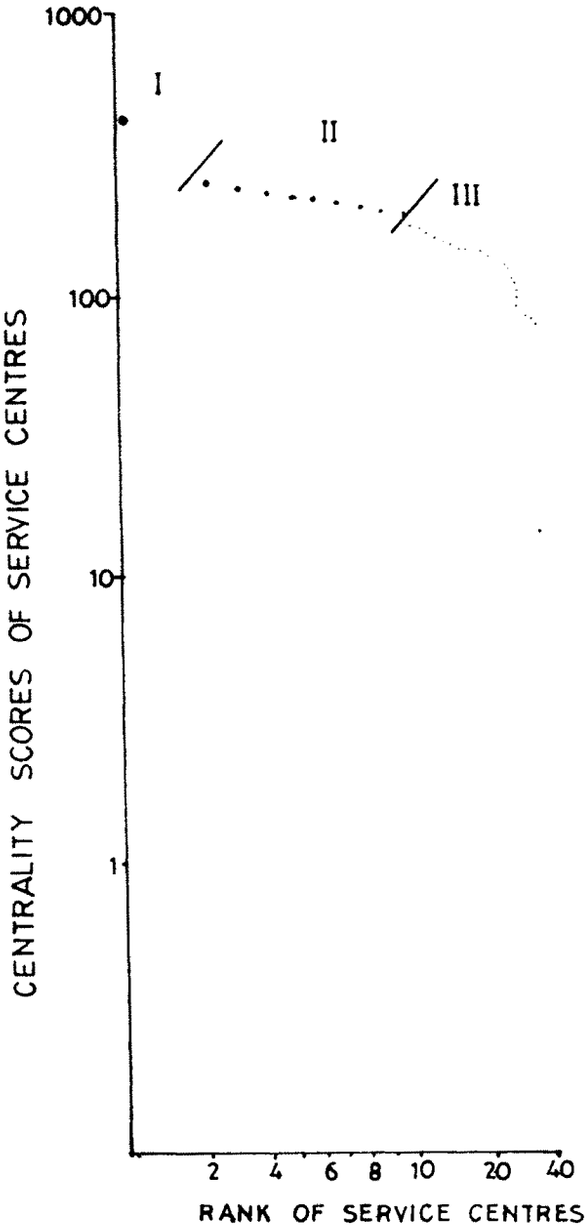


Fig 3.5

centrality range is between 200 to 300. The third order in hierarchy of service centres includes the remaining 25 service centres of the study area. The clearcut breaks in the slope are found, for the first and 10th rank of service centres (Fig.3.5).

HIERARCHIC ORDER OF SERVICE CENTRES

Hierarchic order of service centres is well determined on the basis of centrality score and three tier hierarchy has been established. The first order in the hierarchy is occupied by Islampur with the highest centrality score. It is a centre of regional importance and taluka headquarter. Second order service centres are important market centres of the area. Third order service centres are the small centres which have gained importance because of their nodal locations - or by virtue of their commercial importance or locational significance for specific activities. This hierarchical order consists (25) a large number of service centres of the region.

DETERMINATION OF 'K' VALUE FOR HIERARCHY

Christaller (1933) has suggested in a perfect geometrical pattern, there is a definate numerical relation between the number of central places of two successive orders. The total number of settlements of certain order served by a central place of a next higher order is obtained by multiplying the number of higher order number with fixed multiplier. This multiplier is called 'K' value. 'K' values of 3 is expected to developed when the supply of goods

from the places as near as the dependent places as possible (marketing principle). K_4 system develops where most of the central places in such cases are located on important traffic routes (Transportation principle). If the region has a firm administrative control then a fixed K system where K = 7 value would developed. This perfect geometrical pattern and their fixed values are distorted by physical conditions, localisation of resources and levels of economic development and therefore the pattern and their fixed values are rarely found in reality.

In the determination of the K values, the method of bifurcation ratio used by Geomorphologist is applied.

$$K = \frac{K1 + K2 + K3 + \ldots + Kn}{\text{Number}}$$

Here, K stands for composite. 'K' value for all orders of service centres and hence $\frac{1}{1} + \frac{9}{1} + \frac{25}{9} = \frac{35}{11} = 3.4$

The result of equation clearly indicates that within the study region service centres and their hierarchic class orders are governed by 'K' value of 3.4. Table 3.3 shows hierarchic order and number of service centres.

TABLE 3.3 : Hierarchic order and number of service centres.

Order	I	II	III	Total
No. of service centres	1	9	25	35

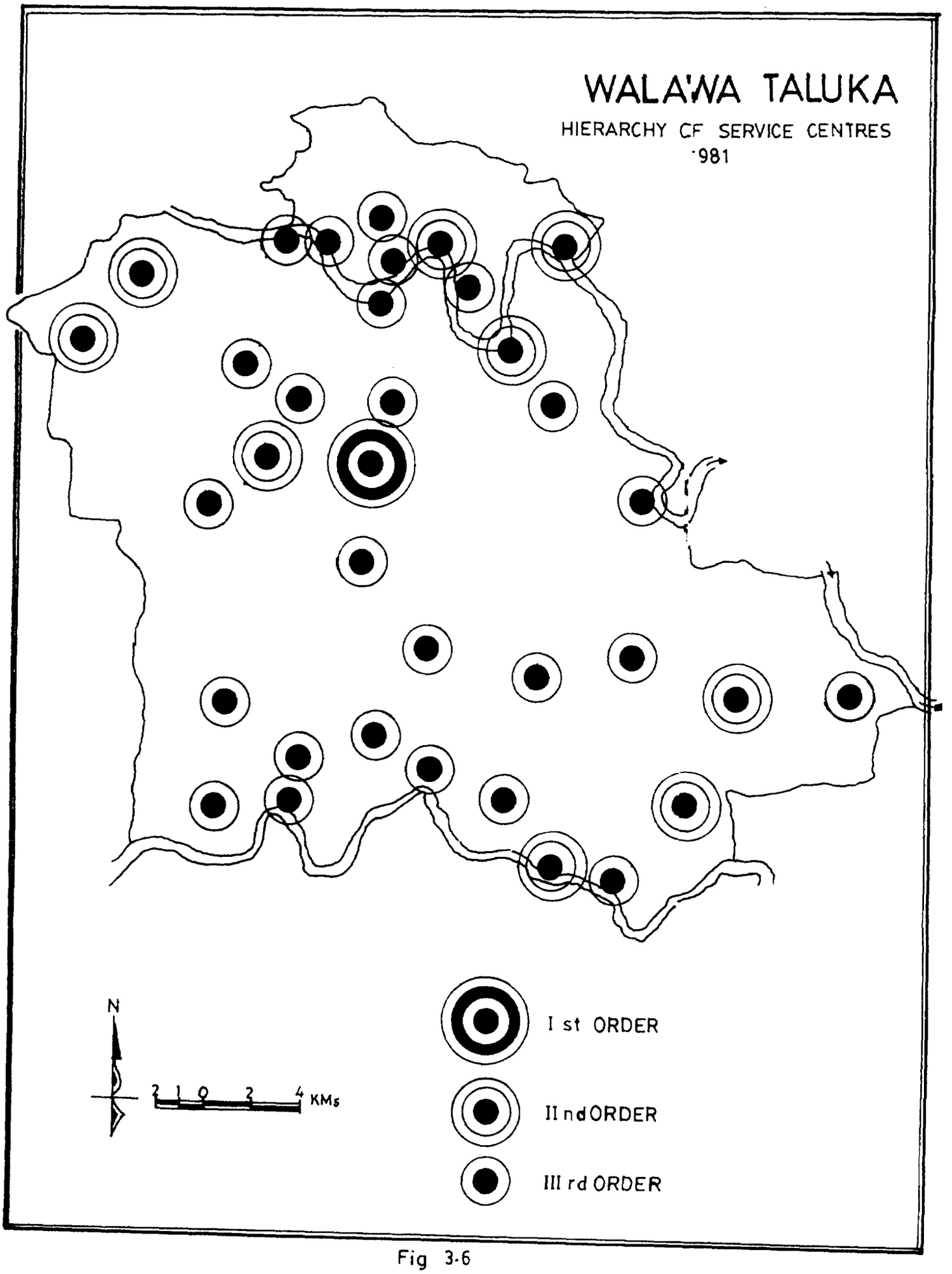
It is evident from the table 3.3 and determined 'K' value that in the study area the pattern indicates some similarity with K = 3. This hierarchy of service centres is represented in Fig.3.6.

The analysis of hierarchic orders of service centres shows that existing pattern deviate from theoritical K value (Table 3.4). According to K = 3 principle the progression of service centre is 1:2:6:18:54 etc. and the progression of service area of such level is 1:3:9:27:81 etc.

By and large K = 3 principle (Marketing Principle) observed in the study area.

SPATIAL DISTRIBUTION OF SERVICE CENTERS IN DIFFERENT ORDERS OF HIERARCHY

The regional study of hierarchic distribution of service centres indicates that higher order service centre i.e. Islampur is located nearly at the centre of the study area and extend the various functions and services to the lower order service centres and entire area of the region. Out of the nine second order service centres Ashta is a urban place and is located at the south east corner of the region. It is located in a fertile tract of soil and good agricultural land. Bagani and Koregaon both the service centres of second order are developed on the left bank of river Warna. It is interesting to note that the service centres like Bichud, Takari and Borgaon are grown at the appex of Krishna river loops within the radius of 4 kilometers. Kasegaon and Peth both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HIERARCHY OF SERVICE CENTRES
1981
N
2 1 0 2 4 KMs
I st ORDER
II nd ORDER
III rd ORDER

Fig 3.6

the service centres of this category are located on the national highway No.4, whereas Wategaon is located at the north-west corner of the area. The next lower order (3rd order) has 25 rural service centres, most of them are concentrated along the river Krishna and Warna. Nearly 33 percent of the third order service centres are distributed in central upland tract of the region.

TABLE 3.4 : Distribution of service centres in different orders of hierarchy in the study region.

Blocks	I order	II order	III order	Total
Kasegaon	00	02	01	03
Peth	0	1	2	3
Kameri	0	0	3	3
Kurlap	0	0	4	4
Yelur	0	1	4	5
Bawachi	0	2	3	5
Walwa	1	1	3	5
Rethare Haranax	0	2	5	7
Total	1	9	25	35

Table 3.4 represents blockwise distribution of service centres and their class order hierarchy. It is evident from the table that Rethare Haranax block comprised seven service centres

out of which 2 are second order and 5 are of third order. Walwa block has 5 service centres within its juridiction which constitutes 3 service centres of third order and one centre each in second order and first order of hierarchy (Table 3.4). Block Kurlap is relatively a drier patch of the area and economically less developed consist 4 service centres of lower order. There are three service centres in each of Kasegaon, Peth and Kameri block.

By and large higher order service centres are distributed in economically prosporous areas on the other hand economically poor areas are characterised with the service centres of lower order.

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