

SPATIAL ANALYSIS OF SMALL TOWNS AND ITS IMPLICATIONS IN DECENTRALISED PLANNING

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ABSTRACT : The spatial analysis is basically related with articulated and integrated system of settlements which need to promote regional growth, social transformation and spatial integration. Decentralised planning is an approach to develop the microregions through spatial planning of settlement systems for the development of the people. Most of the small towns are collecting, processing, distributing and service centres for the agricultural areas around them. Small towns in Eastern Uttar Pradesh have been analysed to understand their spatial distribution, rank-size relationship and functional classification. The character of towns is the boon for decentralised planning in the growth foci approach as formulated in market centres, service centres and growth points in micro-regional/local-level planning.

INTRODUCTION

The spatial analysis is basically related with articulated and integrated system of settlements which need to promote regional growth, social transformation and spatial integration. An articulated and integrated hierarchy of settlements provides potential access for the people living throughout a country and to the markets of different sizes as well as to a wide variety of urban amenities (Rondinelli, 1983, P.381). The towns, situated within the spatial network of a region, work as growth foci/service centres (Sharma, 1984A, 1984B, 1991) and by propelling the development impulses usher in an era of socio-economic transformation within the region. Decentralised planning is an approach to develop the micro-regions through spatial planning of settlement systems for the development of the people.

SPATIAL ANALYSIS OF SMALL TOWNS

Towns are essentially settlements which provide services for the population of their hinterlands alongwith their own population. They provide important economic, social and physical functions to the surrounding area, such as, administrative, educational, professional services, banking, market facility, employment opportunities and so on. The higher order urban centres perform a wider range of services/functions and provide increasingly more specialized services in the urban system.

SPATIAL PATTERN:CENTRALITY AND FUNCTIONALITY

The hierarchical class-system implication, originally developed by Walter Christaller, is an integral part of the spatial model to explain the size, spacing and functions of the urban centres. Most urban geographers believe with

Christaller that towns may be grouped into hierarchical classes according to their size and functions they perform. Others believe that there are no distinct grades, but only a continuum. Brush (1953) found that the Christaller's ratio of population, rank and service area seem to be derived from a priori assumptions rather than from empirical evidences'. Losch proposed a scheme for market areas again using hexagonal service areas as the basic units in his theoretical landscape and allowed various hexagonal systems to co-exist. The resulting arrangement does not produce the "tiered" system of urban centres suggested of Christaller, but leads, more or less, to a continuum of various-sized towns and cities. The functional complexity is not always accompanied by an increase in the size of market areas. Many other geographers have also followed Christaller's 'central place theory' at least in part including a few work in Indian context.

Many geographers have used several types of criteria or methods to determine the centrality of centres depending upon the availability of data. In the present study, a method has been taken for calculating the centralities of small towns after making a slight modification in the method used by Singh (1981). The present method is based on the non-agricultural working population which includes workers engaged in construction, household industry, manufacturing, trade and commerce, transport, storage and communication and other services. The centrality (C) of each small town of Eastern U.P. has been calculated with the help of the following formula:

$$C = \frac{NAW}{TNW} \times 100$$

Where, NAW = Non-agricultural workers of the centre ,

TNW = Total non-agricultural workers of small towns.

Applying the above formula, the centrality indices of all the 95 small towns of the region have been computed. It ranges from the highest (3.42) for Kopaganj town to the lowest (0.289) for Bilariaganj town in Azamgarh district.

The relative importance of any centre, not only depends on the centrality of the centre but services and amenities performed by the centre have their great importance also. Towns are the central places which perform important central functions as economic, social, administration and physical to their own residents as well as to the people living in the surrounding areas. Central functions are typically those which cause movement of people to avail them. To measure the relative importance of small towns in Eastern U.P., a number of central functions have been selected on the basis of availability of data and which are generally found or which can be expected in a small town. Functions, such as, post office, primary school, junior school, bus routes, market etc. are not taken into consideration, because they are found in all small towns. Those functions which generally require a high threshold population (more than 20,000 persons) have been excluded. The occurrence of such functions which are usually found in large/medium towns, may be found in small towns due to accident. For example, there is a university in Kashi Vishwavidyalaya which is a suburb town (This happens due to misleading census definition) of Varanasi city. One cannot expect this function in small towns because it requires certain amount of optimum population. In most cases the higher order services, which are generally found in the large towns, may be found in the sub-urban areas. Therefore, these services cannot be taken as a parameter, common to all the small towns and

classify them into different hierarchical order, viz., district headquarters, polytechnic/engineering college, medical college, university, police headquarters, civil court, stadium, etc. For the purpose of qualitative indices, only fifteen functions have been selected for the present study. Functions differ in terms of the size of population necessary to sustain that function in a centre. Population threshold is the minimum population required for existence of the function. To determine the population threshold values for the fifteen selected functions Reed-Muench method (Hagget et al., 1964) has been adopted. The threshold values range from the highest 15,750 for shorthand type school to the lowest 2,600 for bank. To compute the weight for each function the following formula has been applied.

$$W_j = \frac{T_{pj}}{15} \times 15$$

$$\leq T_p$$

$$J=1$$

Where W_j = weight for J_{th} function population.

The following table 1 indicates the central functions (selected), threshold population and weights assigned to each function. The functionality index (F_i) for each of the 95 small towns has been calculated by adding the number of functions existing in town, where each function has been given the assigned weight. The values range between 19.09 in Saidpur town to zero in Amilo. It has been observed that, the higher order of central functions, the lower the number of towns providing them and they have a wider range than lower order

Table 1 : Threshold Population and Weights of Selected Functions

Sl. No.	Functions Population	Threshold	Weights
1.	Short-hand type School	15,750	1,591
2.	Cinema	15,400	1,555
3.	Tahsil Headquarter	15,150	1,530
4.	Degree/P.G. College	14,850	1,500
5.	Family Planning & Nurshing Home	13,750	1,389
6.	Veterinary Hospital	12,250	1,237
7.	Drinking Water Supply (O.H.T.)	10,300	1,040
8.	Railway Station	9,950	1,005
9.	Block Headquarter	8,650	0,873
10.	Agricultural Credit Society	8,250	0,833
11.	Police Station	7,150	0,722
12.	Telegraph Office	5,630	0,570
13.	Hospital	4,800	0,484
14.	High School/Inter College	4,000	0,404
15.	Bank	2,600	0,262
Total		148,500	15,000

functions. It also has been found that large centres perform more functions than small urban centres and they also have more establishments and functional units. To determine the hierarchy of small towns in Eastern U.P. a multiple criteria, composite index (Coi) has been calculated for all the 95 small towns taking average of the centrality index and functionality index $Coi = 1/2 (C_i + F_i)$. In the present study, all the 95 small towns have been plotted on a simple graph with population size and composite index (Fig. 1.B). Taking almost equal intervals of composite index, three-tier hierarchy of small towns have been identified. The first order centres are not evenly distributed throughout the region (Fig. 1A). Five towns, namely, Muhammadabad and Saidpur in Ghazipur, Khalilabad in Basti, Ghosi in Azamgarh and Rasra in Ballia district have been identified as first order centres. All these centres are tahsil headquarters and relatively big small towns of the region. In these towns, all the first order functions are available. The population of these towns varies from 19,635 (Ghosi) to 12,937 (Saidpur). There are sugar factories in Ghosi, Khalilabad and Rasra towns. The second order centres termed as local service centres are 42 in number. Out of these 42, 18 towns are tahsil headquarters as well as block headquarters too and 17 towns are only block headquarters. The Coi index ranges between 7.113 in Shahganj to 4.103 in Pipraich town. Some towns are the centres of household industries, e.g., Kopaganj, Suriyawan etc., while some towns have sugar factory such as Shahganj, Pipraich, Siswa Bazar, Gauri Bazar and Ramkola. Small towns to third order are market towns. Out of 48, 15 towns are block headquarters, and 27 towns are newly added. Some towns are the centres of handlooms and carpet weaving i.e., Adari, Amilo, Khairabad, Lohta, Kotwa, Ghosia Bazar, Bahadurganj, Ledwa Mahua etc. There are sugar factory in

Anandnagar, Siwarthi, Bhatni Bazar, Kaptanganj etc. The Coi ranges from 3.899 (Nichlaur) to 0.449 (Khairabad). Generally, all these towns have no first order functions and they differ in number and level of central function. These towns are overgrown villages which owe rural characteristics. Reoti, Majhauri Raj, Azamatgarh and Hariharpur are agricultural towns.

The small towns vary in the economic and administrative structure of the region because of their direct link to the vast surrounding rural areas. The small towns serve as centres for providing socio-economic institutions and facilities, viz., marketing, service, education, health, power, banking, credit and co-operatives, transportation and communication as infrastructures to develop the economic activities for harnessing the resources of rural areas. They work as like to facilitate the social and technological innovations from cities to their hinterlands as well as integrate social interactions and the urban and rural economy.

SPATIAL PATTERN : RANK-SIZE RELATIONSHIP

The idea of relationship with regard to size and spacing was introduced by Christaller's K-3 hierarchy. Later on, Losh, Brush, Stewart, Brown and Gibbs, etc. explored the possibility of relationship between size and spacing on the regional and national levels. The 'central place theory' considers the size of urban centres as well as their spacing, but there is another generalization which has been made about city size. It is the so-called 'rank-size rule'. This concept was formalized in the writing of Zipf (1949) who attempted to show this distribution as following an empirical rule, the rank-size rule :

$$P_r = \frac{P_1}{r}$$

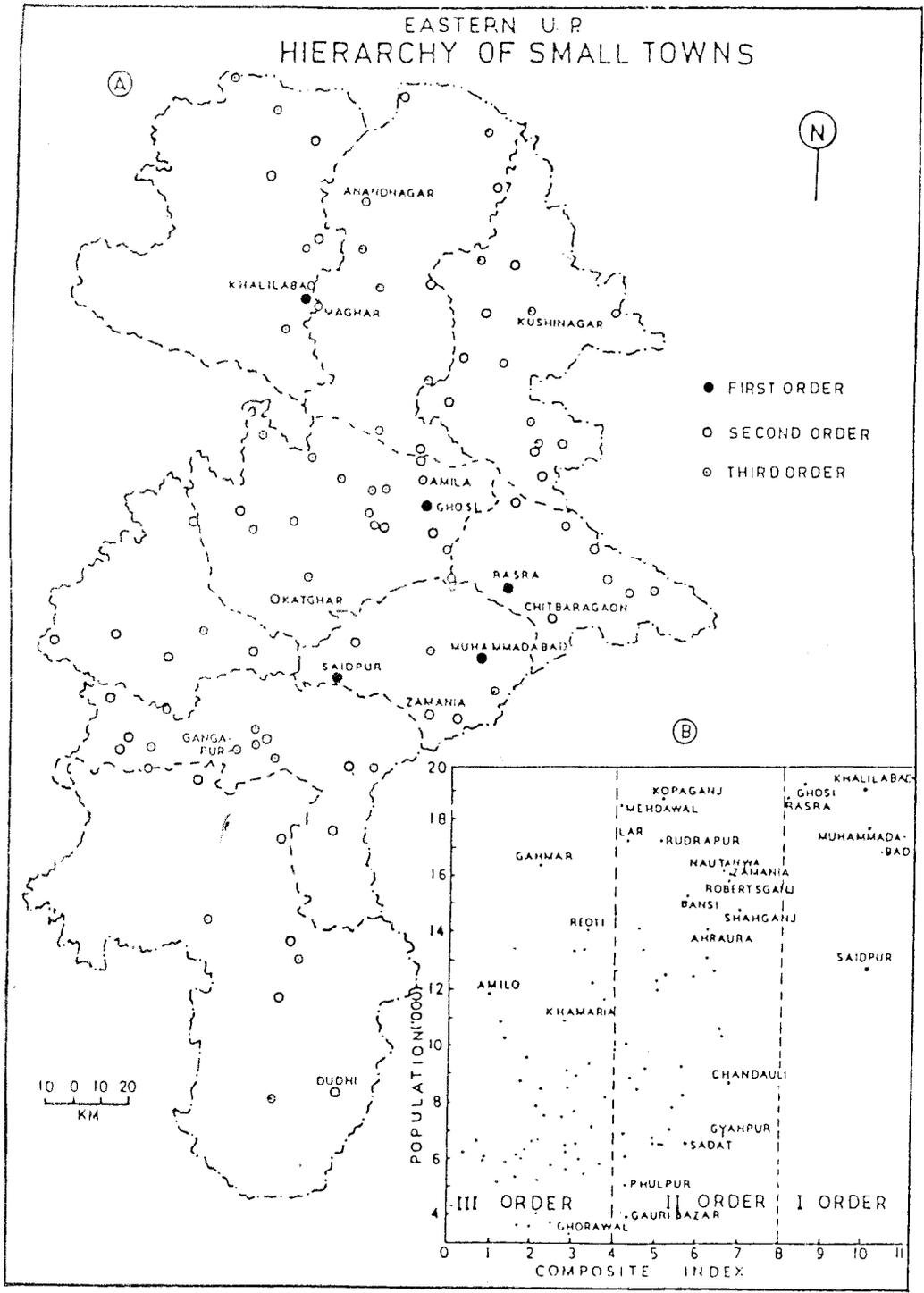


Fig. No. 1: Hierarchy of small towns

Where P_r is the population of rank r , P_1 is the population of the largest city (the primate city) and r is the rank of a given city/town. Christaller's urban hierarchy produces a stepped arrangement of urban sizes while the rank-size rule implies a smooth progression of population size from rank to rank. Zipf's scheme of rank-size rule has been applied by arranging in the descending order according to population of 1981 and 1991 census. The expected population for all the towns (116 in 1981 and 112 in 1991) have been computed. The population of first rank town (primate city) has been calculated by dividing the total actual population by sum of the reciprocal population. For the rest of the urban centres, expected population has been computed by dividing the population of first city by two to get the figure of second, by three for third and so on. To find out rank-size relationship among towns, the ranks of all the towns have been plotted against their population (actual and expected) for the year 1981 and 1991 (Fig. 2 A&B).

The graph clearly reveals that the actual population of towns is not equal to the expected population. Varanasi is the primate city in 1981 as well as in 1991 while Ghorawal in 1981 and Amila in 1991 are the last ranked town. In 1981, Varanasi and Gorakhpur have positive variation from expected population while other large towns have negative variation. In case of small towns, the variation is low in comparison to large towns (Fig. 2A). According to rule, 6 small towns (having actual population between 18,000 - 20,000 persons) should be the large towns (expected population above 20,000 persons).

In 1991, there are 30 large towns and 82 small towns. The deviation between actual and expected population in small towns is low in comparison to large towns (Fig. 2B). According to the rule, 7 small towns, namely, Shahganj,

Ahraura, Reoti, Saidpur, Khamaria, Tetri Bazar and Machhlisahar which have actual population between 17,000 and 20,000 persons, should be the large towns. The applicability of the rank-size rule some certain types of regions as Zipf's explanation needs a homogeneous and sizeable realm. Eastern U.P. is almost a composite large region and a distinguished cultural realm with its distinct socio-economic and histogenetic pattern.

SPATIAL PATTERN : FUNCTIONAL CLASSIFICATION

Functions are essence of towns without which they cannot survive. Dickinson (1950, p.267) observes, "Functions are the driving force of city life and influence to a very large extent its growth and morphology". Functions deals with the external relationship of the town as an organic part of a social group. The nature and character of functions develop in response to socio-economic and resource-base of the region in which the towns are located. Urban functions may broadly be classified into basic and non-basic. The basic functions refer to those city forming ones, and the non-basic to those city serving ones.

In the present study, Nelson's method has been used for the functional classification of small towns. Agriculture is the most dominant economic activity of the region under study and many small towns are overgrown villages having rural characteristics. Therefore, agricultural function (non-urban character) has been considered for functional group. The Indian census has furnished the data of employment under four categories, i.e., cultivators, agricultural labourers, household industries and other workers. Cultivators and agricultural labourers have been treated together as agricultural workers. The percentage of total workers engaged in each functional group for

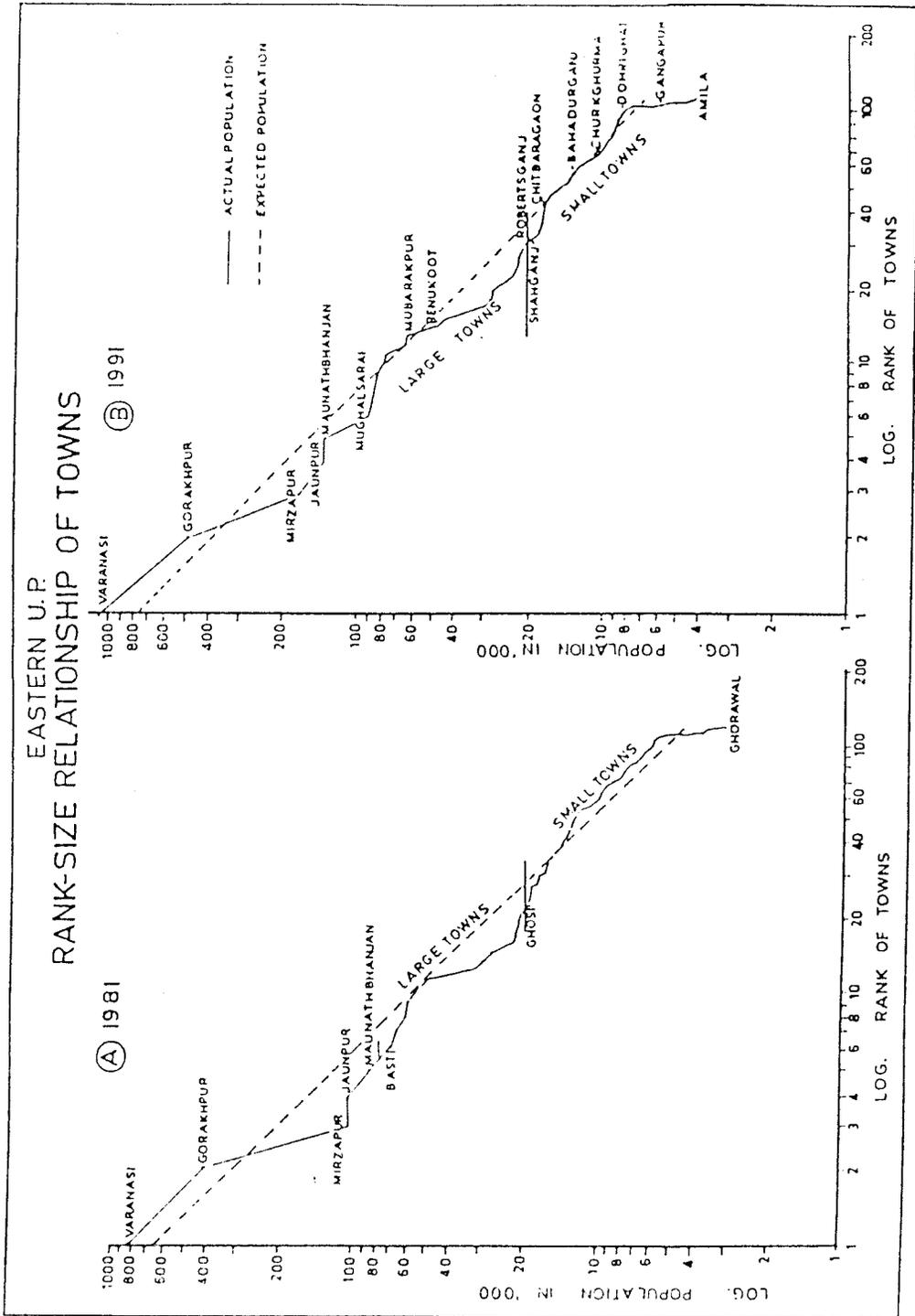


FIG. 2

Fig. No. 2 : Rank-size relationship of towns

each of the 95 small towns of the study region, has been calculated separately. The arithmetic mean and standard deviation ($\sigma = \sqrt{\sum xi^2 - x^2/N}$) have been computed for each activity group for all the small towns of the region as a whole. By adding the standard deviation to the mean, three degrees of variations from the mean have been distinguished (Table 2). Using the S. D. and mean, the small towns

Table 2 : Mean and Standard Deviation for Various Functional Groups

Statistical Devices	Agriculture (Ag)	Household Industry (H)	Other services (O)
Mean	25.88	17.35	56.64
S. D.	17.67	19.10	21.53
Mean + 1 S.D.	43.55	36.45	78.17
Mean + 2 S.D.	61.22	55.55	99.70
Mean + 3 S.D.	78.89	74.65	-

have been grouped according to their appropriate functional categories, e.g., towns with percentage more than one degree of variation from the mean + 1 S.D. in agriculture classed as agricultural towns, above mean + 2 S.D. as Ag₂ and above mean + 3 S.D. classed as Ag₃. The same procedure has been followed for all the other functional groups (Table 3).

Table 3 : Functional Group of Towns

Degree of Specialization	Agriculture	Household Industry	Other Services	Diversified
1	10	4	15	-
2	6	6	-	-
3	-	2	-	-
Total	16	12	15	52

i. Agricultural Towns

Sixteen small towns have been identified as agricultural towns. These settlements are rural

service centres, occurring in the vast agricultural tracts. The percentage of workers engaged in agricultural activity ranges from 74.10% in Gahmar town to 44.41% in Sikanderpur town. The towns of Hariharpur, Majhauraj, Azamatgarh, Reoti, Sahatwar and Gahmar are characterised as Ag₂ towns. The remaining 10 towns namely Nichlaul, Rampur Karkhana, Lar, Ramkola, Kaptanganj, Bilariaganj, Mehnagar, Maniyar, Sikanderpur and Bansdih are categorised as Ag₁ towns. These towns are located in the fertile tracts of Saryupar plain and Ganga-Ghaghara Doab and, are overgrown villages (Fig. 3).

ii. Household Industrial Towns

Out of total 95 small towns, 12 towns have the specialization of the household industry. These towns are not evenly distributed (Fig. 3) and are evolved as local resource and craft-base centres. For example the concentration of such towns in Azamgarh and Varnasai district indicate the socio-cultural attributes and their histo-genetic existence in the region. It is due to the location of a number of cottage industries like weaving, handloom, blanket weaving, carpet weaving, brasswares, soap making, hosiery etc. in these districts. Kotwa in Varnasai and Kopaganj in Azamgarh district have been found as H₃ towns with 82.15% and 75.73% of total workers engaged in household industry, respectively. Kotwa is a centre of silken sarees, while Kopaganj is famous for handloom cloths. In H₂ towns, Lohta is a weaving centre of Banarasi Sarees and cotton cloths. Ghosia Bazar is famous for blanket and carpet making. Amilo for Banarasi Sarees, Khairabad and Adari for handloom sarees and Ledwa Mahua for handloom cloths. The remaining four towns, Bahadurganj (handloom cloth), Mubamadabad (handloom and powerloom cloth), Ghosia (silken sarees) and Nai Bazar (cotton carpet) are recognized as H₁ towns.

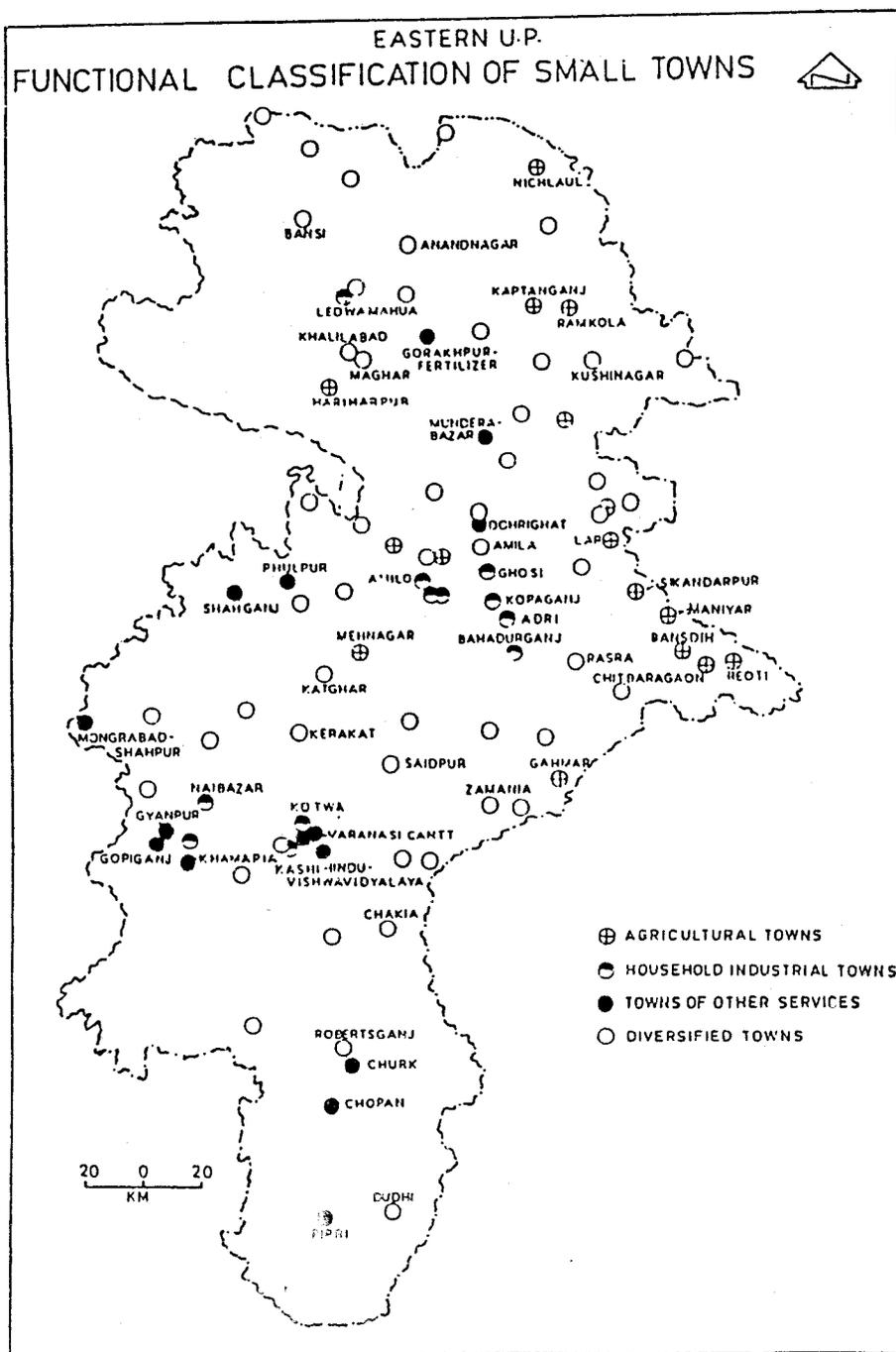


Fig. 3: Functional classification of small towns

iii. Towns of Other Services

There are 15 towns which are classed as towns of other services. It includes factory and plantation workers, Government servants, Municipal employees, teachers, priest, entertainment artists, workers engaged in business, transport, mining, construction, etc. There are 2 towns Mundera Bazar and Gorakhpur Fertilizer located in the Saryupar plain, while 10 towns in the Ganga-Ghaghara Doab and 3 towns (Churk Ghurma, Chopan and Pipri) are located in the Southern Uplands (Fig.3). Churk Ghurma, Gorakhpur Fertilizer, Khamaria and Gopiganj are industrial towns. A hydel power plant is established at Pipri on Rihand dam. Chopan is a transport centre and service town. Kashi Vishwavidyalaya and Varanasi Cantt. are educational and military centre, respectively having 99.26% and 99.43% of total workers engaged in other services. Phulpur, Shahganj and Gyanpur are the administrative centres as tahsil headquarters. Dohrighat and Mungra Badshapur are market towns.

iv. Diversified Towns

As many as 52 towns are identified as diversified as diversified towns. A diversified town is one where the percentage of workers does not reach above the mean + 1 S.D. in any of the occupational groups. It is a characteristic feature of Indian towns to have workers engaged in various activities with non-attaining the degree of specialization. Out of these, 19 small towns are new (1981) and are diversified in the sense of that being in their early stage of development, they are performing many functions and services and service without any degree of specialization. Out of 52 towns, 42 towns perform other services-cum-agriculture-cum-household industries while remaining 10 towns show other services-cum-household-sum-agriculture. Deoria district has maximum-number (8) of

diversified towns followed by Basti (7), Gorakhpur (7), Azamgarh (7) and Ghazipur (6) The minimum number (3) of such towns are located in Ballia followed by Jaunpur (4) (Fig.3).

3. DECENTRALISED PLANNING AND SMALL TOWNS

Small towns act as a link to facilitate social and technological innovations from cities to their hinterlands as well as integrating social interaction and space economy. Most of the small towns are collecting processing distributing and service centres for the agricultural areas around them. Every region exhibits a certain system of areal functional organisation and centres ranging from small hamlets or village markets to large towns and cities are inter-connectedly dispersed over the whole area, creating an economic balance by performing various functions : primary and secondary, small and large, and specialized and diversified for the area (Philbrick, 1957). The decentralised planning has been attempted in many parts of India, but appropriate planning formulations and methodologies may be adopted with or without modification as given by the situations (Mukherjee, 1990 & 1992). The spatial analysis of settlement systems has been considered a core concept in decentralised planning conceived by Mishra (growth foci approach) (Mishra, 1990, pp. 181-218). Small towns in Eastern Uttar Pradesh have been analysed to understand their spatial distribution, rank-size relationship and functional classification. The functional character of towns indicates their nature of emergence in the space economy, i.e., agricultural towns, household industrial towns, towns of other services and diversified towns. The character of towns is the boon for decentralised planning in the growth foci approach as formatted in market centres, service centres and growth points in micro-

regional/local-level planning. The diversified towns are the amalgam of urban character in initiating the different functions which will formulate the future shape of urban space economy

Thus, small towns should be articulated and integrated to form systems of settlements in decentralised planning to promote regional development.

REFERENCES

- Brush, J.E. (1953) : "The Urban Hierarchy in Europe", *Geographical Review*, Vol. 43, p. 414.
- Dickinson, R.E. (1950) : *The West European City : A Geographical Interpretation*, Routledge & Kegan Paul Ltd., London, p. 267.
- Haggett, P. and Gunawardena, K.A. (1964) : "Determination of Population Threshold for Settlement Functions by Reed-Muench Method", *Professional Geographer*, Vol. 16, pp. 6-9.
- Krugman, P. (1995) : *Development, Geography and Economic Theory*, MIT Press, Cambridge.
- Mishra, R.P. (Ed.) (1990) : *District Planning : A Handbook*, Concept Publishing, New Delhi.
- Mukherjee, Amitava (1990) : *Researches in Decentralisation*, Heritage Publishers, New Delhi.
- Mukherjee, Amitava (1992) : "Methodologies in Decentralised Planning : A Survey", *Annals of NAGI*, Vol. 12, No. 1&2.
- Philbrick, A.K. (1957) : "Principles of Areal Functional Organisation in Regional Human Geography", *Economic Geography*, Vol. 33, pp. 297-326.
- Rondinelli, D.A. (1983) : "Towns and Small Cities in Developing Countries", *The Geographical Review*, Vol. 73, p. 381.
- Rondinelli, D.A. (1983) : *Secondary Cities in Developing Countries : Policies for Diffusing Urbanisation*", Beverly Hills, Cal. Sage Publication, pp. 9-46.
- Singh, K.N. et. al., (1981) : "Rationalization of Spatial Organization of Settlement Systems : A Case Study in Integrated Rural Development", *Trans. Inst. Indian Geographers*, Vol. 3, No.2 p. 142.
- Sharma, P.R. (1984) : Growth Centres and Regional Development - Aspects of Theory and Policy, *Habitat International*, Oxford, Vol. 8, No. 2, pp. 133-150.
- Sharma, P.R. (1984) : Spatial Organisation Model for Rural Development : An Approach through Settlement System, *Habitat International*, Oxford, Vol. 8, No. 1, 29-34.
- Sharma, P.R. (1991) : Growth Centres in Regional Development : Reassessment for Implementation, *Perspectives on the Third World Development*, Sharma, P.R. (Ed.), Rishi Publications, Varanasi, pp. 169-17.
- Zipf, G.K. (1949) : "Human Behaviour and the Principle of Least Effort", In Mayer, H.M. and Kohn, C.F. (eds.), *Readings in Urban Geography*, University of Chicago, p. 233.

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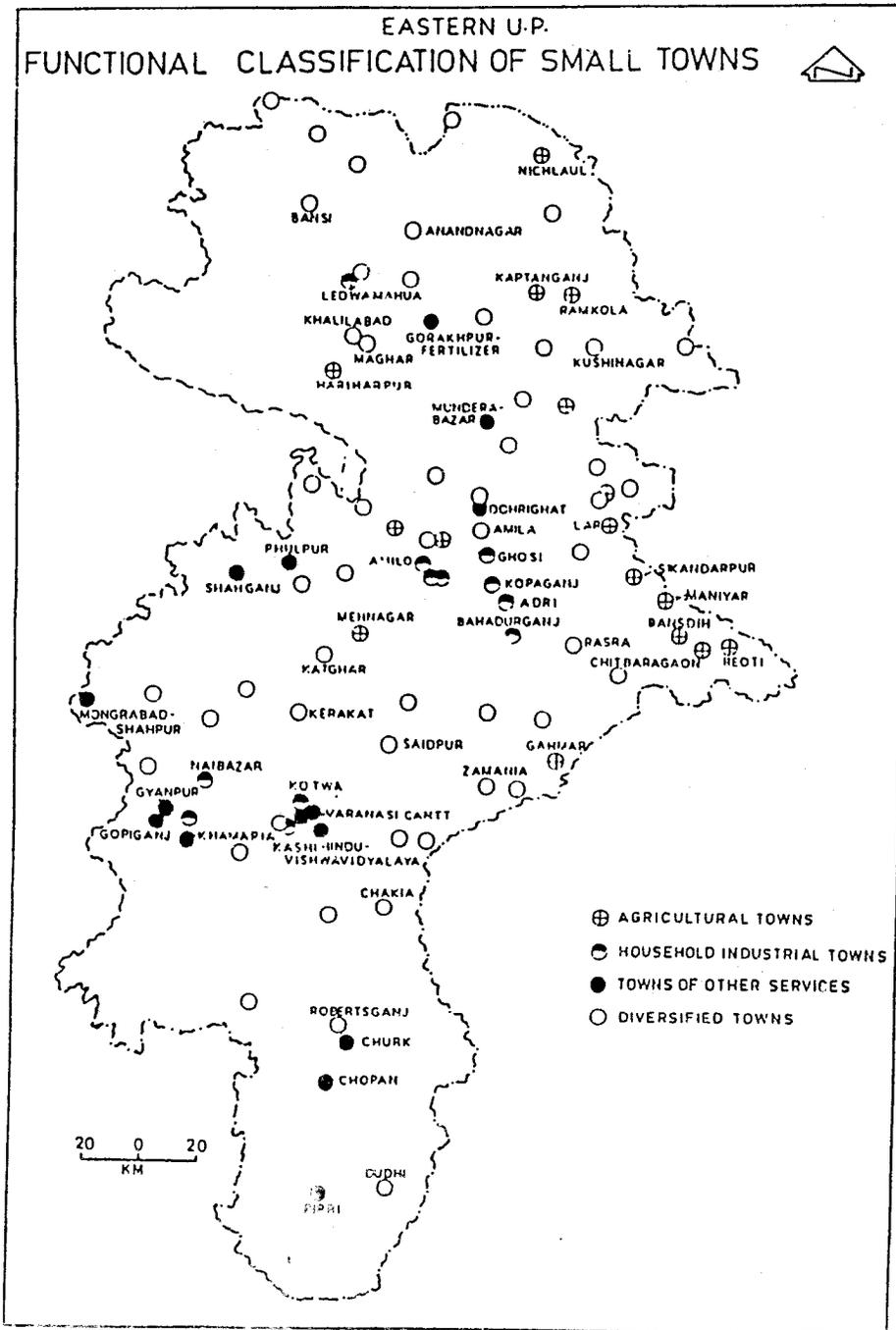


Fig. 3: Functional classification of small towns