ANALYSIS OF RURAL SERVICE CENTRES USING SPATIAL DATABASE APPROACH - A CASE STUDY OF CHANDAULI DISTRICT, UTTAR PRADESH

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ABSTRACT *Rural service centre acts a as stimuli for the development of a region. These centres have taken a shape of hierarchical formation which is framed as first order or superior functionality to lower order based on weightage of functions in regional space. Each and every centre has its own sphere of influence i.e. hinterland in spatial context. In present study, Composite Functional Index (CFI) is computed after compiling three indices viz., Functional Centrality Index (FCI), Worker Index (WI) and Non Worker Index (NWI) to identify the hierarchy of service centres and spatial database are generated for further analysis after taking Chandauli District as a case study. The output results reflect spatial distribution of these service centres with their functional gaps.*

Keywords: Service centre, Hinterland, CFI, FCI, WI, NWI

INTRODUCTION

Rural Service centres are the growth points or settlements with relatively high intensity of functional magnitude and distinctiveness. The fundamental trait of these centres is to serve their surrounding territory in terms of cultural, commercial, administrative and other requirements (Khan, 1995). In regional space, *growth does not occur everywhere and all alone, it appears in points or development poles, with variable intensities. It spreads along diverse channels with varying terminal effects to the whole of economy (Perroux, 1955).* Each centre being the centre of attraction and repulsion has its own field which influence the field of other centres. These centres act as growth foci by generating two types of forces viz., centripetal and centrifugal forces. It is well recognized fact that the location of services and availability of infrastructure facilities such as health, education, connectivity, economic institution, administrative functional bodies etc. play an extremely important role in promoting development in rural areas. Therefore, in present study emphasis is given to understand the network of service centres with their functional hierarchy, extent of zone of influence and functional gaps in rural context. For the development of any area in general and specifically in rural regional counterpart such centres are vital for a developing country like India with its almost seventy percentage share of rural population. Due to accessibility of limited resources, it is better to provide certain services and facilities related to health, education, economic institution and administrative offices etc. at some determined points in space rather than to dissipate the resources in providing them to each and every village. There is certainly a strong need for data and information base for the successful planning and development operations at different levels. The rapid growth and quick development of information technology in developed nations have created awareness in developing world to have such a database system at the district level on various planning issues and problems needed for the multifaceted development programs (Mallick, 1998). During last few decades, India has undertaken a few measures towards globalization, liberalization and decentralization at micro level to achieve vibrant economy, growth and development. The on-going decentralization process initiated by the 73rd and 74th Amendments of the Indian Constitution, provided greater responsibilities and powers to the local bodies as a third tier of governance after offering a new era of opportunity for local planning, effective implementation and monitoring of various socio-economic developmental programmes. This would be helpful for the weaker section of the society to share the responsibility of governance at least at the lower level (Yadav and Singh, 2009).

LITERATURE REVIEW

The conceptual framework for the service centre had its roots in central place theory (Christaller, 1933). Later it was modified by Losch (1954). It might be asserted that geographical study of this aspect is well accommodated within this frame work, which in turn, emphasizes on the node for hierarchical classification of service centres (Hangaragi,2005). Both the terms service centre and central place are not synonymous rather complementary to each other. A central place is the settlement where by virtue of the certain

available functions and services, attracts the people of neighbourhood's settlements (Bhat, 1976) and provides functions or services to its hinterlands.

The studies regarding central places were done by a number of scholars like Hagerstrand (1952), Berry (1967) and Sen et al. (1971). Some scholars also attempted empirical studies to test theories of Christaller (1933) and Losch (1954) in different region. The important among them are Smailes (1944), Perroux (1950), Brush (1953), Bracey (1953), Misra and Shivalingaih (1970), Misra (1972, 1974),Roy and Patil (1977) etc. Mishra, R.P (1974) propounded the concept of 'Growth foci' by integrating the basic elements of central place theory, growth pole theory and spatial diffusion of innovation theory and proposed five- tier hierarchy from top to bottom as growth poles (national level), growth centre (regional level), growth points (sub-regional level), service centres (micro regional level), growth foci as central village (local level).

Further, some of notable scholars who had applied geospatial tools and techniques for regional planning were R.K. Mallick (1998), L.R. Yadav and R.S. Singh (2009), Sarkar (2013) etc.

LOCATION OF STUDY AREA

Chandauli district (25º 16′ N to 25º 27′ N latitude and 83º 16′ E to 83º 27′ E longitudes) is located in the extreme eastern part of Uttar Pradesh. It comes partly under middle *Ganga* alluvial plain in north and partly under rugged *Vindhyan* uplands in south. Agriculture is the main stay of livelihood as about seventy percent people engaged in this primary activity. This district is known as '*Rice Bowl*' of Uttar Pradesh. Administratively, the district is divided into four*Tahsils* and nine Community Development Blocks (CBD) covering 2,541 sq. km area with population of 19, 52,713 persons (2011). There are 1,419 inhabited villages, 102 *Nayapanchayats* and village development centres. About 14 per cent villages have population above 2000 population. Chandauli is the district head quarter located in Chandauli Block. The plain area is well conned with both rail and roadways. Mughalsarai, the biggest marshalling yard in Asia located here (Fig. 1).

OBJECTIVES

Major objectives of the present study are:
(i)   To identify the service center;
(ii)   To observe the spatial distribution of service centres after generate spatial database(SDB); and
(iii)   To study the hinterland and functional gaps in the area.

DATABASE AND SOFTWARE

Primary data is collected through Field survey to know the pattern of spatial preferences of local rural people for a particular function or facility. Other than this, secondary source of information such as- census data (2001& 2011), District statistical handbook (2009-10 and 2011-12) are used to prepare database. Toposheets no. 63O and 63P, NATMO District Planning Map along with satellite imagery (IRS 1D, LISS-III, 2005) are used to extract the spatial information regarding administrative boundaries, transport networks and geo-coding the centres.

Softwares used for generating spatial database are:
▪   ERDAS Imagine 9.1 Software (ESRI)
▪   Arc View 3.1 GIS Software

METHODOLOGY

It comprises three parts: A. Spatial Framing of Digital Base Map, B. Framing of Attribute Information C. Generation of SDB by linking spatial map with attribute information (Fig.2).

A.   Framing of Digital Base map

Operations like geo-referencing, re-projecting, sub-setting and mosaicing of toposheets and image have been performed within the Erdas Imagine 9.1 image processing software domain. Block boundaries are extracted from maps of District census handbook (1991).

B.   Framing of DigitalDatabase Based on Attribute Information

Both primary and secondary sources of information are used to frame the attributes information for spatial analysis of rural service centres. It comprises following steps:

a.   Identification of service centres:

It may be beyond the scope of present study to consider all the 1,419 villages of the district for identifying the hierarchy of service centres, hence sampling techniques have been applied to select the potential service centres. In such a way as much as 63 potential villages (centres) are selected to measure the hierarchy levels of centres by considering the criteria given below:

(i)   It should be a permanent settlement having 5,000 or more population;
(ii) It must have at least three basic functions from functional groups, such as education, health and transport etc.;
(iii) The centre should be connected by any one mode of transport like rail or road;
(iv) It must constitute at least 0.10 per cent share of population; and
(v) It must account at least 0.13 values as FCI.

In some cases, the first criteria related to required number of population is ignored where there is high functional availability due to some socio, economic and political reasons. In this context, total 38 numbers of functions are selected under eight categories to compute functional weightage (Table1).

Table 1: Weighted Score for the Selected Functions in Chandauli District (2009)

Functional Group	Sl. No.	Selected Services	Weighted Score
(1). EDUCATION	1.	Higher primary school	2.0
	2.	Secondary school	2.53
	3.	Senior secondary school	2.71
	4.	Degree colleges	20.0
	5.	Optional educational centres	30.0
	6.	Polytechnique	50.0
(2). HEALTH	7.	Primary health centre	10.0
	8.	Community health centre	50.0
	9.	Allopathic hospital	40.0
	10.	Homeopathic hospital	100.0
	11.	Family welfare centre	6.0
	12.	Mother child welfare centre	4.0
(3). TRANSPORT	13.	Railway stations	130.0
	14.	Bus stop	8.00
(4).COMMUNICATION	15.	Sub post office	8.00
	16.	Telephone exchange	15.0
	17.	P.C.O.	2.0
	18.	Letter box	4.0
(5). FINANCE	19.	Nationalized bank	20.0
	20.	Rural bank	30.0
	21.	Commercial bank	19.0
	22.	Co-operative bank	15.0
(6).ADMINISTRATIVE	23.	Police station	110.0
	24.	*Naya Panchayet*	12.0
	25.	Block head quarters	158.0
	26.	*Tehsil* head quarters	437.0
(7). MARKET	27.	Whole sale market	28.0
	28.	Retail market	20.0
	29.	Govt. purchasing society	50.0
	30.	Co-operative milk collecting centre	20.0
(8). EXTENSION SERVICES	31.	Credit societies	15.0
	32.	Primary agricultural cooperative credit societies	10.0
	33.	Agricultural service centres	28.0
	34.	Seed/pesticide depot	6.0
	35.	Cold storage	5.0
	36.	Veterinary hospital	50.0
	37.	'D' category veterinary hospital	25.0
	38.	Artificial breeding centres	40.0

Source: Personal computation based on District Statistical handbook & Fields Survey Information
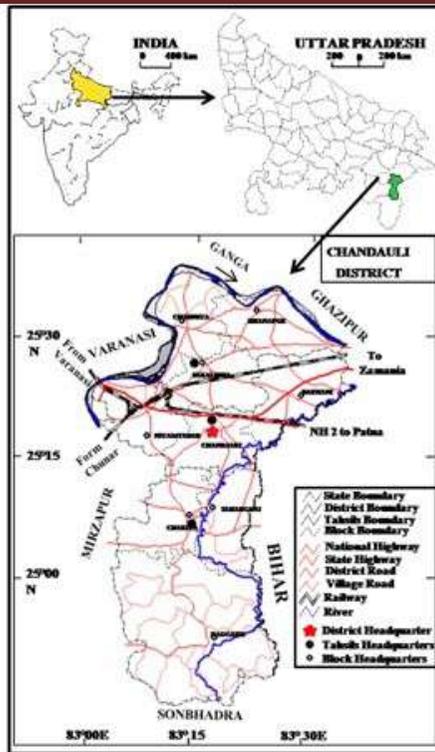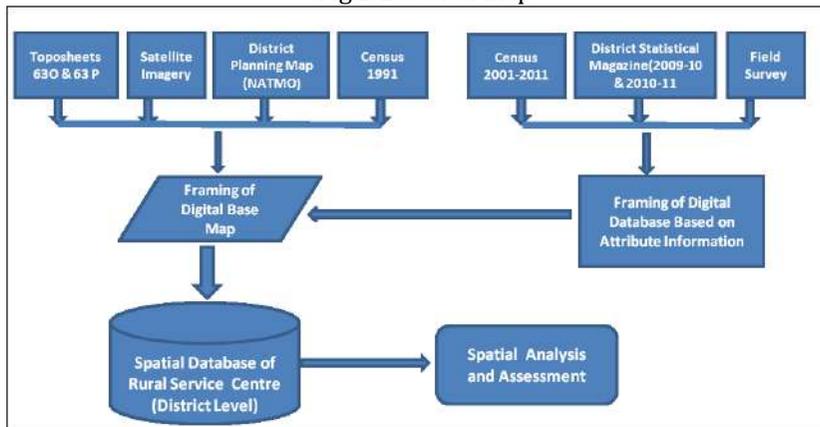
Fig.1 Location map

Fig.2 Methodological flow chart

b. Determination of centrality of service centres

Centrality of a particular centre is measured in terms of its importance regarding functional capacity to serve the needs of the people in the surrounding area (Hangaragi, 2005). It may be expressed by both either qualitatively e.g. high and low centrality or quantitatively in terms of centrality scores obtained by converting the functional base of concerned centres. Many geographers attempted to establish a precise relationship between the size of settlement in terms of population and the range of functions which it offers (Jonson, 1967). Centrality, however, depends upon the intensity of the central functions. Different scholars have adopted different methods to determine the centrality of service centres. For example, Godlund (1956) has used the following formula to determine the 'Index of Centrality' (CI) by taking into consideration the retail trade:

$$CI = \frac{S_t}{P_t} \times 100$$

Where, CI = Index of Centrality.
S_t = No. of persons employed in retail trade
P_t = Total population

Several Indian Scholars have also considered centrality of a centre on the basis of population engaged in retail sectors or commercial activities or tertiary services (Singh, 1966; Singh 1971; Singh, 1977). Bhatt (1976) had used a weighting technique to compute the centrality of service centres. Some scholars have measured the functional hierarchy of settlements on the basis of people's choice of centres to fulfil their needs (Sen *et al.*, 1971; Kayastha and Mishra, 1981; Mishra, 1985). Weighted indexing method (Sinha & Singh, 1995) was generally used to derive composite index value of a settlement based on its functional presence in context to the total functions found in the region. Since, all the functions cannot be treated equally, so weighting technique is used for computing the centrality under which functions are assigned numerical values on the basis of their relative regional importance.The weightage of functions in present study have been computed by adopting following formula (Bhat, 1976 and Mishra, 1985):

$$W_i = \frac{N}{F_i}$$

Where, W_i =Weightage of ith function

N =Total number of settlements

F_i =No. of settlements having that function

In present study, the hierarchy of service centres have been derived by using composite functionality index (CFI) based on three indices (i) Functional Centrality Index, (ii) Working Population Index and (iii) Non - working Population Index.

(i) Functional Centrality Index value (FCI) of a particular centre has been computed by summing the weightage of all available functions of a centre andthen itis divided by the total weightage of all selected centres. This may be expressed as:

$$FCI = \sum_i^n \frac{Wij}{W} \times 100$$

Where, CI = Functional centrality index

W_{ij} =Weightage for j^{th} centre

W=Total Weightage of all the centres.

(ii)The Working Population Index (WI_j) has been calculated after using the following formula:

$$WIj = \frac{Wj}{Wt} \times 100$$

Where, WI_j =Worker index of jth Centre

W_j =Working population of jth centres

W_t = Total working population in the district.

(iii)The Non Worker Index (NW_j) is computed using the following formula:

$$NWIj = \frac{NWj}{NWt} \times 100$$

Where, NWI_j =Non worker index of jth centre

NW_j =Non working population of jth centre

NW_t = Total Non working population in the district

Finally, after taking the average values of these three indices, the *Composite Functional Index* (CFI) for a particular service centre has been computed. This can be expressed as:

$$CFI = \frac{FCI + WIj + NWj}{3}$$

The composite index has been calculated for all the service centres. Higher index values are marked in Mughalsarai and Chandauli as 10.10 and 6.11 respectively. There is neck to neck competition between these two centres. Lowest index values are observed in eleven areas where both the three indices are low, especially in four centres viz. Kamharia, Negura, Dhauraha and Khor.

c. Estimation of hinterland or zone of influence of service centres

One of the challenging acts of service centre planning after identification of its hierarchy is the determination of zoneofinfluence at each level in functional hierarchy. The area which is served by a particular centre is known as its complementary region or zone of influence or hinterland. The identification of service centres and their complementary region involve the determination of area and population dependent on a centre for the supply of goods and services offered by it (Wanmali, 1970). Complementary region of service centre is a function of people's choice and movement for various services. If the centrality of a centre is high, the zone of its influence will also be high and vice versa. The extension of functional zones

depends on various factors like geo-strategic location and transport network, distribution pattern of population, status of infrastructural facilities and accessibilities to the centre. These factors lead to interaction of proximity (Berry, 1967) based on least travel time, cost and efforts. If the spatial interaction would be on a limited scale for commonly available services, it would result for lower order with service area. On the other hand, a less commonly available service can generate spatial interaction on a broad scale which would lead to generate higher order centres having larger service area.

In order to demarcate the hinterland, predictive model has been used by different scholars. Reilly's (1929) *'Breaking point method'*, is one of such method based upon the principle of law of gravitation. This method advocates that two centres attract trade from intermediate places depending on direct proportion of their masses (population) and the square of the distance between these two centres. This can simply be expressed as:

$$P = \frac{M_a \times M_b}{d^2}$$

Where,

P = Common point where two hinterland meet measured from the later centre

M_a = Mass of centre 'a' in terms of population

M_b = Mass of centre 'b' in terms of population

d = Distance between the two centres

Likewise, B.J.L. Berry (1967) used 'Breaking Point Equation' to derive hinterlands of market centres for retail distribution. This method has been used in present investigation to demarcate the boundary of the service area between two centres. This method can be expressed as:

$$P = \frac{d}{\sqrt{(1 + \frac{M_a}{M_b})}}$$

Where,

P = Common point where two hinterland meet measured from the later centre

M_a = Mass of centre 'a' in terms of population

M_b = Mass of centre 'b' in terms of population

d = Distance between the two centres.

The heterogeneous topography of the area under study such as plain in the north and plateau in the south and the administrative limits hardly permit the straight –line distances for considering the demarcation of hinterland of service centres. Therefore, certain points have been taken into consideration to demarcate the hinterlands of service centres such as : (i) straight line distances among centres have been accounted in northern plain area and road length in southern plateau region; (ii) composite score of centrality of each service centres are used to find out the zone of attraction at each level of functional hierarchy; (iii) functional importance of a centres and the people's choice have been taken into consideration at some extent for demarcating zone of influence especially for the centres located in southern part of the area where physio-cultural factors largely affect the consumer's mobility.

C. Generation of Spatial Database

Spatial database (SD) are generated by attaching attributes data regarding distribution of service centre to the spatial unit manually through keyboardin Arc View 3.1 GIS Software environment. Output layers are prepared using three graphical units viz., point, line and polygon and are presented on Visual Display Unit (VDU).

RESULTS AND DISCUSSION

A. Hierarchy of Service Centre

Hierarchy of service centres depicts the stratification of centres into different tier or orders. The higher order centre provide the superior level of functions both in quantitative and qualitative way and have a vast hinterland or serving zone while lower orders provide low level of functions within a short distance. On the basis of CFI as described above, the four orders of service centres have been identified and analysed as below (Fig. 3A& 3B and Table2):
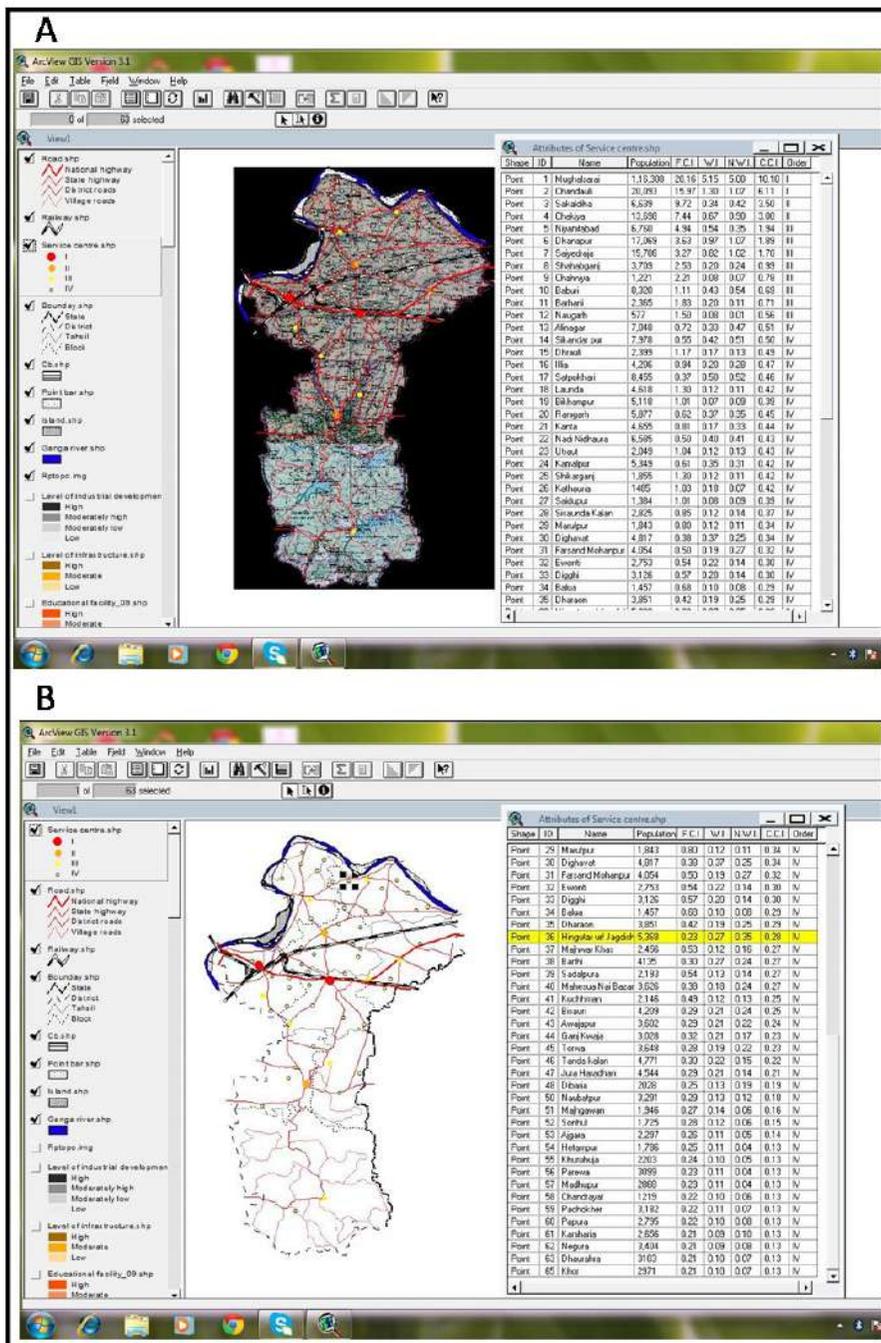
Fig. 3A &B Spatial database of rural service centres in Chandauli district

Table 2: Database of Hierarchy of Service Centres in Chandauli District (2009-10)

Id	Name of Centres	Population	FCI	WI	NWI	CFI	Order
1	Mughalsarai	1,16,308	20.16	5.15	5.00	10.10	I
2	Chandauli	20,093	15.97	1.30	1.07	6.11	I
3	Sakaldiha	6,639	9.72	0.34	0.42	3.50	II
4	Chakiya	13,698	7.44	0.67	0.90	3.00	II
5	Niyamtabad	6,760	4.94	0.54	0.35	1.94	III
6	Dhanapur	17,069	3.63	0.97	1.07	1.89	III
7	Saiyedraja	15,706	3.27	0.82	1.02	1.70	III
8	Shahabganj	3,709	2.53	0.20	0.24	0.99	III
9	Chahniya	1,221	2.21	0.08	0.07	0.78	III
10	Baburi	8,320	1.11	0.43	0.54	0.69	III

11	Barhani	2,365	1.83	0.20	0.11	0.71	III
12	Naugarh	577	1.50	0.08	0.01	0.56	III
13	Alinagar	7,048	0.72	0.33	0.47	0.51	IV
14	Sikandarpur	7,978	0.55	0.42	0.51	0.50	IV
15	Dhrauli	2,399	1.17	0.17	0.13	0.49	IV
16	Ilia	4,206	0.94	0.20	0.28	0.47	IV
17	Sathpokhari	8,455	0.37	0.50	0.52	0.46	IV
18	Launda	4,618	1.30	0.12	0.11	0.42	IV
19	Bikhampur	5,118	1.01	0.07	0.09	0.39	IV
20	Ramgarh	5,877	0.62	0.62	0.37	0.45	IV
21	Kanta	4,655	0.81	0.17	0.33	0.44	IV
22	NadiNidhaura	6,585	0.50	0.40	0.41	0.43	IV
23	Utraut	2,049	1.04	0.12	0.13	0.43	IV
24	Kamalpur	5,349	0.61	0.35	0.31	0.42	IV
25	Shikarganj	1,855	1.30	0.12	0.11	0.42	IV
26	Kathauria	1,485	1.03	0.08	0.09	0.39	IV
27	Saidupur	1,384	1.01	0.12	0.14	0.37	IV
28	Sisaunda Kalan	2,825	0.85	0.12	0.11	0.34	IV
29	Marufpur	1,843	0.80	0.37	0.25	0.34	IV
30	Dighavat	4,817	0.38	0.37	0.25	0.34	IV
31	Farsand Mohanpur	4,054	0.50	0.19	0.27	0.32	IV
32	Ewonti	2,753	0.54	0.22	0.14	0.30	IV
33	Digghi	3,126	0.57	0.20	0.14	0.30	IV
34	Balua	1,457	0.68	0.10	0.08	0.29	IV
35	Dharaon	3,851	0.42	0.19	0.25	0.29	IV
36	Hingutarurf Jagdishpur	5,368	0.23	0.27	0.35	0.28	IV
37	MajhwarKhas	2,456	0.53	0.12	0.16	0.27	IV
38	Barthi	4,135	0.30	0.27	0.24	0.27	IV
39	Sadalpura	2,193	0.54	0.13	0.14	0.27	IV
40	Mahesua Nai Bazar	3,626	0.38	0.18	0.24	0.27	IV
41	Kuuchhman	2,146	0.49	0.12	0.13	0.25	IV
42	Bisauri	4,209	0.29	0.21	0.24	0.25	IV
43	Awajapur	3,602	0.29	0.21	0.22	0.24	IV
44	GanjKwaja	3,028	0.32	0.21	0.17	0.23	IV
45	Torwa	3,648	0.28	0.19	0.22	0.23	IV
46	Tanda Kalan	4,771	0.30	0.22	0.15	0.22	IV
47	Jura Haradhan	4,544	0.29	0.21	0.14	0.21	IV
48	Dibaria	2,028	0.25	0.13	0.19	0.19	IV
49	Naubatpur	3,291	0.29	0.13	0.12	0.18	IV
50	Majhgaon	1,946	0.27	0.14	0.06	0.16	IV
51	Sonhul	1,725	0.28	0.12	0.06	0.15	IV
52	Ajgara	2,297	0.26	0.11	0.06	0.14	IV
53	Hetampur	1,786	0.25	0.11	0.04	0.13	IV
54	Khurhuja	2,203	0.24	0.10	0.05	0.13	IV
55	Parewa	3,099	0.23	0.11	0.04	0.13	IV
56	Madhupur	2,868	0.23	0.11	0.04	0.13	IV
57	Chandrayat	1,219	0.22	0.10	0.06	0.13	IV
58	Pachokher	3,182	0.22	0.11	0.07	0.13	IV
59	Papura	2,795	0.22	0.10	0.08	0.13	IV
60	Kamharia	2,656	0.21	0.09	0.10	0.13	IV
61	Negura	3,404	0.21	0.09	0.08	0.13	IV
62	Dhaurahra	3,103	0.21	0.10	0.07	0.13	IV
63	Khor	2,971	0.21	0.10	0.07	0.13	IV

Source: Personal computation of Census Data & Fields Survey Information

I. First order service centre

Under this category, there are two centres Mughalsarai and Chandauli with CFI value above 5.00. Though Chandauli is the district headquarters with central location but have lesser functional centrality index than Mughalsarai (20.16) associated with lesser working and non-working index. Mughalsarai with its huge

population base of 1, 16,308 persons dominated in the district as the first order service centre where majority of the considered services are available. It has been well connected through National highway (NH-2) and is the biggest railway junction. Because of such facts, it acts as the heart for the whole artery of the district, pumping the goods and services to large hinterlands. On the other hand, the development of Chandauli City was started after 1997 when district headquarters was established with the formation of a new district.

II. Second order service centre

There are two centres like Sakaldiha and Chakiya that occupy the second order in hierarchy. These two centres are *Tahsils* headquarters with CFI values of 3.00 (Chakiya) and 3.50 (Sakaldiha). Relatively high FCI with higher WI and NWI index values are responsible for their present status as a second order centres. Here the administrative institutions along with infrastructural advantages play crucial role behind its relative functional influences than the other lower order centres.

III. Third order service centre

Eight centres viz., Niyamtabad, Dhanapur, Saiyedraja, Shahabganj, Chahniya, Baburi, Barhani and Naugarh have been identified as third order service centres. These centres are mostly block headquarters with composite centrality index value ranges from 0.56(Naugarh) to 1.94 (Niyamtabad). Transport facilities along with spatial location of such centres have made a distinction from the lower order centres.

IV. Fourth order service centre

There are 51 centres which caters the need of local people with limited choices and relatively lower order of functions. Most of them are equipped with basic level of services like primary school, fair price shop, post office, PCOs and family planning centres and sub-centres, primary cooperative societies, seed and fertilizer depot etc. Maximum concentration of these centres is found in northern plain area while the southern part is deprived of such nodes of development due to physiographic inaccessibility.

B. Spatial Distribution of Service Centres

Spatial distributional pattern of service centres reflects the regional development levels. Several factors influence the distribution of centres such as physical, socio-economic and cultural set-up of the area. In present research work, an attempt has been made to analyse the block wise distribution of all level of service centres after taking into account functional weightage of service centres and their total CCI values (Table 3).

Table 3: Block wise Distribution of Service Centres and Weighted Scores in Chandauli District

Development Block	Area (Sq.km)	Population	No of service centers					% of village	Weightage of service centre of different order	Total CCI of service centers
			I	II	III	IV	Total			
Chahniya	227.31	1,75,550	-	-	1	9	10	11.49	20	2.85
Dhanapur	232.48	1,89,936	-	-	1	9	10	8.67	20	4.23
Sakaldiha	221.5	2,20,820	-	1	-	9	10	11.84	26	5.68
Niyamtabad	164.37	2,22,289	1	-	1	6	8	9.09	65	14.11
Chandauli	185.81	1,67,604	1	-	2	8	11	11.77	71	10.51
Barhani	271.7	1,53,369	-	-	1	3	4	10.29	8	1.15
Chakiya	207.24	1,48,734	-	1		4	5	17.69	16	4.74
Shahabganj	162.09	1,23,655	-	-	1	2	3	10.57	6	1.85
Naugarh	211.19	67,736	-	-	1	1	2	8.60	4	0.72
Total	1883.69	14,69,693	2	2	8	51	63	100.00	236	45.84

Source: Personal computation of Census Data & Fields Survey Information

It is observed that higher number of service centres (above 10) are available in all the four blocks of northern part of district, viz., Chandauli, Dhanapur, Chahniya , Sakaldiha whereas lowest number (2) is marked in southern part, i.e., Naugarh block. It is not the quantity rather quality of service centres that determine the status of a block in terms of development scale. To sum up the service centres of a block, it is not wise to put various levels of centres in equal category. Therefore, a weighting technique adopted to bring out 'quality variation' is the thumb rule that has been adopted to assign the weightage. The number of I, II, III and IV order centres are accounted 2, 2, 8 and 51 respectively. The weightage for I, II, III and IV are, therefore, decided by reversing the number with values of 51, 8, 2 and 2 respectively. For example, in Chakiya block there are 1 second order centre and 4 fourth order centres then the total weighted score of service centres would be (1 X 8) +(4 X 2) =16. Higher Weighted score values are generally marked in the blocks having higher order of service centres such as the case of Niyamtabad and Chandauli blocks where presence of Mughalsarai and Chandauli urban area as first order centres may be noticed respectively. As

regards the total CCI value, it is also higher in Niyamtabad (14.11) and Chandauli (10.54) blocks and lower in Naugarh (0.72). Remaining blocks have moderate values.

C. Spatial Distribution of Hinterland
I. Hinterland of first order service centres

It is quite difficult to draw a clear cut boundary of influence zone between the two first order centres, i.e., Mughalsarai and Chandauli because of their spatial location being in the central part of flood plain zone and having similar physio-cultural and economic set ups with easy accessibility of both rail and roadnetworks. These two centres, although of the same order, are in fact, complementary to each other. The Mughalsarai is bigger than Chandauli in terms of various aspects (size of population, trade and commerce, traffic movement etc.) so it attracts the people living in the periphery of Chandauli. On the other hand, Chandauli attracts the huge population of influence zone to be accounted under Mughalsarai for administrative services and district level functions. As such, the combined influence zone may be suggested for these two centres which attract the peoples of the district as a whole.

II. Hinterland of second order centres

Two centres viz.,Sakaldiha and Chakiya serve as second order centres. These centres are well connected with metalled road. Sakaldiha serves the largest part of the plain region where as Chakiya serves the largest part of southern plateau region.

III. Hinterland of third order centres

There are eight third order centres mostly of block headquarters and market centres viz., Niyamtabad,Dhanapur,Saiyedraja, Shahabganj,Chahniya,Baburi,Barhani and   Naugarh. Saiyedraja in the north and Shikarganj in the south have larger hinterland(Fig.4).

IV. Hinterland of fourth order centres

These are central villages which perform smaller level services to the surrounding villages. The demarcation of hinterlands for such large number of clusters i.e., 51 is a typical problem and it requires ground level information regarding the people's choice and economic condition that was beyond the scope of present investigation. However, some spatial gaps pertaining to fourth order centres were marked during analysis which needs due consideration for the proper supply of goods and services at grass –root level.
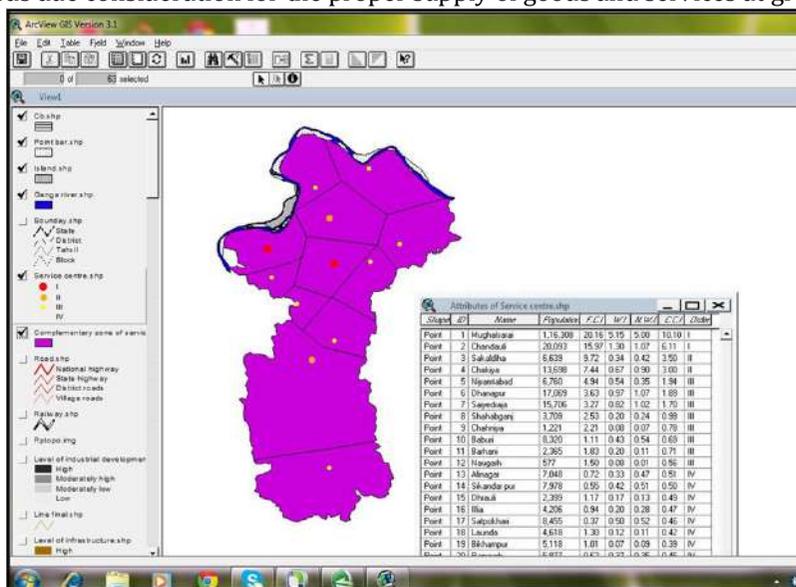

Fig. 4 Hinterland of service centres up to third order level in Chandauli district

Conclusion

It can be drawn from the present study that existing physical factors as well as socio-cultural and economic factors, the size and distribution of rural settlements have largely influenced the spatial distribution of service centres. Higher order of service centres constitute comparatively higher population base which induced better demands for functions and services and more centres emerge in regional canvas as service providing areas. Niyamtabad and Chandauli blocks have accounted high values for both weighted score of centres as CCIbecause of their central location in flood plain belt with very good connectivity, well infrastructural development and other supporting elements. On the other hand, Naugarh block being

located on plateau area is marked with lower values of weighted score (4.00) and CCI (0.72) because of its meagre position in physico-cultural and socio-economic back grounds.

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