CHAPTER -6

CENTRAL PLACE THEORY AND HIERARCHICAL ARRANGEMENT OF CENTRAL PLACES

CENTRAL PLACE THEORY AND HIERARCHICAL ARRANGEMENT OF CENTRAL PLACES

Planning for regional development is aimed at achieving the spatial arrangement of facilities in an organized manner so that it can usher socio-economic development in the region. Balanced regional development could be achieved through the enactment of micro-regional planning which envisages assessment and evaluation of resources and participation of the people.

Keeping in view the merits of micro-level planning to achieve balanced regional development, many scholars have adopted different models, theories and concepts for realizing the truth. However, Christaller's Central Place model occupies eminent position among all the models of settlement analysis because it emphasize the analysis of settlement origin, growth and distribution and also gives a direction for development of such function at selected settlement. Keeping in view the merits, it has been used as a tool in the present analysis.

6.1 CENTRAL PLACE THEORY

Central places are those service centres which have attained their central entity to serve their surrounding settlements pertaining to their basic needs. The philosophy of the central place theory was put forwarded by Walter Christaller in 1933. The essence of his theory was based on the two principles that work simultaneously to sustain the central place, i.e. threshold population and range of goods. Christaller envisaged the laws governing the distribution and size of towns, the functions they perform and their arrangements.[1]

The basic aspect of the theoretical formulation is the regularity of distribution and hierarchical arrangement of settlements in a given region. Christaller's concept is based on certain assumptions - the region should be isotropic surface, i.e., under conditions of uniform distribution of population, purchasing power, resources, and transport facilities over a uniform terrain.[2] But it is difficult to find such an isotropic surface and Malda district is not an exception. In the present study, some of the philosophical outlooks of Christaller's model have been considered to carry out the different steps of planning procedure.

The central place model explains that there exists hierarchy of central places in the settlement pattern. The higher order central places provide functions,

which are not available in the lower order places. However, lower order central places offers the facilities, are equally found in the higher order central places. The higher order central places are few in number and more widely spaced than the lower order central places. Another important thing is that the higher order central places have larger area of coverage in contrary to lower order central places. The degree of influence on the surrounding settlements depends on the number and types of facilities available at the central place. Here an assumption is that people avail the goods and services from the nearest place.

Different scholars have adopted Central Place model as the tool of planning for regional development. Misra, *et. al.* (1976)[3] tried to formulate a micro-level planning in order to arrange the socio-economic functions in an organised manner using basic concepts of central places i.e., centrality score of central places and their hierarchical arrangement. Maithini (1986)[4] adopted the concept of central places to work out the hierarchy of settlements based on estimated mean population threshold and centrality score of settlements. For the analysis of dynamic situation involving locations, spread and use of rural service facilities Wanmali (1987)[5] adopted the concept of population threshold and ranking of services, and assessed their accessibility to the rural households. Babu (1988)[6] tried to use the basic concepts like threshold population, hierarchy of central places, complementary regions and functional gaps for the formulation of micro-level planning.

6.1.1 Basic Concepts of Central Place Theory

The basic concepts, which constitute the foundations of the central place theory are;

(i) Centralisation as an ordering principle,

(ii) The central place,

(iii) Importance or centrality of central place,

(iv) Central functions,

(v) The complementary region, and

(vi) Range of goods and Threshold Population.

(i) Centralisation as an Ordering Principle

Christaller's hypothesis is that, services and functions are tending to concentrate in and around certain points (settlements) which are more important than others. More important settlements are less in number, while less important settlements are more.

(ii) The Central Place

The most important aspect of the Christaller's philosophy of central place is the settlement which may be a city, a town or a village. The characteristic feature of central place is to be centre of its surroundings and mediator of local trade and commerce with the outside.[7] Based on the number of services and functions provided and the size of population served by the central places are ranked in hierarchical order. The central places of the higher order cater the need of larger population of larger area in contrary to lower order central places. Lower order central places come under the nesting pattern of next higher order central place.

(iii) Centrality of Central Place

The importance or centrality of settlements does not depend on the total number of population living but it is defined as the functional importance of central place that attract the people of surrounding settlements. The central places are hierarchically arranged depending on their importance or centrality. Higher the centrally of central place greater will be the population dependent on it and vice-versa.

(iv) Central Functions

Christaller conceived central functions, which are not available everywhere but consumed at many scattered settlements and needed by every one. Therefore, the central functions are non-ubiquitous in nature, whereas the ubiquitous functions cannot be treated as central functions. The central functions are not uniform in their importance, rather classified as higher order to lower order based on their importance. In this regard, an interaction of people, flows of goods and communication takes place between the central place and its complimentary

region. It is clear that central functions involve the movement of men and goods, and generates spatial interaction.[8] Christaller considered the central functions are, trade, commerce, banking, administration, education and transportation.[9]

(v) Complementary Region

The central places cannot function in isolation. It provides services and functions to its own population and the population of its surrounding settlements. Their origin, growth and development largely depend on surrounding areas, called as the complementary region, area of influence, service area, hinterland or trade area.[10] The complementary region focuses the inter-relationship and inter-dependence of central place and its surrounding dependent area.

(vi) Range of Goods and Threshold Population

The market range of service activity is the distance people willing to travel to obtain the services and functions. It is the outer limit of market area for the service activity beyond which people will look to another centre.[11] In Christaller's central place concept, the supply and demand of goods and services are determined by freight rate (cost), insurance, storage costs, loss of weight, and in the case of passenger movement, travel cost, travel time and discomfort perceived by the consumer. Considering all these things the spatial range of goods and services are measured by the maximum distance over which the demand of goods are positive and the minimum distance within which the minimum volume of demand from population for goods ensures normal profit to seller. The former is range of goods or upper limit and the latter is 'threshold population' or lower limit.[12] Therefore, threshold population is the minimum population required for functioning of the service activity, below of which the activity will run at loss and in long run it will face closure.[13] However, the concept of range of goods and services is not static, rather varies spatio-temporally due to increasing purchasing power, improvement of socio-economic conditions and the advancement of transportation and communication.

6.2 HIERARCHICAL ARRANGEMNET OF CENTRAL PLACES

Different approaches and methods are adopted to arrive at the hierarchical arrangement of central places. Mainly two approaches are well recognized i.e.,

first approach related to the measurement of centrality of central place based on Median Population Threshold (MPT) of functions provided by it, and another one approach is related to the study of spatial traveling behaviour of the consumers to obtain goods and services. Adopting the first approach, many scholars have conducted researches for the study of hierarchy of central places and their nesting pattern. In this method, the hierarchy of central places is arranged by going through different steps of measuring the functional importance of facilities based on their threshold population and estimating the centrality score or functional importance of central places.

In the second approach, the central places are arranged into hierarchic order measuring their attractive power or the gravitational force tending to interact with the centre for a particular function or group of functions. Adopting this method many researches have been conducted by many scholars prominent among them are Green[14] and Carruthers.[15]

6.2.1 Median Population Threshold and Weightage Score of Facilities

Some aspects of Christaller's central place theory help in identification of hierarchical arrangement of central places. In order to achieve it, different steps in subsequent manner have been followed. Hierarchy is the out come of threshold population, weightage value of each facility and centrality of central place. So, the first step is to estimate the threshold population which is the base of determination of functional importance (weightage value) of each facility. However, centrality has been computed as the composite weightage value of the existing facilities, based on which central places are hierarchically arranged.

Median Population Threshold

Different scholars have tried to measure the population threshold or entry point of services and facilities by adopting different techniques. B.P. Maithini[16] estimated the population threshold as the population–function ratio of each facility separately, which is designated as the Mean Population Threshold or mT. Besides the easy and simple methods of estimation of the population threshold, one complex but authentic, logical and mathematically sound is Reed-Muench[17] method devised by them in 1938 and was used by Hagget and Gunawardena[18] in

1964. This method seeks to find out the location of entry point or population threshold below and above the limit of which all the settlements are lacking and possess the facility respectively. This method is designated as the Median Population Threshold (MPT). According to the Reed-Muench method of MPT, the services and functions are tend to cluster themselves within the definite population size group.[19]

MPT of each amenity and facility is not equal, rather varies from one to another depending on their importance or order of function. The higher order functions have higher value of MPT and vice-versa. On the basis of Reed-Muench method (App. III), MPT of all socio-economic facilities under study have been estimated. Table 6.1 reveals that the computed MPT ranges from 361 persons for the facility Electricity for Domestic Purpose being lowest to 161,500 persons for both the facilities i.e., Soil Testing Centre and District Head Quarter being the highest. The computed MPT of 572 persons for the facility of Primary School implies that, in the existing pattern of distribution of services and facilities, a settlement with population 572 persons is supposed to sustain the location of a primary school in the study region.

Weightage Score of Facilities

The variations of importance of facilities have been identified after assigning a certain weightage to them. Once the MPT were estimated facilities were assigned centrality weights corresponding to their size of MPT. The weightage value has been determined by first assigning an arbitrary value of 01 to the facility having lowest threshold, while the weightage value of other functions has been obtained simply by dividing its MPT by the lowest MPT value in the distribution. For instance, in the district, the weightage value of 01 has been assigned to the facility of Electricity for Domestic Purpose with lowest MPT of 361 persons. Thus, a facility with MPT of 5,804 persons (secondary school) attained the weightage value of 16.08 and so on. In the same way, functional weightage has been assigned to each of the 45 socio-economic facilities in the study (Table 6.1).

The weightage value of facilities is the indicative of their relative importance which can be used for inter-functional comparison. Highest weightage

score is achieved by two facilities, i.e., District Head Quarter (447.37) and Soil Testing Centre (447.37), while lowest weightage score of 01 is attained by the facility of Electricity for Domestic Purpose followed by Primary School (01.58), Electricity for Agriculture (04.88) and so on.

Table 6.1: Median Population Threshold and Weightage Score of Facilities
Malda District
(2001)

Sl. No.	Name of the Facility	No. of Facility	No. of setts. Having the Facility	Median Pop. Threshold (MPT)	Functional Weightage
01.	Primary school	1902	1134	572	1.58
02.	Middle School	309	265	4,573	12.67
03.	Secondary school	217	184	5,804	16.08
04.	Higher Secondary School	62	43	16,481	45.65
05.	College	08	07	51,756	143.37
06.	Professional Training Institute	03	02	72,969	202.13
07.	Primary Health Sub-centre	225	214	5,539	15.34
08.	Primary Health Centre	48	48	16,128	44.67
09.	Health Centre	07	06	58,795	162.87
10.	Dispensary	364	144	6,993	19.37
11.	Hospital	09	07	56,346	156.08
12.	Nursing Home	19	05	61,074	169.18
13.	Branch Post Office	287	273	4,447	12.32
14.	Sub Post Office	34	26	19,680	54.51
15.	Post and Telegraph Office	09	09	52,755	146.13
16.	Telephone	*	515	2,340	06.48
17.	Fare Bus Stop	358	358	3,499	9.69
18.	Bus Station	20	20	35,883	99.40
19.	Railway Station	23	23	33,018	91.46
20.	Pucca Road	*	554	2,181	06.04
21.	Daily Market	75	75	11,685	32.37
22.	Periodic Market	151	151	6,802	18.84
23.	Regulated Market	02	02	79,728	220.85
24.	Electricity for Domestic Purpose	*	1,285	361	01.00
25.	Tap Water	*	170	6,202	17.18
26.	Electricity for Agriculture	*	606	1,761	04.88
27.	Agricultural Seed Distribution Centre	81	49	14,688	40.69
28.	Fertilizer Distribution Centre	1,068	270	4,454	12.34
29.	Cooperative Cold Store	02	02	79,728	220.85
30.	Soil Testing Centre	01	01	161,150	447.37
31.	Agricultural Farm and Research Centre	10	09	49,314	136.60

32.	Agricultural Credit Society	161	157	6,571	18.20
33.	Commercial Bank	80	65	13,024	36.08
34.	Cooperative Commercial Bank	35	27	28,282	78.34
35.	State Animal Health Centre	04	04	64,029	177.36
36.	Block Animal Health Centre	15	15	41,982	116.29
37.	Additional Block Animal Health Centre	16	16	44,527	123.34
38.	Block Head Quarter	15	15	40,892	113.27
39.	Police Station	11	11	46,502	128.81
40.	Sub-Division Office	02	02	75,944	210.37
41.	District Head Quarter	01	01	161,500	447.37
42.	Park	03	02	68,464	189.65
43.	Public Library	105	100	9,297	25.75
44.	Free Reading Room	104	100	9,297	25.75
45.	Cinema Talkies	33	25	25,830	71.55

Note: * In case of functions Sl. No. 16, 20, 24, 25 and 26 are not counted in number, rather counted as the number of settlements having that function.

Relationship between Socio-Economic Facilities and Population

In the study, an endeavor has been made to analyse the relationship between existing socio-economic facilities and the distribution of population among the settlements of different size group. Population is the prominent factor in the initiation of process of development. Socio-economic facilities are the function of population distribution, and the adequacy of socio-economic facilities in a region is the process of change in the size and quality of life of its population. To examine the relationship, distribution of settlements, population and the composite score of socio-economic facilities have been classified on the basis of population size group of settlements (Table 6.2).

Distribution of Population

Table 6.2 and Figure 6.1 depict the salient features of the distribution of population among different size group of settlements as follows;

i) Small size group of settlements having population below 500 persons accounted for more than 28 percent, but accommodates only 4.04 percent of total population.

ii) The settlements being larger in size having population more than 10,000 persons share only 2.19 percent, but provide accommodation to more than 20 percent of the population, and

iii) Both the settlement curve and population curve do not correspond to each other. This trend indicates the uneven distribution pattern of settlements and population in the district.

Table 6.2: Distribution of Population, Socio-Economic Facilities and Settlements among the Size Group of Settlements
Malda District
(2001)

Size of Settlements (persons)	Settlements		Population		Socio-Economic Facilities	
	No.	%	No.	%	Composite Score*	%
< 250	189	11.48	28,674	0.87	439.49	0.45
250-499	280	17.01	104,402	3.17	2199.18	2.26
500-999	360	21.87	258,772	7.86	5367.55	5.51
1000-1999	354	21.51	491,225	14.93	12213.01	12.53
2000-4999	316	19.20	990,575	30.11	31013.76	31.83
5000-9999	111	06.74	755,117	22.95	19158.90	19.66
>10,000	36	2.19	661,703	20.11	27044.82	27.76
Total	1646	100.0	3,290,468	100.0	97436.71	100.0

*In case of five facilities like, Tel., PR, EDP, TW and EA (abbreviations refer to the list of abbreviations) which are not counted in number, therefore are not included in this analysis.

Distribution of Facilities

Figure 6.1 depicts that both the population curve and functional curve runs somewhat corresponding to each other, but the deviation of functional curve from the population at every size class of settlements indicate that more socio-economic facilities should be provided for ensuring rational spatial development in the district.

To examine the causal relationship between spatial distribution of socio-economic facilities and population among the settlements of size group, Karl Pearson's technique of correlation coefficient has been adopted and the level of significance has been tested using student's 't' test technique. Two variables i.e., percent composite score of weightage value of socio-economic facilities being independent (X) and the percent of population being dependent (Y) (Table 6.2) are

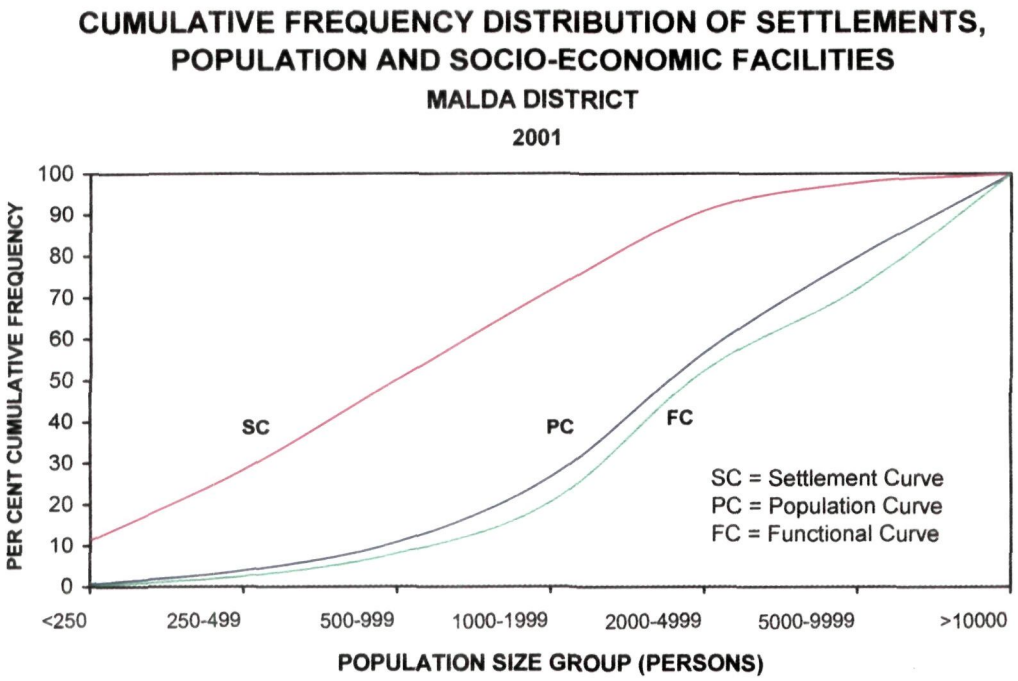
CUMULATIVE FREQUENCY DISTRIBUTION OF SETTLEMENTS, POPULATION AND SOCIO-ECONOMIC FACILITIES
MALDA DISTRICT
2001
PER CENT CUMULATIVE FREQUENCY
100
90
80
70
60
50
40
30
20
10
0
SC
PC
FC
SC = Settlement Curve
PC = Population Curve
FC = Functional Curve
<250
250-499
500-999
1000-1999
2000-4999
5000-9999
>10000
POPULATION SIZE GROUP (PERSONS)

Fig. 6.1

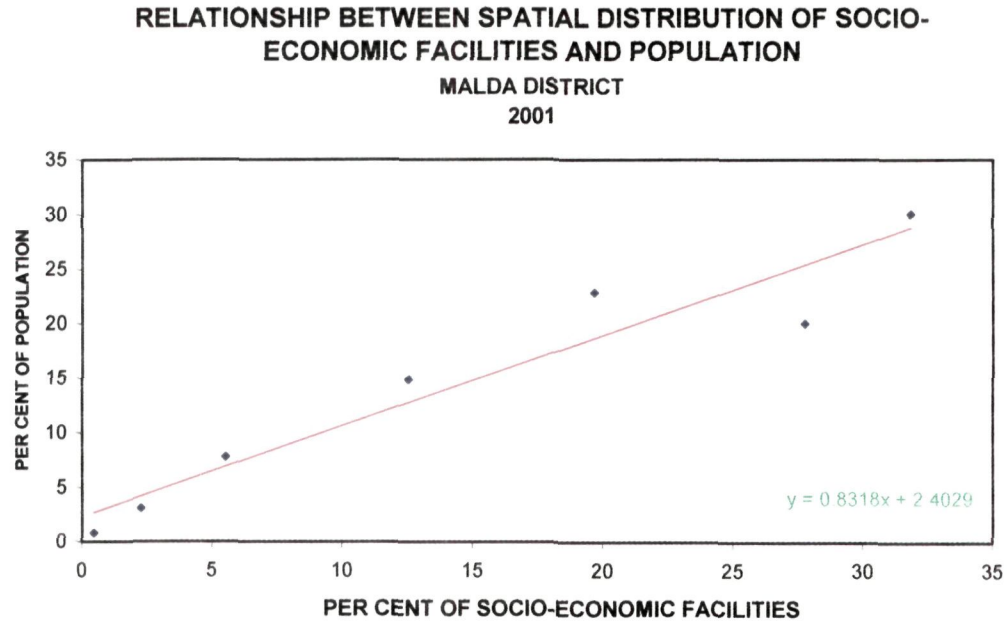
RELATIONSHIP BETWEEN SPATIAL DISTRIBUTION OF SOCIO-ECONOMIC FACILITIES AND POPULATION
MALDA DISTRICT
2001
PER CENT OF POPULATION
35
30
25
20
15
10
5
0
y = 0.8318x + 2.4029
0
5
10
15
20
25
30
35
PER CENT OF SOCIO-ECONOMIC FACILITIES

Fig. 6.2

order of functional hierarchy with their weightage value below 50. Only three facilities, i.e. sub post office, cooperative commercial banks and cinema talkies have been identified in 3rd hierarchic order. Six facilities with functional importance more than 200 are considered in the 6th order of hierarchy rendering highest order function in the district.

6.2.2 Centrality Score and Hierarchical Arrangement of Central Places

The centrality score of service centres is defined as an objective measure of its functional importance. It depends on the number and types of the existing facilities provided by the central place. In other words, centrality score is the sum of weightage score of all the functions provided by the central place.

The weightage value assigned to each of the functions was multiplied by their number in order to arrive at the centrality score of central place. By considering the types and number of services available in a central place, it is easy to estimate its centrality score. For example, if a central place has four Primary Schools (weightage value of 01.58), two Middle Schools (weightage value of 12.67), two Dispensaries (weightage value of 19.37) and the settlement has Electricity for Domestic Purpose (weightage value of 01), the centrality score of that settlement would be, (4 X 01.58) + (2 X 12.67) + (2 X 19.37) + 01 = 71.4. Centrality score of all central places were calculated in the same way.

Identification of Central Places

A settlement is not considered as central place unless it provides services and facilities to its own population and to the population of its surrounding settlements. There are 1646 settlements (rural and urban settlements) in the district. All the settlements are not considered as central place or service centre. A settlement is considered as central place which has at least 1,000 persons in total. In the analysis, the criteria have been adopted for the identification of central place are, (i) it holds a permanent establishment, (ii) it has total population of 1,000 persons and more, and (iii) it provide at least five different functions. When the three criteria are fulfilled, a settlement is considered as central place for the study. On the basis of defined criteria as many as 361 settlements have been identified as central places in the district.

Centrality Score and Hierarchy of Central Places

Hierarchy of central places refers to the stepwise differentiation of settlements based on the types and number of functions offered by it. Generally, there are central settlements that provide some essential services to the cluster of settlements around it. The central settlements provide services and facilities of different orders. The settlements which have higher centrality score providing higher order services are considered as higher order central place while, it is contrary to the settlements having lower centrality score. Lower order central places are functionally linked with the next higher order centre. Thus we get a hierarchy of central places in the study region. On the basis of centrality score, the central places have been classified into six hierarchic orders starting from first order (lowest order) to sixth order (highest order), using the value of mean and standard deviation (Table 6.4 and Fig. 6.3).

Table 6.4: Hierarchical Classification of Central Places
Malda District
(2001)

Hierarchic Order	Class Interval of Centrality Score	Central Place		
		Number	Mean Spacing (km.)	Percent
First order	Below 236.09	274	3.89	75.90
Second order	236.09-788.90	71	7.63	19.67
Third order	788.90-1341.71	11	19.39	3.04
Fourth order	1341.71-1894.52	03	37.14	0.83
Fifth order	1894.52-2447.33	01	64.33	0.28
Sixth order	Above 2447.33	01	64.33	0.28
Total	--	361	--	100

The class interval is based on the mean value of 236.09 and value of standard deviation i.e., 552.81 of total centrality score of all central places (i.e., 361) in the district, whereas mean value has been taken as the lower limit below of which all settlements fall in first order hierarchy, and value of standard deviation as the class interval of each hierarchic order. It is observed from the analysis that, as the hierarchical order of central place increases with higher centrality score, the number of central place decreases but their mean spacing tend to increase (Table 6.4). Table 6.5 exhibits the block wise distribution of central places of each hierarchic order. Table 6.5 reveals that Harishchandrapur-II, Chanchal-II and

Ratua-II blocks have recorded only first order and second order central places mainly due to the availability of lower order and lack of higher order facilities.

First Order Central Places

In the hierarchical pattern, all the central places with centrality score less than 236.09 are categorised in the first order hierarchy. 274 central places have been identified this hierarchy (Fig. 6.3). Ranipura in HC Pur-I block, is the first order central place has accounted lowest centrality score, i.e. 17.31 (App. IV). Mean spacing of the central places of this hierarchy is 3.89 km. (Table 6.4). The Block Head Quarter of Harishchandrapur-II block is located at Khanta lies in this hierarchic order of central places with centrality score 206.62.

Second Order Central Places

There are 71 settlements with the centrality score ranging from 236.09 to 788.90 are considered as the second order central places in the district (Table 6.4). It is important that two central places of this hierarchic order i.e., Malatipur and Pukhuria are the Block Head Quarters of Chanchal-II and Ratua-II blocks with centrality score 523.25 and 703.423 respectively (App. IV). Second order central places are located at the mean spacing of 7.63 km. (Table 6.4).

Third Order Central Places

Table 6.4 reveals that with centrality score 788.90 to 1341.7 as many as 11 central places have been identified under the third order hierarchy. Of them 08 central places are the Block Head Quarters, i.e., Ratua (Ratua-I block), Rangabhita (Gazole block), Bamangola (Bamangola block), Habibpur (Habibpur block), Manikchak (Manikchak block), Baliadanga (Kaliachak-I block), Mothabari (Kaliachak-II block) and Baishnabnagar (Kaliachak-III block) (App. IV). Central places of this hierarchy are located at 19.37 km. mean spacing.

Fourth Order Central Places

The lower and upper limit of centrality score of the fourth order central places are 1341.71 and 1894.52 respectively. Only 03 central places i.e., Uttar Harishchandrapur, Shamsi and Old Malda with centrality score 1691.75, 1742.53 and 1857.50 respectively (App. IV) have been identified in fourth order hierarchy. They provide variety of functions of higher functional importance. Only Old Malda is urban centre while rests are rural settlements. Among them, Uttar

Table 6.5: Block wise Distribution of Central Places of Hierarchic Order

Malda District

(2001)

Name of the Block	Total Inhabited Settlements	Hierarchic Order of Central Places					
		First Order (<236.09)	Second Order (236.09-788.09)	Third Order (788.90-1341.71)	Fourth Order (1341.71-1894.52)	Fifth Order (1894.52-2447.33)	Sixth Order (>2447.33)
1. Harishchandrapur-I	104	20	02	01	01	-	-
2. Harishchandrapur-II	72	15	06	-	-	-	-
3. Chanchal-I	99	22	05	-	-	01	-
4. Chanchal-II	88	18	04	-	-	-	-
5. Ratua-I	91	19	04	01	01	-	-
6. Ratua-II	48	22	04	-	-	-	-
7. Gazole	288	33	05	02	-	-	-
8. Bamangola	141	15	03	01	-	-	-
9. Habibpur	233	13	07	01	-	-	-
10. Old Malda	115	11	03	-	01	-	-
11. English Bazar	113	21	07	-	-	-	01
12. Manikchak	72	20	04	01	-	-	-
13. Kaliachak-I	61	19	06	02	-	-	-
14. Kaliachak-II	55	15	04	01	-	-	-
15. Kaliachak-III	66	11	07	01	-	-	-
Malda district	1646	274	71	11	03	01	01

Note: Figure in brackets refer to the range of centrality score of central places.

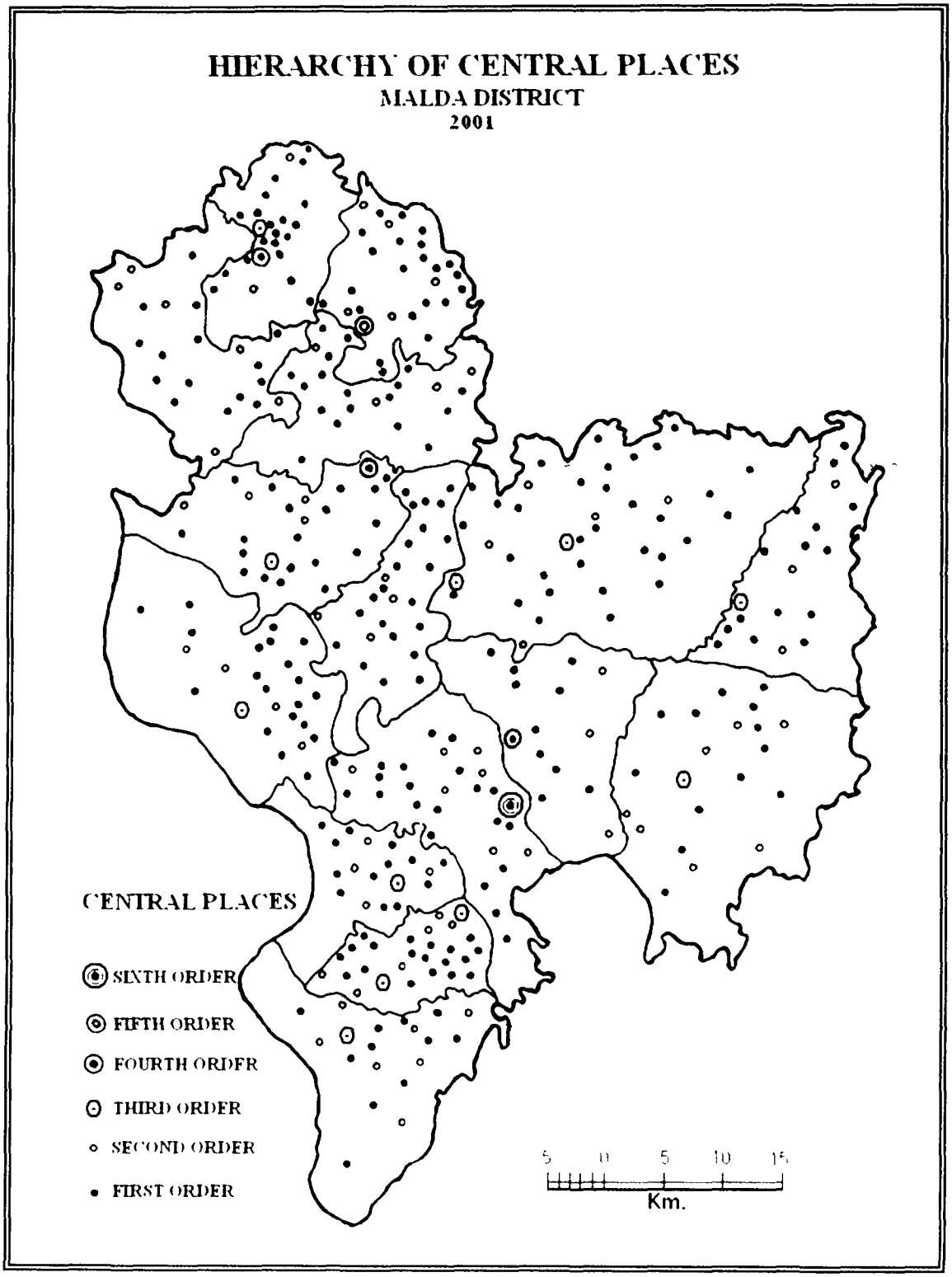
HIERARCHY OF CENTRAL PLACES
MALDA DISTRICT
2001
CENTRAL PLACES
SIXTH ORDER
FIFTH ORDER
FOURTH ORDER
THIRD ORDER
SECOND ORDER
FIRST ORDER
5 0 5 10 15
Km.

Fig. 6.3

Harishchandrapur and Old Malda are Block Head Quarters as well as Police Stations. These central places are located at the mean spacing of 37.14 km. (Table 6.4).

Fifth Order Central Place

The lower and upper limit of the fifth order central place is the centrality score of 1894.52 and 2447.33 respectively (Table 6.4). Singia in Chanchal-I block is the single central place with centrality score 2339.72 comes under this hierarchic order inhabiting total population 10,051 persons. It provides the higher order facilities like Sub Division Office, Block Head Quarter, and Police Station, College etc. to the dependent population (i.e., population of its own and surrounding settlements). But Singia is not an urban centre as per census of India 2001.

Sixth Order Central Place

English Bazar, the District Head Quarter, is single settlement accounted for the highest order i.e., sixth order central place attaining the centrality score 9381.72 (Fig. 6.3). It provides both higher and lower order functions and being district head have complete control over the district administrative boundary. Total population of English Bazar accounts 161,456 persons (App. IV).

Relationship between Centrality Score and total Population of Central Place

On the basis of Karl Pearson's technique of coefficient of correlation the hypothesis, centrality score of central places is directly correlated to its population, has been tested. To examine the causal relationship between centrality score being the 'X' i.e., independent variable and the total population being 'Y' i.e., dependent variable, 361 central places of the district have been taken into consideration. The analysis reveals that both the variables are positively correlated with r value 0.867. Their correlation is significant at 1 percent level at 359 degree of freedom (d.f.). Therefore, it may be ascertained that the central places with higher centrality score have attained higher population and vice-versa. The computed equation, $y = 1.3809x + 4542.1$ gives the best fit regression line to determine the linear relationship between centrality score and population of the central places (Fig. 6.4).

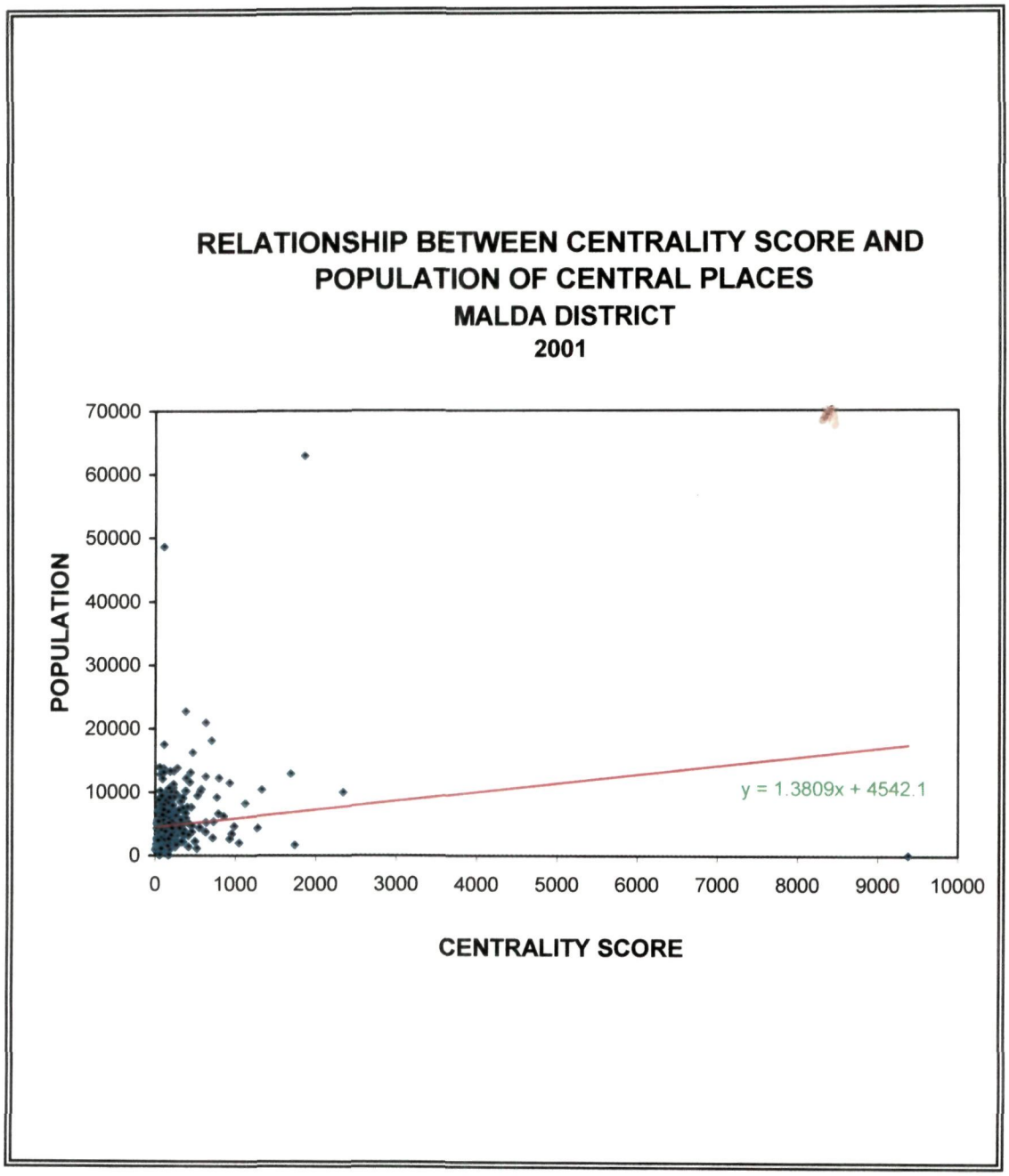
RELATIONSHIP BETWEEN CENTRALITY SCORE AND
POPULATION OF CENTRAL PLACES
MALDA DISTRICT
2001
POPULATION
70000
60000
50000
40000
30000
20000
10000
0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
y = 1.3809x + 4542.1
CENTRALITY SCORE

Fig. 6.4

REFERENCES

1. Christaller, W., *'Central Places in Southern Germany'*, translated by C.W. Baskin, Englewood Cliffs, New Jersey, 1966.
2. Sharma, R.C., *'Settlement Geography of Indian Desert'* Kumar Brothers, Hauz Khas, New Delhi-16, 1972, p. 171.
3. Misra, R.P. *et. al.*, 'Regional Development Planning in India: A New Strategy', Vikas Publishing House Pvt. Ltd., Delhi, 1976.
4. Maithini, B.P., *'Spatial Analysis in Micro-Level Planning'*, Omsons Publications, New Delhi & Guwahati, 1986.
5. Wanamali, Sudhir, *'Geography of a Rural Service System in India'*, B.R. Publishing Corporation, Delhi, 1987.
6. Babu, P. Krishna, *'Regional Planning in India'*, Chugh Publications, Allahabad-India, 1988.
7. Christaller, W., (1966), *Op cit*, p. 16.
8. Rao, V.L.S. Prakash. 'The Problem of Micro-level Planning', Report of a Seminar, *Behaviourla Sciences and Community Development*, 6(1), 1972, p. 147.
9. Wanwali, Sudhir and Khan, W. 'Conceptual and Methodological Dimensions of Central Place Theory' in Sen, L. K. (Ed.) *Readings on Micro-Level Planning and Rural Growth Centres*, 1972, p. 178.
10. Lokhande, T.N. and Pawar, C.T., 'Comparative Analysis of Service Area of Market Centres in Kolhapur District, Maharashtra', *Geographical Review of India* Vol. 66, No.1, March, 2004, pp. 40-49.
11. Glasson, J., (1978), *'An Introduction to Regional Planning'* Anchor Press Ltd., Great Britain, Tiptree, Essex, 1978 (2nd Edition), pp. 150-151.
12. Sudhir, Wanwali, and Khan, W. (1972), *Op cit.*, p. 179.
13. Glasson, J., (1978), *Op cit*, p. 150.
14. Green, F.H.W., 'Urban Hierarchy in England and Walse, Analysis of the Bus Services', *Geographical Journals,* Vo. 16, 1950, pp. 64-83.
15. Carruthers, W.I., 'Major Shopping Centres in England and Walse', R*egional Studies*, Vol. 01, 1967, pp. 65-81.
16. Maithini, B.P., *'Spatial Analysis in Micro-Level Planning'*, Omsons Publications, New Delhi & Guwahati, 1986, pp. 91-93.
17. Reed, I.J. and Muench, H., 'A Simple Method of Estimating Fifty, Percent Endopoints', *American Journal of Hygiene,* Vol. 27, May 1938, pp. 493-497.
18. Hagget, P. and Gunawardena, K.A., 'Determination of Population Thresholds for Settlement Function by the Reed-Muench Method', *Professional Geographer*, Vol. XVI, No. 4, July 1964, pp. 06-09.
19. Singh, R.Y., *'Geography of Settlements'*, Rawat Publications, Jaipur & New Delhi, 1998 (Reprinted), p. 295.