

## **SPHERE OF URBAN INFLUENCE: A CASE STUDY OF SELECTED TOWNS FROM BIRBHUM DISTRICT, WEST BENGAL**

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### **ABSTRACT**

Urban centre acts as nodal point for spatial planning by virtue of being economically propulsive for goods and services. It takes a leading role in radiating economic development for whole region. In India, 68.24% of total population live in rural areas and rest 31.16% in urban centres. Thus, it is very difficult to diffuse economic development over wide rural area. Hence, a comprehensive approach is imperative for spatially continuous development between rural and urban areas. For this purpose, it is necessary to identify few potential pockets of urban centres in region for radiating development process or function as growth centres, which can be done by means of assessing the functional importance of urban centres and its influence over surrounding areas.

**Keywords:** Functional importance, Nodal point Spatial planning, Sphere of urban influence, Urban Centre

### **INTRODUCTION**

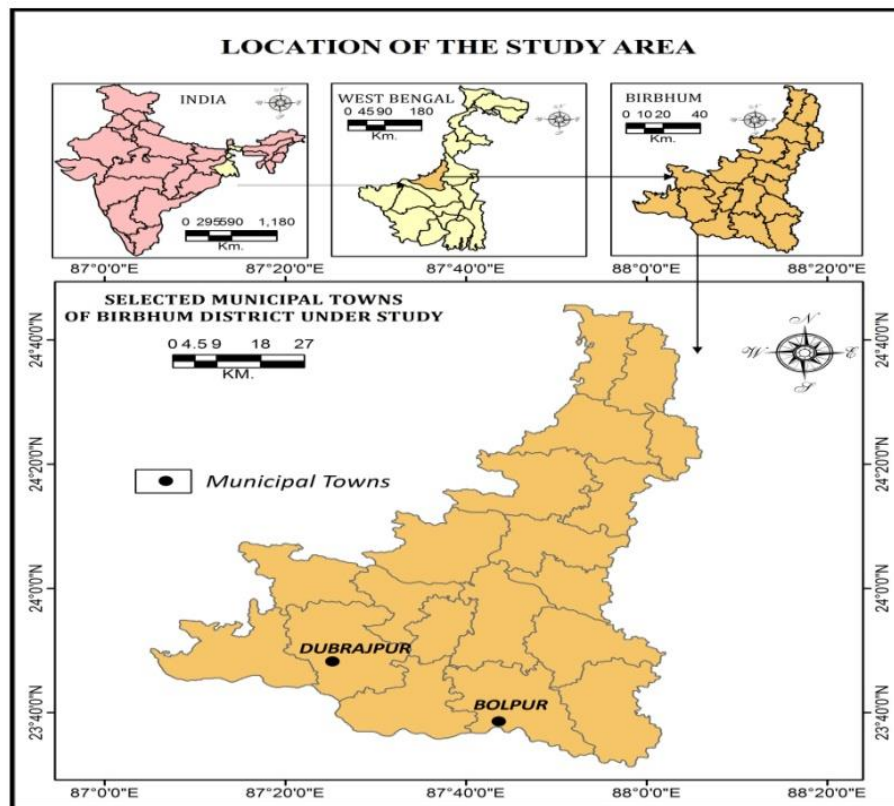
An urban centre thrives and grows through interaction with the surrounding areas to form functional region. A town acting as core area diffuses its service and goods to surrounding area, which functions as periphery. In turn periphery provide raw material, cheap labour which lead to accumulation of industrial expansion in the former and thereby a progressive urban growth. Thus an urban centre and surroundings are functionally interdependent. The concept of Urban Sphere of influence has been explained by several Urban Geographers. S.M. Alam, 1965 defines it 'A city's Hinterland is area socially, economically and culturally linked with it'. The area over which it exerts its influence is known as Sphere of urban influence. According to Verma, 2006 'Each city forms the core of a larger area and dominant area actually is the city's Sphere of influence'. The area around each town which comes under its economic social and political influence known as sphere of influence (David Waugh 1995). Every urban centre irrespective of their size of population and nature of function has a region of influence .The existence and definition of those various spheres depend on the assumption that people will travel to the

nearest place at which some goods or services are easily available (Carter 1995). Several interchangeable terms of urban sphere of influence are-Umland, Urban field, hinterland, catchment area etc.

**STUDY AREA**

Two urban units of Birbhum district has been chosen based on hierarchy of class of towns-the largest and smallest town based on Census 2011 population data. The 2 urban units are i. Bolpur (Class II)-largest town with a population of 80210 ii. Dubrajpur (Class III) smallest town with population of 38041.

Class of town	Name of Town	Location	
		Latitude	Longitude
II	Bolpur	23° 39' 51"	87° 39' 56"
III	Dubrajpur	23° 48' 00 "	87° 22' 48"



Source: prepared by author.

## **OBJECTIVES**

- i. To find out the relationship if any between hierarchy of towns and their respective zone of influence.
- ii. To delineate the sphere of influence of the selected urban centre.
- iii. To find out whether functional importance of towns is the factor of its influence or not.

## **LITERATURE REVIEW**

Literature review acquaints the researcher with the concerned field of enquiry carved out by others directly or indirectly connected. Thus, it lays foundations upon which the researcher can construct the research questions by providing basic guidelines tools and techniques. The Literature related to the concept and definition of sphere of influence has been reviewed and cited in the beginning of paper. Other dimensions of subject of enquiry have been reviewed in the present section.

**Cleef (1941)**- made an attempt to differentiate the etymology of Hinterland and Umland. Umland is the area contiguous to a trade centre whose whole economic and cultural activities are alike while in Hinterland includes the area which are adjacent to trade centre wherein economic and some cultural activities follow the primary centre.

**A.E. Smailes (1947)**- stressed on accuracy of delimiting the sphere of urban influence. Indices selected to measure it are –educational, health, recreational, newspaper circulation, milk supply zone. The study traced out a gradient character, which diminished with distance from the town.

**Hans Carol (1960)**- The study presented a qualitative aspect of finding out central function of Zurich city, Switzerland. It was found out that difference in demand for central services led to form hierarchy of central places, which is location of a group of central functions. It further brought out density of population of town is a factor of size of influence densely is less.

**S. M. Alam (1965)**- attempted to delineate the hinterland by 2 sets of indices of Hyderabad-Secundrabad Firstly, the supplies of fresh food, firewood and country liquor secondly, central functions –wholesaling, newspaper circulation, education. Sphere of influence decreases with distance, areas which lie close to core marked by high degree of influence.

**Garbis Armen (1972)**- attempted to delineate city-region by taking into 130 parameters relating to people, place and activity. He emphasized to apply threshold time limit for obtaining a particular service or goods by means of demand cone for various services. The time limit was 40-45 min travel beyond which a significant drop of people to avail service.

**B.J.L Berry and R.F. Lamb (1974)**- made an attempt to assess interactional model as basis for measurement of urban sphere of influence based on newspaper market circulation in the USA which highlighted 2 important dimension firstly-higher status urban centres had extensive sphere of urban influence secondly- urban centres with wide spacing tend to have wide service area than closely packed urban centres.

**David L Huff and James M. Lutz (1995)**- The paper demonstrates to delineate sphere of Urban influence of Ireland based on probabilistic models that show there exists a series of attraction contour ranging from value of less than one to greater than zero.

**M J Ali and Deepika Varsney (2012)**– presented delineation of sphere of influence of towns of Aligarh District based on total centrality score of facilities of towns which is sum of all services and goods it provide to surrounding areas. Towns with higher centrality score encompasses larger sphere of influence in comparison to lower centrality score and become a centre of growth.

**Wang Ho. Et al (2014)**– delineated sphere of urban influence by applying both gravity model and Field model. It finds association to mark urban agglomeration and urban hierarchy in any regional set up emphasizing multiple time point date analysis. Gravity model analyses the formation of urban hierarchies while field Model focuses on urban agglomeration.

## **DATABASE AND METHODOLOGY**

### **Data source:**

The study has been based on Secondary source of data published by Census of India 2011. Data has been obtained from District Census Handbook, Birbhum 2011.

### **Methodology:**

For the purpose to delineate the zone of influence following methods has been adopted –

1. Mean population threshold of all the facilities has been computed which is as follows-

$mT = P/N_f$  (Hagget and Gunwardena 1965) where  $mT$ =mean Population threshold-total population,  $N_f$ -total number of facility

2. Functional weightage of facility has been calculated by-

$W_{fi} = m_{Ti}/m_{T1}$  (Bhatta, 1976) where,  $W_{fi}$ - estimated weight age of function I,  $m_{Ti}$ -mean population threshold of ith function  $m_{T1}$ - lowest mean threshold population

3. To obtain centrality score or functional importance following method has been used-

$$CF_c = \sum_{i=1}^n (F_i \times W_i)$$

where- $CF_c$ -composite functional score,  $F_i$ -No of Functions  
 $W_i$ - weightage function of  $i$

4. To delineate the zone of influence a method devised by V.L.S Prakash Rao has been taken-

$SI = TCA/C$  &  $R = \sqrt{TCA/C}$  where- $SI$ - sphere of influence (sq.km),  $TC$ -Total centrality score of central place  $C$  –total centrality score all towns  $A$ -total area of the study region and  $R$ =radius of influence of towns.

## **RESULTS AND ANALYSIS**

### **Growth of towns:**

Bolpur is located on the southern tip of the district lying in close proximity to Burdwan town. The town has historical legacy that has contributed to its growth. The town is known for Visva-Bharati Santiniketan an experimental model of education founded by Nobel Laureate Rabindranath Tagore. It is also known for scenic beauty khoai- a land of ruggedness a place of great interest to the tourist. The driving force of economy is based on tourism. People in thousands from every corner assemble on Basonto Utsav (A festival), Poushmela (a Fair held in the month of Decemeber every year) which fetch capital to the town.

### **History:**

Historically Bolpur town was a village of 163 families (Sherwile report 1851-520.Paddy sugarcane and cotton were chief crops. The name Bolpur derived from ‘Bali’ and ‘pur’ meaning a place of Sacrifice (O’Malley 1910) Raja Surat made 1,00,000 sacrifices to Goddess Kali Henceforth it is known as Bolpur. It contained a Munshif court, charitable dispensary police thana sub-registry office and a high school. Bolpur started to grow after foundation of Railway in the year 1850 between Khana and Sainthia, which yielded a boost to economy based on export of Rice Mill in the whole district. In the year 1863 Maharshi Debendranath Tagore founded a small retreat for meditation ‘Brahmacharyasrama’. Later this Ashrama came to know as Visva Bharati in 1921 founded by Nobel Laureate Rabindranath Tagore. As a consequence Bolpur became gradually a centre of in-migration from adjoining areas which drove the growth of it. It became a town in 1950 with a population of 14802.

Dubrajpur- esoned in the south west of Birbhum district It is 60 km away from Bolpur town. Genetically Dubrajpur is rural and evolved as town from it. Railway communication played the crucial role for transformation of rural economy to urban economy. The village was under Zamindari of the Raja Bahadur of Hetampur (O’Malley 1910).It gradually gained importance

since opening of Ondal –Sainthia railway network and thereby promoted trade of rice. Apart from rice trading, manufacturing of brass ,bell –metal articles were the base of economy. It became municipal town in 1984.

**Growth of Bolpur and Dubrajpur in terms of population size-** There exists divergence of perspectives regarding the conception of urban areas across the countries. Hence, scope of identification of urban areas has varied. In India Census of India has adopted multi level criteria- demography economic and administrative to identify urban areas. In this paper, urban growth has been meant to an increase in the population of towns and cities over time.

Table 1: exhibits the temporal change of population in the concerned towns to assess the growth of towns to identify the size and hierarchy of towns since Independence.

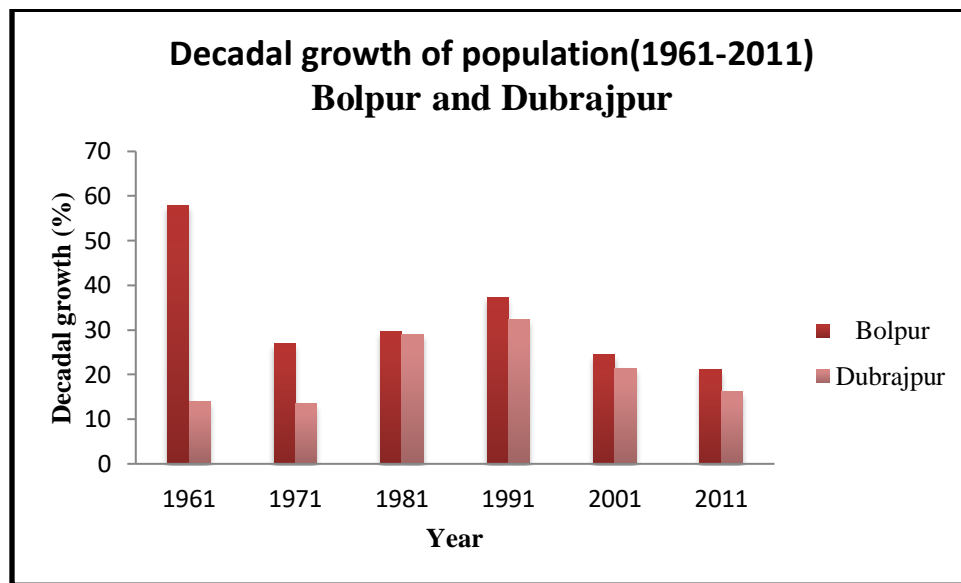
**Table 1: Growth of towns**

Year	Total Population		Decadal Growth (%)	
	Bolpur	Dubrajpur	Bolpur	Dubrajpur
1951	14802	12205	-	-
1961	23355	13917	57.8	14.0
1971	29636	15797	26.9(-30.9)	13.5(-0.5%)
1981	38436	20381	29.7(+2.8)	29.0(+15.5%)
1991	52760	26983	37.3(+7.6)	32.4(+3.4)
2001	65693	32752	24.5(-12.5%)	21.40(-11.0%)
2011	80210	38041	21.1(-3.4)	16.10(-5.3%)

Source: Census of India 2011.

(Figures in parentheses indicate the net change)

Bolpur experienced a mammoth increase of 57.8 % during 1951-61 as compared to Dubrajpur which had mere a rise of 14.0% However, Bolpur witnessed a sharp drop in growth rate from 57.8% to 26.9% which accounts for 30.9% net fall. However, during the same decade Dubrajpur’s growth rate fell marginally by 0.5% hence its growth rate stood at 13.5 %.In the next decade Bolpur gained net increase by 2.8 % over last decade and recorded growth rate of 29.7%. Dubrajpur grew at much higher rate in terms of net increase by 15.5% and its gross decadal growth rate was 29.0%.The trend of increase persisted till 1991 for both towns. Both towns experienced declining growth rate during 1991-2001 & 2001-2011. The net difference of growth between these towns during 1951-61 is 43.8 %, which was reduced to 5.0% during 2001-2011.



**Fig. 1: Decadal growth of population 1961-2011**

**Mean population threshold and functional weightage of facilities:**

Mean population threshold is the minimum number of population required to sustain a particular goods or services in the market. In other words, it is the minimum demand of a particular goods or services below which availability or services ceases to be made available. The Threshold concept has an important utility value for spatial planning (Ramchandran). Each goods or services has its own threshold value depending on nature or type of goods. Higher order goods and services has higher value of threshold limit while lower order has lower threshold. Thus, population size of town is directly linked with availability of goods and services. A town with large population is marked by diversified higher order goods and services. Hence its sphere of influence for each goods is large. Mean Population Threshold is viewed as population-function ratio (M.J Ali). Hence each facility has its own value in accordance with order of goods and service. To delineate the zone of influence- educational institutes, Health, financial institutes and recreational facilities has been taken.

The weightage value of facilities gives an indication of relative importance (M J Ali) Weightage of facilities has been computed by dividing its population thresholds by lowest mean population thresholds for each town. The lowest population thresholds have been given a weightage value of 01 to ascertain the weightage facility for rest of facilities available at each town

**Table 2** exhibits the mean population thresholds and weightage score of facility corresponding to each facility for the towns Bolpur and Dubrajpur. The population thresholds value of each

facility which is changeable subject to their importance as evident in the **table 2**. The population thresholds for primary school is 2110 persons and 2717 persons for Bolpur and Dubrajpur respectively while secondary and senior secondary has value of 80210 and 13368 for Bolpur. In case of Dubrajpur it stands at 38041 persons and 9510 persons. Dubrajpur has no degree college hence its facility is null. In case of Health Facilities there is only 01 Primary Health Centre hence serving its entire population having thresholds value of 80210 persons and 38041 for Bolpur and Dubrajpur respectively. Number of Nationalised bank is more as many as 10 in Bolpur while it is only 02 in Dubrajpur. The threshold value for recreational facilities in both towns is high.

It can be assumed that with increasing population size of towns-the availability of higher order functions and services tend to go up proportionately which induces a lesser weightage value. The weightage value is an indicator to assess the urban civic amenities. In a combination of small population size with higher frequency of facilities yields a low weightage value which is an indication of better infrastructure.

**Table 2: shows the mean population threshold for Bolpur and Dubrajpur towns.**

Category of facilities	Bolpur				Dubrajpur		
	Name of the facility	No. of facility	Population threshold	Estimated weightage of facility	No. of facility	Population threshold	Estimated weightage of facility
<b>Educational facility</b>	Primary School	38	2110	1.00	14	2717	1.00
	Secondary School	1	80210	38.01	01	38041	14.00
	Senior Secondary School	6	13368	6.33	04	9510	3..50
	Degree College	2	40105	19.00	-	-	-
	University	1			-	-	-
<b>Health Facility</b>	Primary Health Centre	1	80210	38.01	01	38041	14.00
<b>Financial and commercial institutes</b>	Nationalised Bank	10	8021	3.8	02	19020	7.00
	Co-	01	80210	38.01	01	38041	14.00



	Operative Bank						
	Agricultural Credit Societies	01	80210	38.01	02	19020	7.00
	Non-Agricultural Credit Societies	11	7291	3.46	04	9510	3.50
<b>Recreational Facilities</b>	Public Library	1	80210	38.01	01	38041	14.00
	Stadium	1	80210	38.01	01	38041	14.00
	Cinema Houses	2	40105	19.00	01	38041	14.00

Source: computed from Birbhum District Census Handbook, 2011.

**Sphere of influence based on total centrality score:**

W. Christaller defined centrality of a place as excess function over the needs of the central settlement. It was re-defined, as centrality is the amount of central functions necessary to serve external service area (Hans Carol, 1960). Centrality value incorporates the aggregate amount of services that a central place provides to its hinterland around it (R.B. Mondal 2001). Here in this paper, centrality score for each facility has been computed by multiplying weightage facilities with its number of function. Thus total centrality score for each town is sum of all centrality score of all facilities that each town provide.

Table 3 exhibits the total centrality score and sphere of influence of selected towns .Total centrality score for Bolpur is 456.10 as compared to Dubrajpur which has 154.00.Bolpur exerts its influence upto 7.7 km covering an area of 59.5 sq.km while Dubrajpur has 4.5 km of radius of influence having an area of 20.10 sq km.

**Table 3: centrality score and sphere of influence**

Name of Towns	Area of town (sq. km)	Population (2011)	Total Centrality Score	Sphere of Influence (SI) in Sq. Km.	Radius of Influence (R) in Km.
Bolpur	13.13	80210	456.10	59.5	7.7
Dubrajpur	16.83	38041	154.00	20.10	4.5

Inspection of Map (Fig 2) reveals the circular form (after V. L. S Rao) to conveniently represent its influence area. Both town lie on the transition zone of administrative boundary .Hence sphere of influence of Bolpur and Dubrajpur with radius of 7.7 km and 4.5 km crosses the district boundary of Birbhum district encompassing adjacent areas of Burdwan district. Bolpur has extensive sphere of influence covering blocks Bolpur –Sriniketan, part of Illambazar ,part of Nanoor, and Labpur because of firstly large population size which induces high demand for goods and services. Population size and availability of functions co-exists. Availability of Functions tend to increase with increasing population size.

Secondly- Availibility of higher order function in Bolpur.

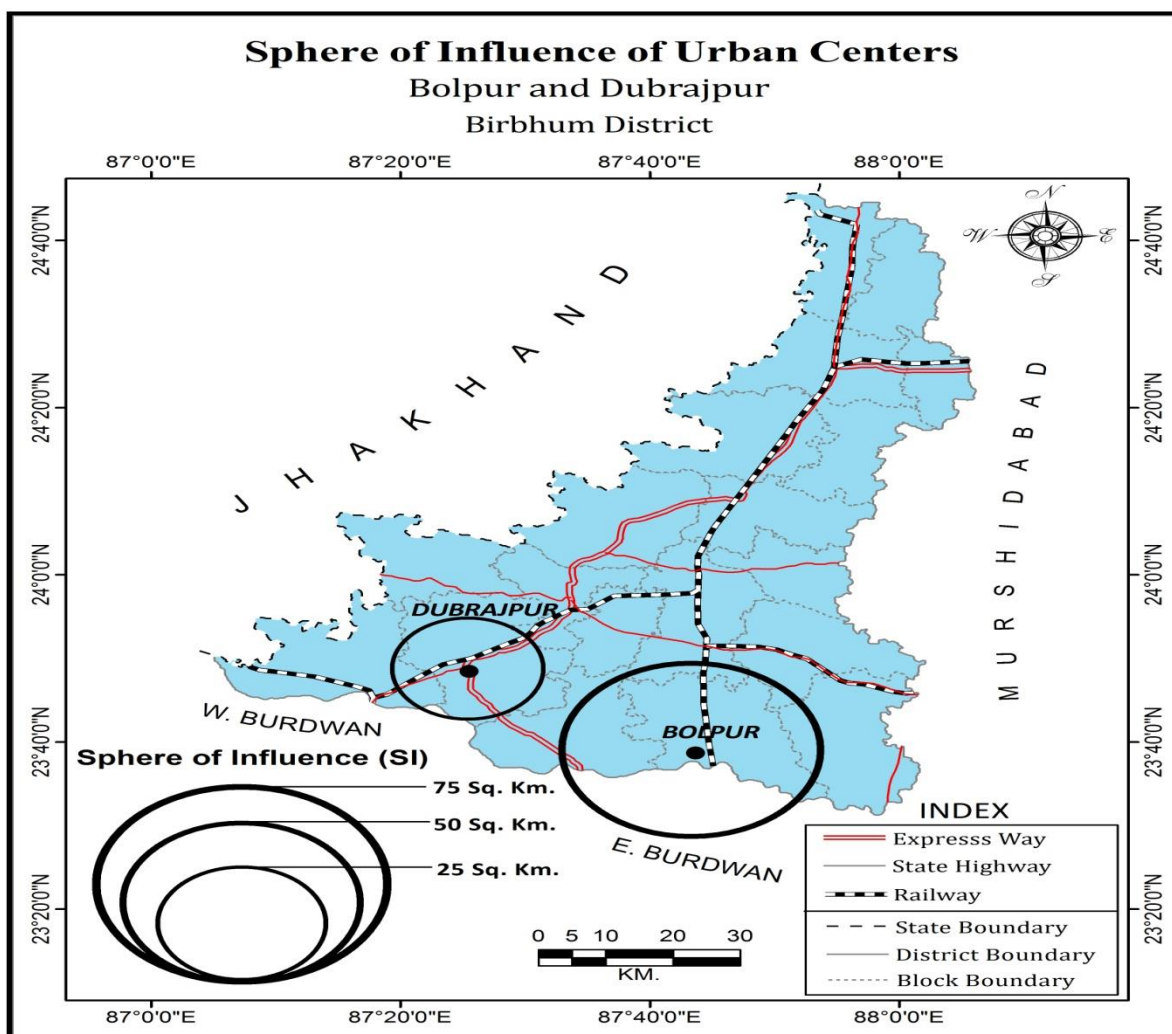


Fig. 2: Sphere of influence of Bolpur and Dubrajpur

## CONCLUSION

Sphere of influence of Bolpur and Dubrajpur has been delineated which reveal that class of town is determinant. Bolpur has a zone of 59.5 sq km of area under its influence while Dubrajpur has only 20.10 sq km. It may be inferred that class of town is determinant for both town. Availability of functions are more in Bolpur having a total centrality value of 456.10 as compared to Dubrajpur's 154. Hence it encompasses extensive area of influence. Such a difference in the functional magnetism leads to hierarchy of urban units. It can also be predicted that Bolpur has greater potentiality of growth by virtue of its availability of higher order functions as compared to Dubrajpur.

**Acknowledgement:** I extend my deep gratitude to my Research Supervisor Dr. Manjari Bhattacharji, Associate Professor, Visva Bharati, for her scholarly guidance in the preparation of this topic.

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