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Trend of Urbanization and Rank-Size Distribution of Urban Centre: A Case Study of West Bengal, India

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Abstract:

Urbanization, a multi-dimensional process, means cumulative concentration of urban population and functional dimension of urban settlements including the movement of people from rural areas to urban areas and shifting of a community from rural lifestyle and static economy to urban lifestyle and progressive-diversified economy. Now it is at an accelerating stage in the country. The state of West Bengal has been one of the most urbanized states since pre-independence and 32 percent share of its total population living in urban areas as of 2011. Since 1901, urban primacy has been a feature of urbanization of the state and continuous increase of population in highly urbanized districts around Kolkata. The Census data of 2011 reveals that the urbanization process of the state exhibits a growing trend and begins to spread into the interior districts. The present paper tries to focus on the nature, trend and pattern of urban population in the state over the period of time. For the present study basically secondary data have been adopted and the different cartographic techniques and statistical methods such as decadal growth rate, urban-rural ratio, rank size rule, location quotient etc have been applied. The district has been taken into account as a unit of study for showing the variation and pattern of urbanization across the district. The study conclusively reveals that growth of urban population has been increased throughout the census years though there is a huge variation of level of urbanization as well as its concentration over the districts. While the district Kolkata, the primate city of the state is fully urbanized and the primacy index is 11.36.

Keywords **— Growth of cities, Primate city, Rank-size rule, Urbanization**

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I.   INTRODUCTION

Urbanization in India is slower than in the other developing countries. Although the history of urbanization in India is a distant past, first sign of which is seen in the Indus Valley Civilization around 2350 BC, but since the year 1901 population related data are available at regular intervals. The clustering of urban population in the major cities in India has increased steadily from 11.4 percent in 1901 to 31.16 percent in the year of 2011.

As per the provision of Census of India (CoI), the term 'urban' is defined based on the following criteria:

- All places with a municipality, corporation, cantonment board or notified town area committee,
- Minimum population of 5000,

- At least 75 percent of male working population engaged in non-agricultural pursuits and
- A density of population of at least 400 persons per sq. km area.

In the state of West Bengal, the characteristics of the urban area are remarkably unique. The state is rich in environmental resources, having a long historical urbanization, people centered political rule and rich in rural traditional heritage which make a suitable and vibrant image of urbanization with a great challenge.

The state has witnessed a steady rate of urbanisation. Since independence, the share of urban population in West Bengal has always been higher than the national average. According to the CoI (2011), 31.89 percent of the total population in West Bengal lives in urban areas. The capital of the state, Kolkata has almost 100 percent urban population. In terms of numbers, the district of North 24 Parganas has the largest urban population with 58,07,128 and the lowest is in the district of Dakshin Dinajpur with only 2,36,075. Although, the district Bankura has the lowest urban population in terms of proportion to total population (8.36 percent).

II. STUDY AREA

The state of West Bengal has been selected as a study area which is located between 21°25' North to 26°50' North latitudes and 86°30' East to 89°58' East longitudes with three international boundaries such as Bangladesh, Nepal and Bhutan. It occupies a geographical area of about 88,752 sq. km and extends from the Himalayas in the north to the Bay of Bengal in the south. It is surrounded by Sikkim and Bhutan in the north, Assam and Bangladesh in the east, the Bay of Bengal in the south and Orissa, Jharkhand, Bihar and Nepal in the west. The total population of the state is 91347736 and the population is 1029 as of the 2011 census. According to the CoI (2011), 68.11 percent of the
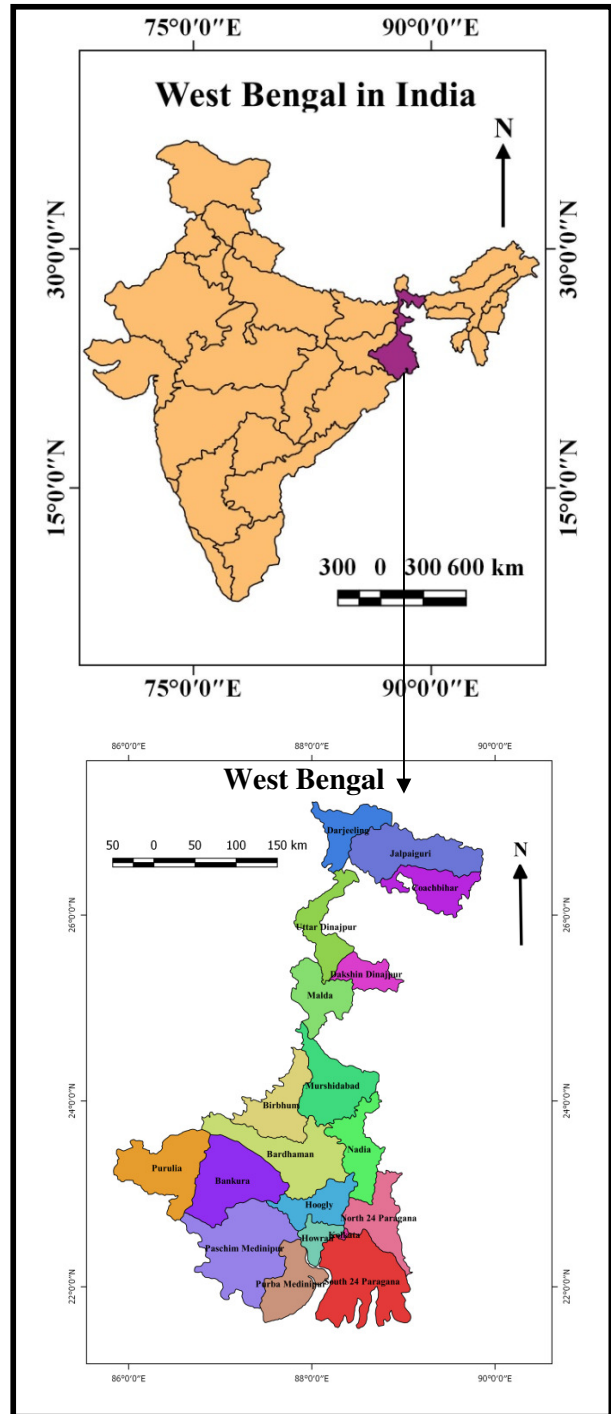
total population resides in rural areas while 31.89 percent lives in urban areas.

Fig. 1 Location map of the study area

III.   OBJECTIVES

The major objectives of the present study are as follows:

- To analyse the trend and pattern of urbanization in West Bengal,
- To show the distribution of the major urban centres in the light of rank-size rule,
- To find out the primate city in the area under study.

IV.   DATABASE AND METHODOLOGY

Basically, the present study is based on the secondary data that have been collected from the census of India, District census handbooks, bureau of applied economics and statistics, different articles, reports, thesis etc. District is taken as a unit of study, for analysis and mapping purposes.

The methodology includes data compilation, calculation and presentation of collected data. Some cartographic techniques and methodologies have been adopted for determining trends of urbanization, the level of urbanization, decadal growth of urban population etc.

A. Least square method: For showing the trend of urban population of the state from 1901 to 2011 least square method is applied. Equation of trend line, **Yc = a + bx**

B. Level of urbanization: It is defined as the relative number of people who live in urban areas. Share of urban population [(UP/TP)*100] and urban-rural ratio [(U/R)*100] are used to measure the degree of Urbanization.

C. Decadal growth rate of urban population: Urban Growth Rate can also help in understanding the degree of urbanization and it can be measured by using a simple formula stated below.
Decadal Growth between 1991 and 2001:

[Urban Population in 2001-Urban Population in 1991)/Urban Population in 1991*100] or

$$\frac{P2-P1}{P1} * 100$$

Where,
P2=Present Year Population
P1= Past Year Population

D. Urban population density: Urban population density (person/sq.km.) is measured of different districts of West Bengal by the following formula:

$$\text{Urban population density} = \frac{Urban\ Population}{Urban\ Area\ (sq.km.)}$$

E. Location quotient: To know the concentration of urban people in the different districts Location Quotient (L.Q) is done. The formula of Location Quotient is:

$$LQi = \frac{Pij / Pi}{Pj/P}$$

Where, Pij = number of person in jth (=1, 2 ...m) category of area i (=1, 2 ...n)

$Pi = \Sigma\ Pij$ = total population in all the category of area i

$Pj = \Sigma\ Pij$ =Sum of persons of category j in all the n area *i.e.* population of region under Category j

P = Sum of Pi in all the areas *i.e.,* total population of the region in each category.

F. Urban-rural ratio: The urban rural ratio has benn calculated of the different districts by following formula:

$$\text{U-R Ratio} = \frac{Urban\ population\ of\ a\ district}{Rural\ population\ of\ the\ district} * 100$$

G. Rank –size rule: The population of a city of Rank (R) can be calculated by dividing the population of the largest city (P1) by the rank (R) in a graph showing ranks on the X axis and the population size of the urban centers on Y axis in a normal graph. (Ghosh, 2003, P. 47-49).

If the population of the largest city is 100000, the population of the 5th ranking city can be deduced as:

Population of the 5th ranking city (P5) =20000

H. *Primacy index:* The degree of primacy of the largest city can be measured by the ratio of its population to that of the second larger city (Kumari, 2014).

$$\text{Primacy index (1)} = \frac{P1}{P2}$$

Where, P1 = populations of the 1st settlement and
         P2 = populations of the 2nd settlement.

V.   RESULTS AND DISCUSSION

A. *Trend of comparison of urbanization between India and West Bengal (1901 – 2011)*

India is the second largest populated country with a population of 121,019,3422. It was divided into 36 political units with 29 states and 7 Union Territory at the time of the 2011 Census. After independence, urbanization has significantly started in India. In the decade of 1951-1961 under the 1st and 2nd five year plans, the growth of economy and urban population started simultaneously. (Bose, 1993)
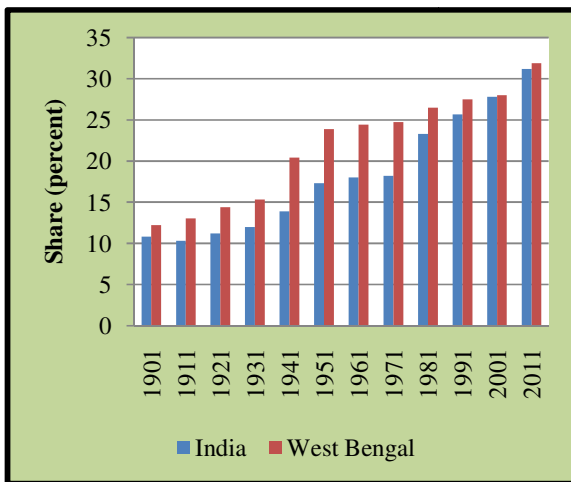

Fig. 2 Proportion of urban population (1901-2011)

The urban population of the country at the beginning of the 20th century (1901) was only 25.9 million which is 10.8 percent of its total population in 1901 but in 2011 it reached 31.2 percent with a population of 377.1 million. From 1901 to 2011 the urban population increased by nearly 351.2 million. The figure 2 clearly shows that the share of urban population in the state of West Bengal has always been higher than the national average since 1901. Though the growth rate of urban population is much slower in the state compared to the country which gradually narrows the difference of gap with regard to the proportion of urban population to the total population. The share of urban population in the state was 12.2 percent to the total population in 1901 which has increased to 31.89 in 2011 which is higher than the national average.

B. *Trend of urban population of West Bengal (1901-2011)*

From 1901 to 2011 the urban population has always increased rapidly in West Bengal. In 1901 the urban population was 2066691 which reached 29130793 in 2011. But it is evident from the trend line that the total urban population has increased after 1991 and the actual urban population is higher than the estimated urban population. It may be the result of rural-urban migration due to various facilities and opportunities in urban areas.
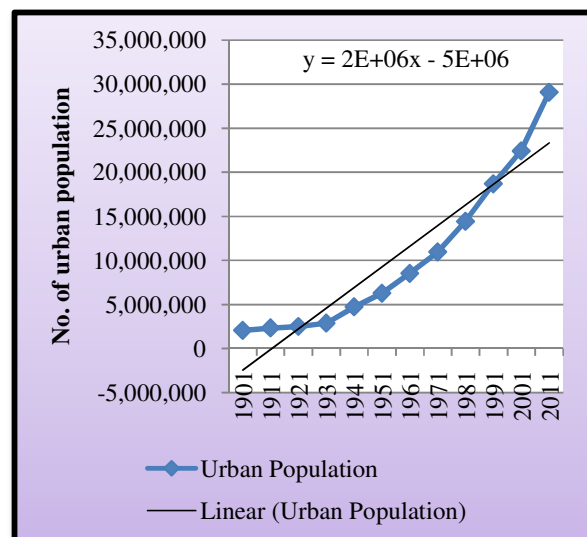

Fig. 3 Trend of urban population of West Bengal (1901-2011)

C. Pattern and regional variation of urbanization in West Bengal

The rate of urbanization is not evenly distributed through the state. The capital city of the state, Kolkata is fully urbanized without any ray of rural area. In the year of 2001, after Kolkata the district North 24 Parganas witnessed the highest Urbanization with 54.30 percent followed by Howrah (50.36 percent), Burdwan (36.94 percent) and the lowest share of urban population has been recorded in the district of Malda with 7.32 percent followed by Bankura (7.37 percent), Purba Medinipur (8.29 percent). While as per the CoI (2011), the district Howrah being the adjacent of the capital city has the highest proportion of urban population with 63.30 percent followed by North 24 parganas (57.03 percent), Burdwan (39.87 percent), Darjeeling (38.99 percent) and the district Bankura has recorded the lowest urbanization with 8.36 percent to its total population which is much lower than the state as well as national average followed by Cooch Behar (10 percent), Uttar Dinajpur (12.07 percent).

D. Urban growth index (1991-2001) and (2001-2011)

Decadal growth rates of the different districts of West Bengal are different from 1991 to 2001 and all the districts have positive urban population growth. The highest decadal growth rate of urban population from 1991 to 2001 has been found in Murshidabad (48.22%) and South 24 Pargana district (42.85%). Kolkata and Bankura districts have lowest decadal growth rate of urban population in the given period 1.19% and 3.93% respectively. Maximum districts have a low decadal growth rate ranging from 10% to 20%.

From 2001 to 2011 Kolkata has the negative decadal urban population growth (-1.67%) and it may be the result of suburbanization, rural-urban fringe effects and also the emergence of satellite towns. The maximum growth rate is 124.81% in Malda district. Jalpaiguri, Murshidabad and South 24 Pargana have high decadal growth rates ranging from 72.15% to 99.51%. North 24 Pargana,
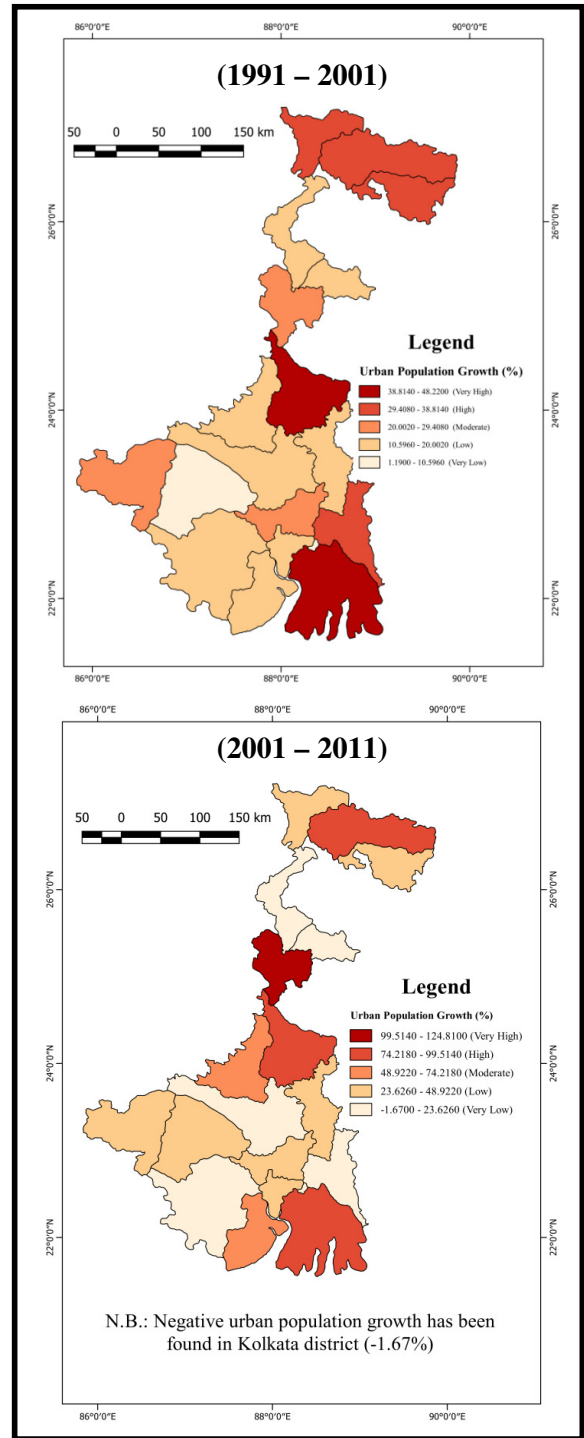
Paschim Medinipur, Bardhaman, uttar and Dakshin Dinajpur have a low decadal growth rate of less than 23.62%.

Fig. 4 Decadal growth of urban population by district (1991-2001) & (2001-2011)

E. Urban population density

Urban population density means the number of urban population lives in 1 sq. km urban area. The urban density of the state in 2011 is 5683 persons/sq.km but it varies from district to district. Kolkata district has an excessively urban population density (24306/sq.km.) followed by North 24 Pargana having 9187/sq.km. The lowest urban density is 2530/sq.km in Purulia.
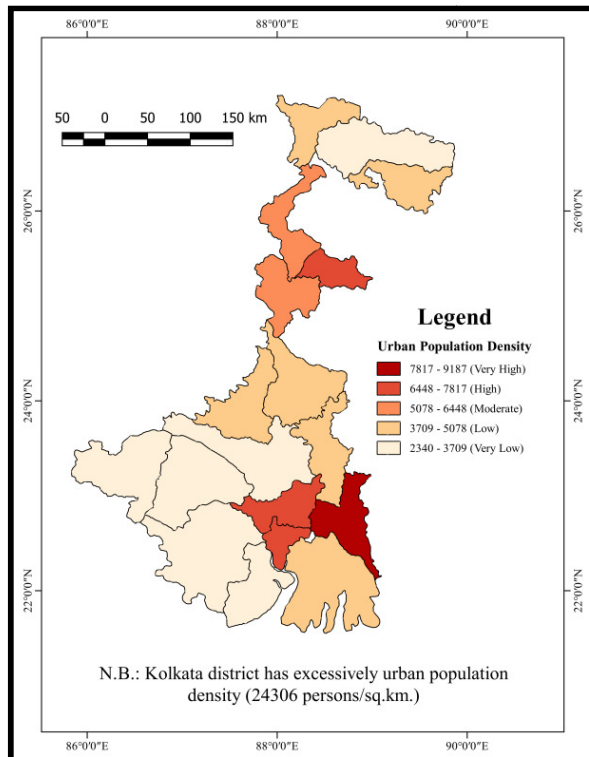

Fig. 5 District-wise urban population density (2011)

All the districts are classified into five categories based on their urban population density. Howrah, Hooghly, Dakshin Dinajpur have high urban density; Uttar Dinajpur and Malda have moderate urban density; Darjeeling, Cooch Behar, Murshidabad, Nadia, Birbhum and South 24 Pargana have low urban density; Jalpaiguri, Bankura, Bardhaman, Purba Medinipur, Paschim Medinipur and Purulia have very low urban density. So it is evident that the western part of the state is

parsely urban due to an unfavorable physical environment.

F. Regional variations of urban concentration

According to Census of India, 2011 Kolkata, Howrah and North 24 Pargana have the highest concentration of urban population with respect to the whole state. It may be due to the effects of Kolkata urban agglomeration. South 24 Pargana, Hooghly, Bardhaman, Nadia, Darjeeling and Jalpaiguri have the moderate concentration of urban population and the rest of the districts have low urban population concentration.
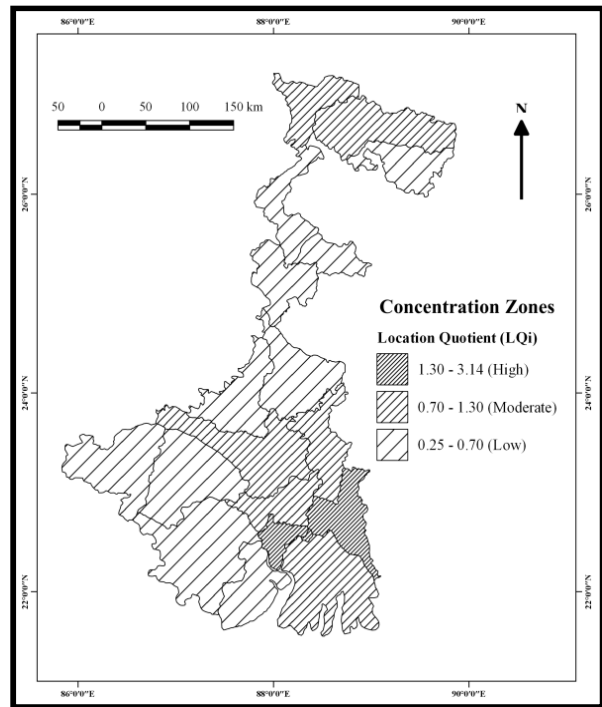

Fig. 6 Concentration of urban population by district (2011)

TABLE I
CATEGORY OF DISTRICTS BY LOCATION QUOTIENT

Category	LQ value	No. of districts	Name of district
High	1.30 – 3.14	3	Kolkata, Howrah and North 24 Parganas
Moderate	0.70 – 1.30	6	Hooghly, Nadia, Burdwan, Jalpaiguri, Darjeeling and

			South 24 Parganas
Low	0.25 – 0.70	10	Purba Medinipur, Paschim Medinipur, Purulia, Bankura, Birbhum, Malda, Murshidabad, Dakshin Dinajpur, Uttar Dinajpur and Cooch Behar

G. Urban –rural ratio

Urban –rural ratio means number of urban population with respect to 100 rural populations. As Kolkata is a fully urbanized district, it has excessively urban-rural ratio. Howrah and North 24 Pargana have a high urban-rural ratio ranging from 118% to 173%. Bardhaman and Darjeeling have moderate urban-rural ratio ranging 64-118% and rest of the districts have a low urban-rural ratio. Actually urban-rural ratio is high in Kolkata and its surrounding districts. It is evident that urban –rural ratio is moderately high in the districts which have municipal corporations like Kolkata, Howrah, Bardhaman, Darjeeling etc.
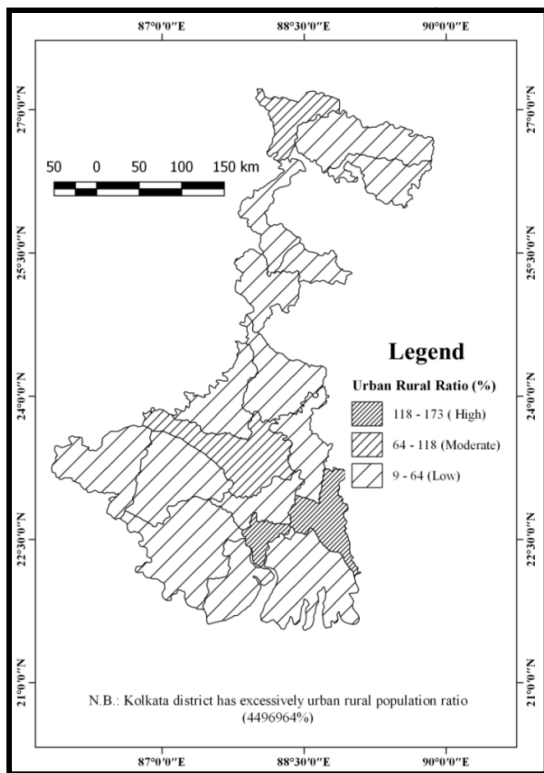

Fig. 7 Urban-rural population ratio by districts (2011)

H. Distribution of urban centre

As per 2011 census the state West Bengal has six municipal corporations (M.C). Among them in Burdwan district have two municipal corporation i.e. Asansol and Durgapur. Others are Howrah M.C. in Howrah District, Chandannagar in Hooghly District, Kolkata M.C. in Kolkata district & Siliguri in Darjeeling district which is in North Bengal. Highest number of municipality is found in North 24 Parganas i.e. 27 and lowest number of municipality is found in Howrah, Malda and South Dinajpur i.e. 2. Highest number of census towns is found in Howrah district i.e. 139 but in South Dinajpur number of Census towns is only 8.
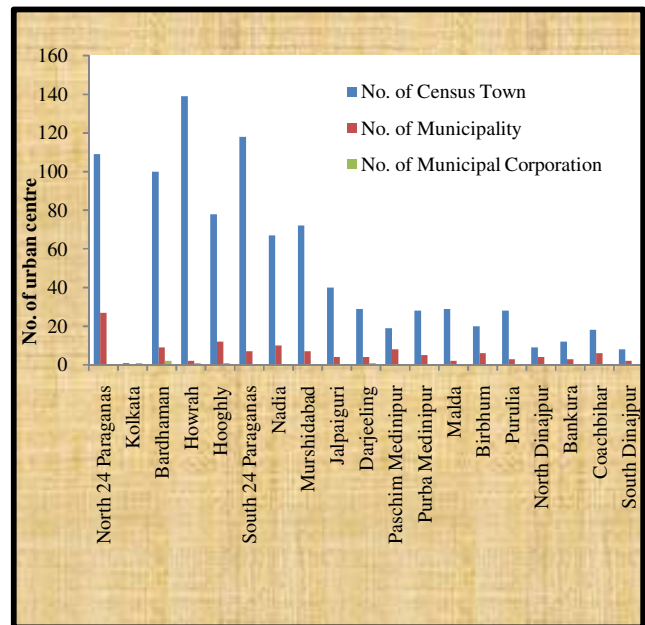

Fig. 8 District-wise distribution of urban centre by category (2011)

I. Distribution of major urban centres by rank-size rule

In the present paper 50 major cities are selected on the basis of population size of 2011 census. Rank size rule is a mathematical analysis of the settlement hierarchy of any country or state or any places or region. According to Census of India, 2011 North 24 Pargana is the 1st rank district based

on urban population size in West Bengal but its actual population is less than the estimated urban population. But Howrah, Hooghly, South 24 Pargana, Nadia, Murshidabad etc districts have more than urban population with respect to estimated population. Districts of the northern and eastern parts of the state have less urban population than the estimated population due to low urban concentration.
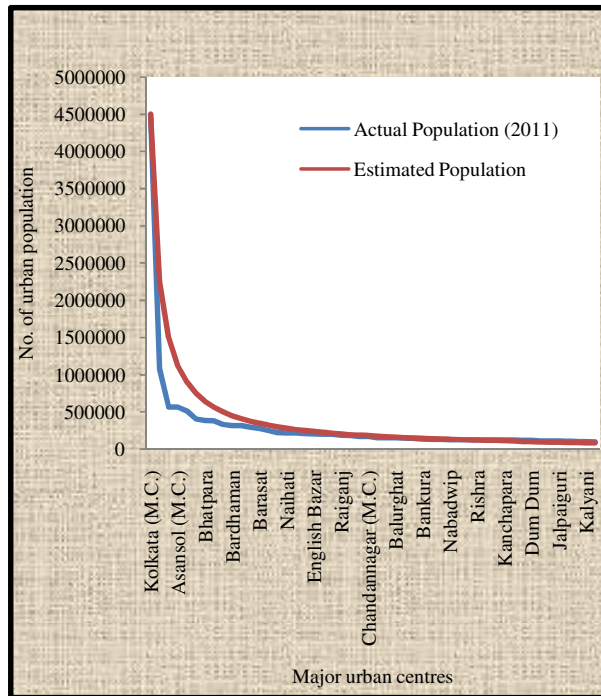

Fig. 9 Actual and estimated population of major urban centres using rank-size rule (2011)

J. Primate city and primacy index

The idea of primacy was formulated by Mark Jefferson in his paper entitled 'Law of the primate city' in 1939. He observed that the population of the first ranking city was often more than double that of the second city and five times that of the third city. (Ghosh, 2003)

According to the census of 2011, the population of Kolkata is 14112536 and its rank is first and Asansol is second with 1243008 populations.

Primacy index of Kolkata = 14112536/1243008
= 11.36

According to the rank size rule, the second largest city will half the population of the first ranked city. The difference between the population of Kolkata and Asansol is 12869528 and the population of Kolkata is 11.36 times larger than the population of Asansol. So According to the rule of primate city, Kolkata is the primate city of West Bengal.

The population of Kolkata is very high relatively other cities in West Bengal and it is the leading city of the state due its colonial heritage, principal commercial, cultural and educational centre of eastern Asia and north-east India, major industrial regions including film industry etc.

VI. MAJOR FINDINGS

The major findings of the present study are as follows:

- Kolkata district is the most urbanized area of the whole state.
- Urban population is more concentrated in Kolkata and its surrounding districts area.
- Bardhaman district has low urban population density in spite of a large number of urban population.
- Howrah district has the highest number of census towns.
- The number of urban population has increased highest in Murshidabad district and Malda district from 1991-2001 and 2001-2011 respectively.
- The urban population is more than the estimated population after 1991.
- Percentage of urban population to total population is increased in all the districts from 1991 to onwards.
- Middle and western parts of the state have less urban concentration and high mainly in the north and around the Kolkata districts.

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