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**RESEARCH ARTICLE**

# SPATIAL DISTRIBUTION OF INFRASTRUCTURAL FACILITIES AND REGIONAL INEQUALITY: A CASE STUDY OF WEST BENGAL, INDIA

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**ABSTRACT**

*The development process often produces spatial inequality among different regions. As a result of this some regions may appear to have more than their average share of some facility and this evident in developing countries where the urban centres usually have concentration of essential goods and services compare to the rural counterparts. This research paper is an attempt to examine the spatial disparities in infrastructural facilities in different Districts of Indian state of West Bengal and intern analysis its impact on regional development. A simple multivariate method has been followed to compute a composite Infrastructure Development Index (IDI) by combined various Infrastructural Services available at the District level. Empirical evidence suggests that there is a positive relationship between Infrastructural Development Index and Per Capita Income and negative relationship between Infrastructural Development Index and Poverty. However, an effort should be made to create more infrastructural facilities at the district level to raise the state domestic product and reduce the level of poverty of the people concern.*



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## INTRODUCTION

Infrastructure is a major sector that propels overall development of the Indian economy. Infrastructural facilities are not evenly spread over space because certain environmental factors, operation of economic, culture and political processes often produce areas of concentration and specialization. Spatial disparities in the levels of development are the result of uneven distribution of natural resources and regional differences in the history of human development (Adefila *et al*. 2014). Human life and Development is based on the extent to which man can satisfy the basic needs such as food, Clothing and shelter. In order to full fill these basic needs and other demand, man require access to certain facilities such asmarket, housing, water supply, electricity and adequate transportation which is directly or indirectly helps to creates spatial inequality (Adekunle *et al*, 2011). The role of infrastructural facilities in the overall economic growth and development cannot be overemphasized. UN (2011) had remark that infrastructure plays a critical role in poverty reduction, economic growth and employment for the masses. Moreover, (Ale, *et al*. 2011) shared similar opinion that provision of basic infrastructure is a prerequisite for developing economics to stimulate economic growth through economic recovery, poverty alleviation and diversifying agricultural outputs. Though these infrastructures form an important and integral part of life of any community either rural or urban but they are unequally distributed over space. Many empirical findings have shown that facilities are unequally distributed in our communities such that the vast majority of the people are caught in a never ending struggle to gain access to these infrastructures in order to improve their quality of life (Eyles, 1996; Oyerinde, 2006).

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### Objectives

Objectives of the work includes,

- To examine the spatial disparities in infrastructural facilities in different Districts of West Bengal.
- To show the influence of infrastructure on regional development.
- To analyze how Infrastructural facility is related with Per Capita income and poverty in the study area.
- To investigate the planning strategies undertaken by the government of India for removing regional imbalance.

### Study Area

West Bengal an eastern state of India has been selected as the

It extends from 21˚ 25' N to 26˚ 50' N latitudes and 86˚ 30' E to 89˚ 58' E longitudes and covering an area of about 88,968 sq. km. It is bounded on its north by Bhutan and the state of Sikkim, on its east by Bangladesh, on its south by the Bay of Bengal and its west by the state of Bihar. The Himalayan north, comprising the district of Darjeeling, Jalpaiguri and Cooch Behar are watered by the swift flowing rivers Teesta, Torsa, Jaldhaka and Ranjit. Variation in altitude results in diversity in the nature and climate of West Bengal. From the northern highlands at the feet of the Himalayas to the tropical forests of Sunderbans, each region different from the other which influences the spatial distribution of infrastructural facility as well as regional development.

**Review of Previous Literature**

***International Level***

- **Dalenberg, D. R. & Partridge, M. D. (1995)** used data from 28 metropolitan areas of U.S. over a fifteen year period to determine the impact of government spending, taxes and public infrastructure on total employment. They found that taxes are negatively related and educational expenditure is positively related to total employment.
- **Kessides, C. (1995)** reviewed the linkages between infrastructure and economic development on the basis of both formal empirical research and informal case studies. The main thesis is that economic benefits result from investments in infrastructure only to the extent that they generate a sustainable flow of services valued by users.

***National Level***

- **Shah, N. (1970)** studied the pattern and level of infrastructure facilities in India at the time of independence. He also attempted to relate the level of per capita income of Indian states with their level of infrastructural development. The study revealed that there was a strong high degree of positive correlation found between per capita income and level of infrastructural development.
- **Prakash, S. (1977**) attempted to analysis the regional inequalities in terms of infrastructure facilities in India during 1951-71. The main objective of his work was to determine the extent of existing inequalities and identify the backward regions. The author selected the important indicators like population size, density, literacy rate, urbanization, power, irrigation, banking, communication and transport, industrial and agricultural implements in his study.

***State Level***

- **Sengupta, P. (1987)** has examined the functioning of wholesale market and infrastructural development of the city of Kolkata in order to analysis the volume and type of goods that were transected and extent of congestion inside the overall effect of the market on the civic and economic life are described in the paper.
- **Majumder, R. & Mukherjee, D. (2005**) in their paper explored the correlation between Infrastructural availability and development for the West Bengal economy using a multidimensional approach and a time series data. It is observed that both developmental and infrastructural indices have shown a continuously rising trend in the period of during 1971-2001. The long run relationships suggest strong positive impact of infrastructural availability on development levels.

**Data Base and Methodology**

The entire analysis has been completely based on secondary data which are collected from District Census Handbook of 2011 and West Bengal Census Report, 2011. The necessary cartographic techniques like maps, diagrams and tables have been used with the help of Q-GIS software. For the analysis of the study different statistical method have been used. To calculate the composite Infrastructural development Index (IDI) quantitative method has been applied specially Standard Score. It is a dimensionless quantity that involves the varying means and varying standard deviations. Standard Score (Z-Score) has been calculated using the following formula:

$$Zi = \frac{Xi - X}{SD}$$

Where, Xi is the original value for observation (i)

$\bar{X}$ is mean of the variable
SD is the standard deviation

Statistical techniques have also been applied to analyze the nature of relationship between different concerned variables.

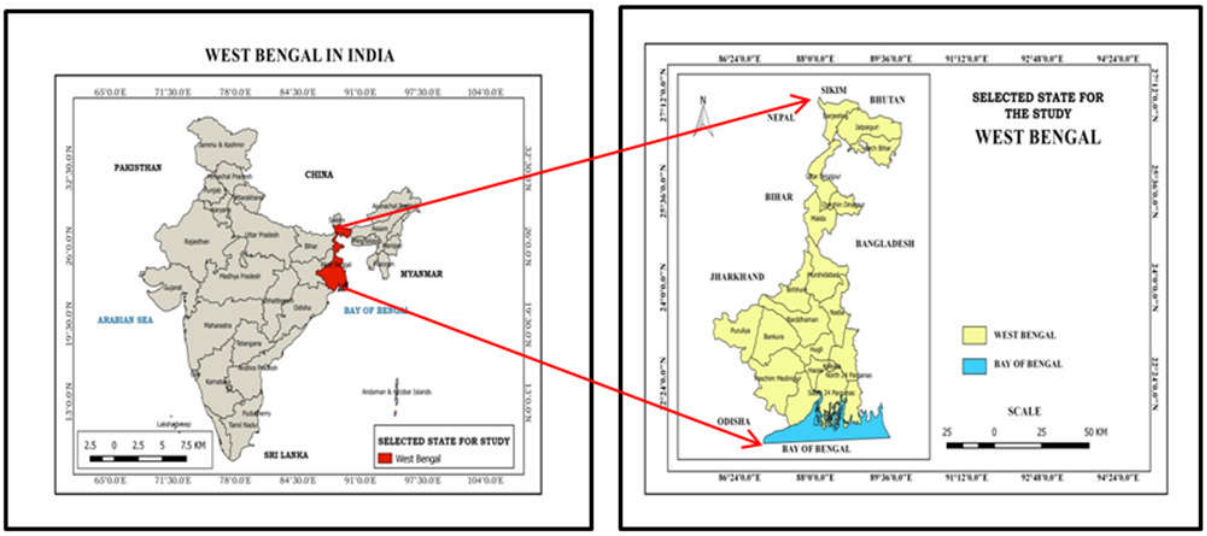
**Statement of the Problem**

The state West Bengal has been selected for the detailed study. It has only one metropolitan city i.e. Kolkata, which is known as "City of joy". It has vast infrastructural facility such as, Kolkata metro was the first underground metro system in India. National Highway 2 (NH-2) connects Kolkata to New Delhi. It has well connected railway system. The number of educational institution, water supply facility, banking facility, electric facility, medical services etc. are quite well here, in spite of that West Bengal faces wide imbalance in spatial distribution of infrastructure among the different districts. Even after the seventy one years of the independence to till now there are some remote rural villages in West Bengal. Where there has been absence of electricity, adequate number of road length, medical services, educational institutions etc. which creates imbalance in regional growth.

**Discussion of the Study**

***Road Density and Total Number of Vehicles:*** Road density is one of the major essential indicators of infrastructural. The role of transport in the socio-economic development of a region is very important. It helps in the rapid growth of a region. The main function of transport is to carry goods and people from one place to another. Indeed it is so important that it can truly be the life line of any region. Spatial disparity in the level of road density in different district of West Bengal is represented in the below diagram (Fig. 1). The maximum road density is found in some district like Darjeeling (0.42), Burdwan (0.41) etc. and it is minimum in Jalpaiguri (-0.631), Puruliya (-0.58), Paschim Medinipur (-0.39), Nadia (-0.41) etc. districts. Due to the Physical, an economic and social barrier this kind of imbalance in spatial distribution of road density is observed.

**LOCATION MAP OF THE STUDY AREA**




**Map 1. Source: Prepared by the Authors Based on National Atlas and Thematic Mapping Organization (NATMO), Government of India**

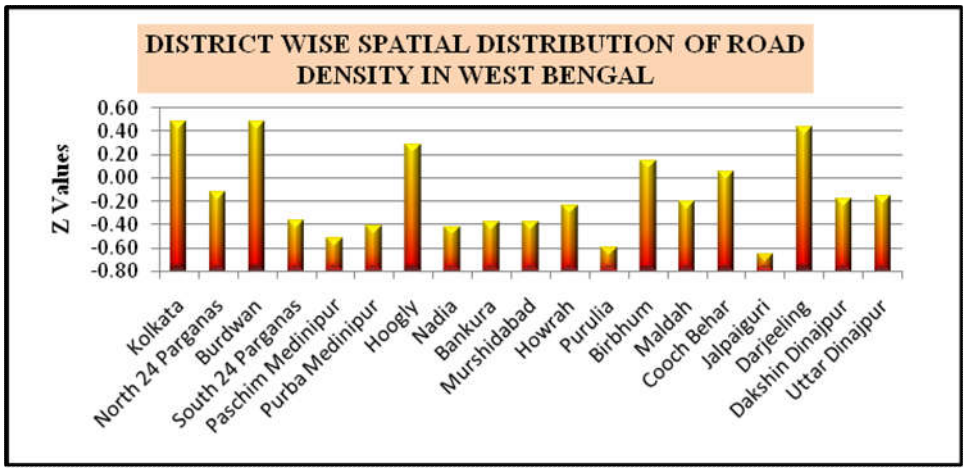



**Fig. 1. Source: Bureau of Applied Economics and Statistics**

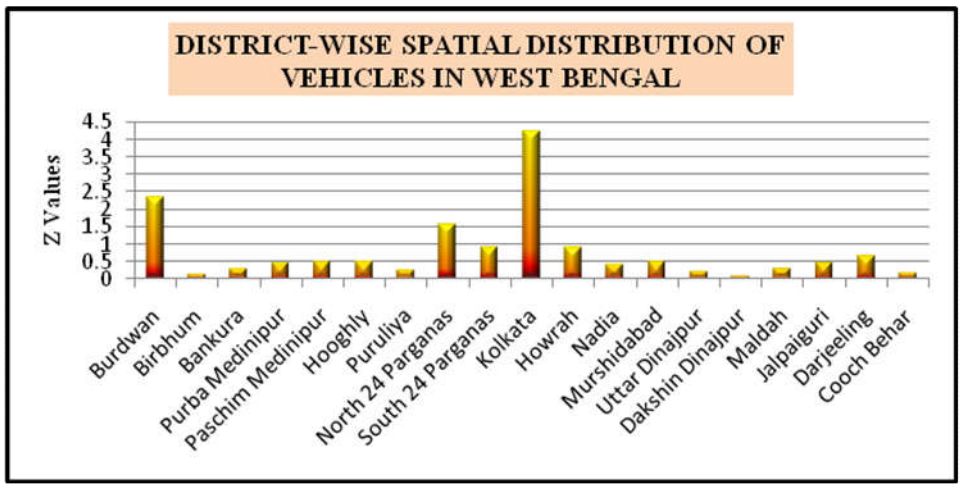



**Fig. 2. Source: Bureau of Applied Economics and Statistics**

Fig. 2 shows the spatial distribution of total number of vehicles in different district of West Bengal. This diagram depicts that there is an imbalance distribution innumber of vehicles. Most of the vehicles are concentrated in the surrounding part of the Kolkata district except Burdwan and North 24 parganas Due to rapid population growth, urbanization and industrialization magnitude of vehicular service is drastically increased. There is a huge drop in number of vehicles in the remaining part of the state especially Birbhum, DakshinDinajpur, Uttar Dinajpur, Cooch Behar, Puruliya and

### *Total Number of School*

Literacy is one of the prime source of social, cultural as well as economic growth of any region. There is a close relationship between educational development and the man power planning. Thus spatial distribution of educational institution is very important in order to analyzing the availability of infrastructural facility of any area. District wise spatial distribution of school has been portrayed in the following diagram (Fig. 3). This figure reveals that the southern part of the state which include Birbhum, Bankura, PurbaMedinipur, Paschim Medinipur, South 24 Parganas have a large number of educational institutions. A huge number of districts record less number of educational institutions, which is mainly situated in the northern and central part of the state such as Darjeeling, Jalpaiguri, Cooch Behar, Malda and Murshidabad district.

On the other hand it had been seen that minimum number of health care facilities are concentrate in some districts including Uttar Dinajpur, DakshinDinajpur, Darjeeling, Jalpaiguri and Murshidabad. Therefore, there is a wide variation in the distribution of Health units among rural and urban areas.Most of the super specialist hospitals are distributed in urban centres. Even till now in some remote rural villages of West Bengal where there is not adequate medical services. People often suffer various diseases due to the lack of proper medical treatment. This is a matter of great concern.

### *Banking and Insurance*

Distribution of banking and insurance facility in West Bengal can be easily understood from the figure (Fig. 4).

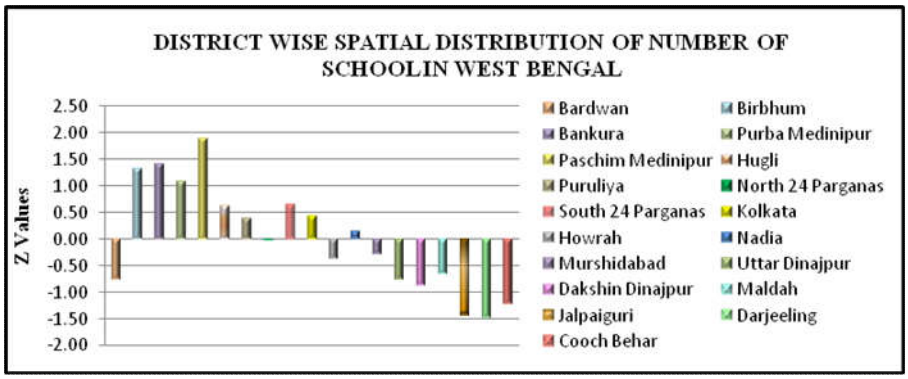



**Fig. 3. Source: Bureau of Applied Economics and Statistics**

**Table 2. Showing Z Score of Total Number of Health Unit in different districts of West Bengal**

| District | Number of total Health units | Mean ($\bar{X}$) | SD | ($X-\bar{X}$) | Z Score |
|---|---|---|---|---|---|
| Burdwan | 1094 | 732.58 | 306.51 | 361.421 | 1.179 |
| Birbhum | 609 | | | -123.579 | -0.403 |
| Bankura | 701 | | | -31.579 | -0.103 |
| PurbaMedinipur | 927 | | | 194.421 | 0.634 |
| PaschimMedinipu | 1102 | | | 369.421 | 1.205 |
| Hoogly | 638 | | | -94.579 | -0.309 |
| Puruliya | 896 | | | 163.421 | 0.533 |
| North 24 Parganas | 1227 | | | 494.421 | 1.613 |
| South 24 Parganas | 1329 | | | 596.421 | 1.946 |
| Kolkata | 1688 | | | 955.42 | 3.117 |
| Howrah | 618 | | | -114.579 | -0.374 |
| Nadia | 999 | | | 266.421 | 0.869 |
| Murshidabad | 391 | | | -341.579 | -1.114 |
| Uttar Dinajpur | 286 | | | -446.579 | -1.457 |
| DakshinDinajpur | 588 | | | -144.579 | -0.472 |
| Maldah | 654 | | | -78.579 | -0.256 |
| Jalpaiguri | 394 | | | -338.579 | -1.105 |
| Darjeeling | 476 | | | -256.579 | -0.837 |
| Cooch Behar | 577 | | | -155.579 | -0.508 |

Source: Calculated by the Authors Based on Bureau of Applied Economics and Statistics, Government of West Bengal.

### *Total Number of Health Unit*

Health is commonly considered as wealth. Proper health care facility is another important parameter towards development. It is basic requisite for the social wellbeing and overall development of a region. The following table represent the Standard score (Zi) values of total number of health units in different districts of West Bengal. The district Kolkata (3.117) North 24 Prganas (1.613), South 24 Parganas (1.946), Paschim Medinipur (1.205), Burdwan (1.179) and Nadia (0.869) have the maximum number availability of health checkup units.

It can be demonstrated that in Burdwan, Bankura, Birbhum, Purba Medinipur, Paschim Medinipur, Hooghly, Puruliya, North and South 24 Parganas districts the banking service are not fairly distributed but wherever in case of Kolkata it can be observed that the banking service is too much developed and highly distributed among all corner of the metropolitan city. Thus it is evident that maximum numbers of banking sectors have been pulled by the city of Kolkata. Rest in Nadia, Murshidabad, Uttar Dinajpur, Dakshin Dinajpur, Maldah, Jalpaiguri, Darjeeling and cochbehar district the banking service is not distributed in well manner especially because of the inconvenience of transport networking system in hilly

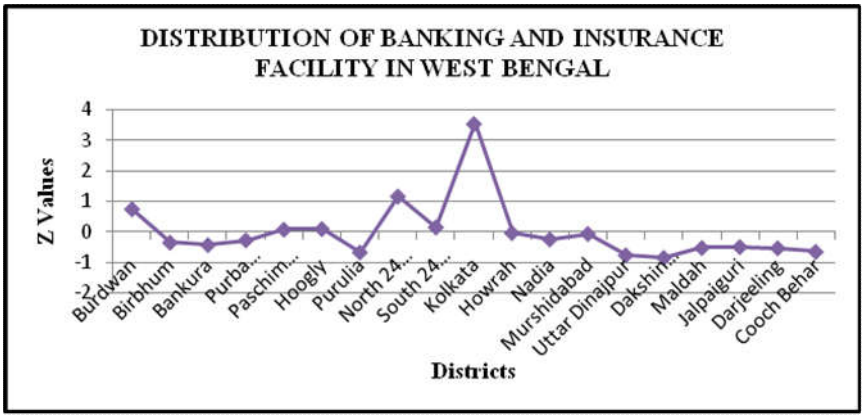



**Fig. 4.** ***Source: Bureau of Applied Economics and Statistics***

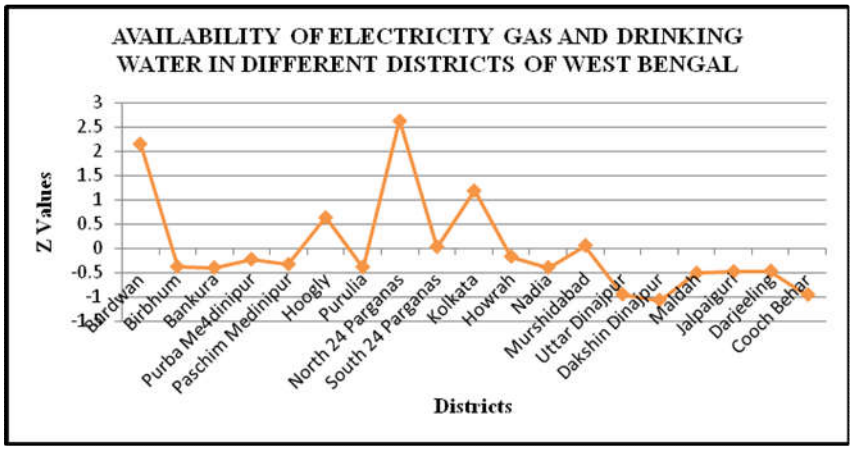
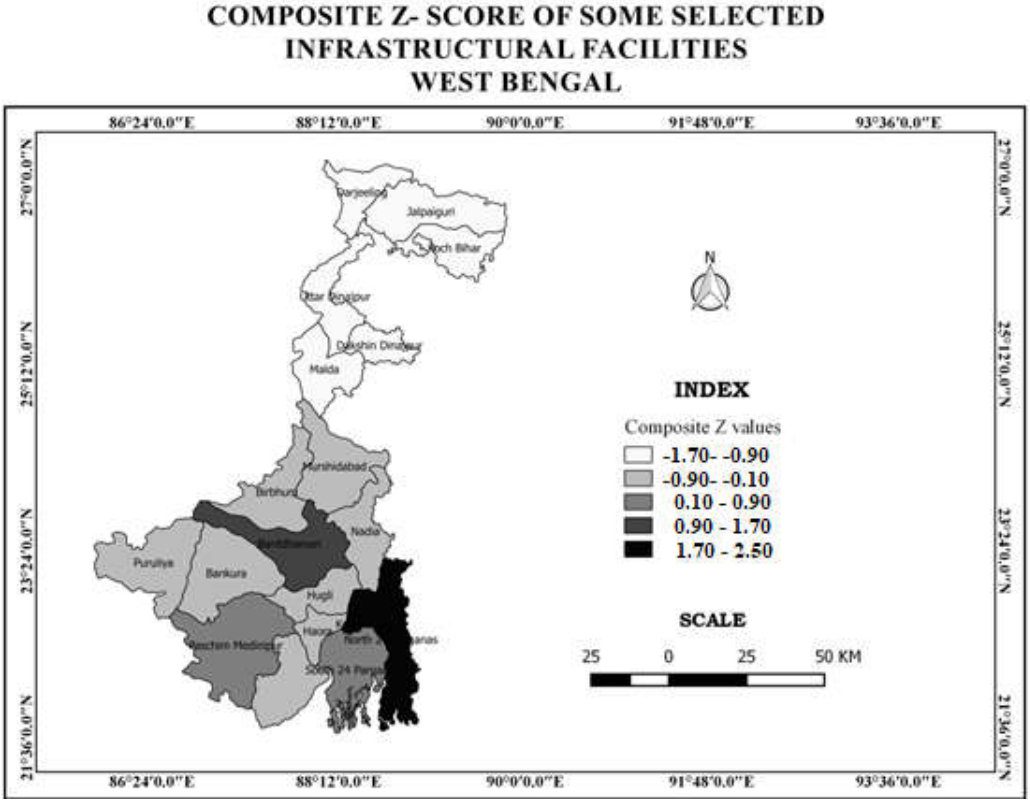



**Fig. 5.** ***Source: Bureau of Applied Economics and Statistics***



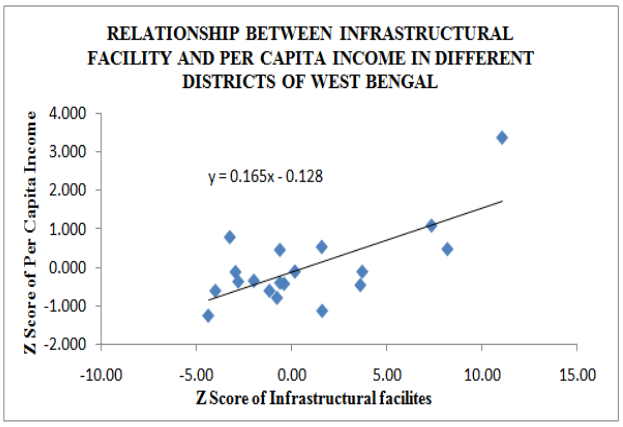
### *Electricity, Gas and Water supply*

Availability of electricity gas and drinking water in different districts of west Bengal can be depicts from the z values. Here from the curveit has been seen that in the city of Burdwan the electricity facility, gas and drinking water facility has been enriched firmly. Besides, Birbhum, Bankura, Purba Medinipur, Hooghly, Puruliya, Howrah, Nadia, Mursidabad, Uttar Dinajpur, Maldah, Jalpaiguri, Darjeeling and Coch Bbehar districts the facilities are not adequately distributed. In the era of post modernization due to the transformation of people choice towards the western culture they use LPG gases instead of fuel in their houses. Kolkata and the North and South 24 parganas are in good condition in availing the electricity, gas, and drinking water.

### *Composite Z-Score*

It is observed that some regions within the study area experienced higher level of economic development and concentration of infrastructures compare to some other region had been changed drastically. The major suitably used to examine the pattern of regional distribution of a variable is measured by z-score. The following map (Map no. 2) represent that all types of public infrastructures associated with urban development are available especially in North 24 Parganas and Kolkata. However, the infrastructural condition is moderate in Burdwan and Paschim Medinipur district. The condition of Puruliya, Bankura, Birbhum, Hugli, Haora, Nadia, Murshidabad, South 24 Parganas are less developed due to unavailable circumstances of infrastructureal facilities. The northern states Darjeeling, Jalpaiguri, Cochbehar, Uttar and Dakshin Dinajpur are worst condition infrastructural developed.

***Infrastructural Facilities and Per Capita Income:*** One of the most powerful graphical methods, especially for describing the relationship between two continuous variables is the scatter plot. The two variables of interest in the study are the relationship between Z score of per capita income and Z score of infrastructural facility. X axis is representing z score of per capita income and y axis represent the infrastructural z score of infrastructural facilities. As the diagram depicts a linear line runs through the bulk of data and the r value is near about 0.78 that there is a strong positive relation between two variables. This indicates that along with the increasing of z score of per capita income, the z score of infrastructural facilities are also increased in a large extent.




### *Uneven Distribution of Infrastructural Facilities and Poverty*

The most useful graph for displaying the relationship between two quantitative variables is a scatter plot. The two continuous variables Z score of poverty rate and z score of infrastructural facilities are investigated in the x and y axis respectively. As the diagram illustrates these two variables have negative association or relationship which means in general as a z score of poverty rate decreases in terms of z score of infrastructural facilities.

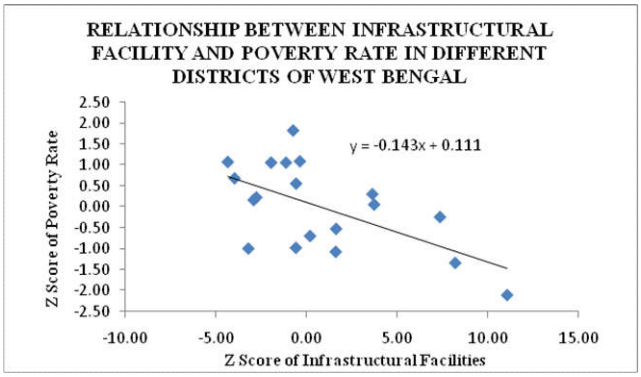



**Fig. 7.** ***Source: Bureau of Applied Economics and Statistics***

### Planning Related Programmes Taken by the Indian Government

As the Eleventh Plan commences, a wide spread perception all over the country is that disparities among states, and regions within states, between urban and rural areas, have been steadily increasing in the past few and that the gain of the rapid growth witnessed in this period have not reached all parts of the country and all section of people in an equitable manner. There are huge planning programmes have been taken by the planning commission and the government of India. Some of them are discuss in the following manner:

### *Backward Region Grand Fund (BRGF)*

The development of backward region has been a major concern of planners in India. However, prior to the Tenth Plan, the issue of development of backward areas was approached as primarily one of development of states through the formula of distribution of Central Assistance which was weighted in favour of less developed states and through Special Area Programmes such as Hill Area Development Programme, Bordered Area Development Programme, Drought Prone Area Programme, etc.

### *Hill Area Development Programme (HADP)*

The HADP has been in operation since the fifth five year plan in designated hill area. Under these programmees, SCA is given to designated hill areas in order to supplement the efforts of the State Governments in the development of these ecologically fragile areas. The designated areas covered under HADP include:

- Two hill district of Assam- North Cachar and KarbiAnglong
- Major part of Darjeeling district of West Bengal

***Border Area Development Programme (BADP)***

The BADP introduced during the Seventh Year plan, aim at making special efforts for socio-economic development of the bordered areas and to promote a sense of security among the people living in these areas. The programme was revamped in the Eighth Plan and extended to the states adjoining the international border with Bangladesh and it was further extending during the Ninth Plan to the states which have bordered with Mayanmer, Chaina, Bhutan and Nepal.

**Findings of the Study**

The findings of the study reveal that there are a good number of policy and planning implication for infrastructural development in the state of West Bengal. The information and knowledge derived from the spatial pattern of concerned infrastructural facilities is mainly concentrating around the Kolkata metropolitan region and North 24 Parganas Districts, which has the highest number of Urban Local Bodies among the all districts of West Bengal, on the other hand the peripheral region of the study area having very low level of infrastructural facilities. Thus a North-South spatial inequality is observed. This study also reflect that some area have more than average share of Infrastructural facility which makes infrastructural facilities to be localized in the study area. This fact reveals that one would have to travel long distance for enjoying the essential services. This kind of imbalance spatial pattern of development tends to magnify the problem of regional imbalance which is a matter of great concern. There is a negative relationship between poverty and spatial pattern of infrastructural facility is found that means the regional inequality of the distribution of essential facilities is the major causes of poverty in the study area. A positive relationship between per capita income and spatial pattern of infrastructural facility is found which indicate the fact that regional development can be achieved in the study area only by the balanced distribution of the essential facilities.

**Recommendation and Conclusion**

The existence of spatial inequalities in the distribution of infrastructural facilities inform the planners and policy makers that increase resources should be distributed among less privileged and deprived areas with a view to promoting a balance regional development. There is an urgent need for the co-operation both socio-economic and physical planners for the improvement of the present imbalance condition. The community development strategies have to be applied. It is impossible for the government to fulfill all the demands and the needs of the citizen. Thus the government has to be encourage the local community through provision of financial grants and technical assistance for the construction of the local infrastructure such as: road, bridges, supply of pipe borne water and electrification project. From the foregoing analysis and discussion, it is cleared that inequalities exist in the varying degree among the different districts of West Bengal. The results generally confirm the idea of the core and periphery spatial pattern of development.

A basic challenge in the future development process in the study area is therefore the narrowing the gap between the privilege and underprivileged areas. The analysis of the distribution of public facilities as presented above indicators that there is a lead-lag relationship among different districts in terms of facilities. The varying degree of concentration and dispersion of different types of public facilities indicate that the existing planning effort could not produce satisfactory result in terms of balance development in the study area. It is now expected that in the far future the planners and policy makers must take some necessary plan by which the regional inequality will be removed and balance regional development in infrastructural facility will occur.

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