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A REFLECTION ON DISPARITIES IN LEVEL OF INFRASTRUCTURAL DEVELOPMENT AMONG THE DISTRICTS OF ASSAM

SANGEETA BARUAH*[1] AND M. BORAH[2]

[1,2]Department of Mathematics, Tezpur University, Tezpur, India.

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ABSTRACT

This paper documents the disparities in the infrastructural development among the districts of Assam spanning the data of the year 2015. The development in infrastructure is estimated with the help of composite index based on optimum combination of different developmental indicators. The main objective of the study is to classify the districts into different stages of development such as high level, medium level, developing and low level developed. The composite indicators are obtained with the help of three different methods. The district-wise data in respect of forty one indicators are used for twenty seven districts of the State. Irrespective of the indicators used, the district of Kamrup Metro stands out as the most uniform in terms of the development of infrastructure. However, the district Chirang stands at the bottom of the list in this regard. For bringing about uniform development in this sector among all the districts of Assam, model districts have been identified for fixing up the potential targets of different developmental indicators for low developed districts. These districts require improvements of various dimensions in some of the indicators for enhancing the level of overall socio-economic development of the entire State

Key words: *Composite index, Model districts, Development indicators, Potential targets.*

1. INTRODUCTION

Development is a complex process. There is no generalised definition for development. The meaning of development varies from one context to another. Development involves social, economic, infrastructural and political transformation. Among varies dimension of development, present study deals with infrastructural development among the districts of Assam. It is an admitted fact that the level of economic development in any country directly depends upon the development of infrastructure. The lack of infrastructure is the main hindrance to economic progress. The term infrastructure refers to the fundamental facilities and systems serving a place or an area, including the services and facilities necessary for the economy to function. It does not directly produce goods and services but facilitates production in primary, secondary and tertiary economic activities by creating positive external economies. Infrastructure is used to describe the facilities which support human life. These are mainly water supply, education, health, transport and communication, banking and insurance, irrigation, business and government buildings etc. This sector is highly responsible for propelling a nation’s overall development. The development of a region depends upon the development of agriculture and industry but such a development cannot take place without simultaneous development of infrastructure. The World Development report, which focuses on infrastructure for development brought out a strong positive relationship between the level of GDP and infrastructure stock per capita. Disparities in infrastructure tend to increase the disparities in the aggregate level of development as lack of these basic facilities reduces the efficiency of resource use in the backward regions. India also faces the interstate disparity in the level of infrastructural development. It becomes highly important to estimate the relative levels of infrastructural development across Indian states and to examine the extent and nature of disparities therein.

Our study involves the state of Assam and its districts. Though Assam is lack of proper infrastructure facilities yet priorities are given in each plan for development in infrastructure sector. During first plan the outlay for infrastructure was Rs. 11.6 crores, which was 54.46 percent of the total plan outlay. This figure had been increased to Rs. 122.03 crores in the fourth plan, which was 61.50 percent of the total outlay of that plan. In the sixth plan the percentage of expenditure of total outlay is highest that is 67.50 percent and expenditure in Rs 866.12 crores. The percentage of expenditure of seventh, eighth, ninth and tenth plan are 59.80 percent, 40.00 percent 28.67 percent and 37.7 percent respectively.

Corresponding Author: Sangeeta Baruah[1],*
[1]Department of Mathematics, Tezpur University, Tezpur, India.

The problem of regional disparity has become a worldwide phenomenon today and specially in the developing countries. Adhyapok and Ahmed (2012) studied about the infrastructure disparity in Assam and found that Assam was ranked as one of the poor states in the country and also have inter-district disparity. So, present study deals with the inter-district variation in infrastructural facilities across 27 districts of the state of Assam. In this study, an attempt has been made to rank the districts of Assam using district level data on women's development indicators. A deep analysis using the district level data on socio-economic indicators was made for the States Orissa [1992-1993], [5, 6], Kerala [1994], [7], Maharashtra [1996], [8], Karnataka [1997], [10], Tamil Nadu [2000], [9] and Assam [2004, 2010], [1, 2, 3, 4]. In all, the study for evaluating the level of socio-economic development was conducted in two hundred twenty eight districts belonging to the states of Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu and Uttar Pradesh and it was found that 73 districts were low developed which require special attention for undertaking future developmental programmes. Knowledge of the level of development at district level will help in identifying where a given district stands in relation to others. The region and the population under different stages of development have been evaluated and the model districts have been identified for fixing up the potential targets of different indicators for low developed districts so that these districts may make improvements of various dimensions for the overall socio-economic development of the state.

2. METHOD OF ANALYSIS

Development is a multi-dimensional continuous process. The impact of development in different dimensions cannot be fully measured by any single indicator. Moreover, a number of indicators when analysed individually do not provide an integrated and comprehensible picture of reality. Hence, there is a need for building up of a composite index of development based on various indicators combined in an optimum manner. For this study, the districts have been taken as the unit of analysis. Twenty seven districts of the state of Assam are included in the study. Two methods have been separately used to rank the districts of the state; there is a need for standardization as shown below:

2.1 Narain Et. Al. Method

Let a set of n points represent districts 1, 2, . . . , n for a group of indicators 1, 2, . . . , k, which can be represented by a matrix (X_{ij}); i = 1, 2, . . . , n and j = 1, 2, . . . , k. As the developmental indicators included in the analysis are in different units of measurement and since our objective is to arrive at a single composite index relating to the dimension in question. There is a need for standardized as shown below:

$$Z_{ij} = \frac{X_{ij} - \overline{X}_j}{S_j}$$

$$S_j^2 = \frac{\sum_{i=1}^{n} (X_{ij} - \overline{X}_j)^2}{n},$$

and $$\overline{X}_J = \sum_{i=1}^{n} \frac{X_{ij}}{n} \quad \text{(i=1,2,…,n),} \quad \text{(j=1,2,…,k)}$$

Let $\lfloor Z_{ij} \rfloor$ denotes the matrix of standardized indicators. The best district for each indicator (with maximum/minimum standardized value depending upon the direction of the indicator) is identified and from this the deviations of the value for each district has been taken for all indicators in the following manner:

$$C_i = \left(\sum_{j=1}^{k} \left(Z_{ij} - Z_{0j} \right)^2 \right)^{1/2},$$

where Z_{0j} is the standardized value of the j^{th} indicator of the best district and C_i denotes the pattern of development of i^{th} district.

The pattern of development is useful in identifying the districts which serve as 'models' and it also helps in fixing the potential target of each indicator for a given district. In this study, the composite index of development is obtained through the following formula:

$$D_i = \frac{C_i}{C},$$

C= $\overline{C}$ +2S, where $\overline{C} = \sum_{i=1}^{n} \frac{C_i}{n}$

and $$S = \left(\sum_{i=1}^{n} \frac{(C_i - \overline{C})^2}{n} \right)^{1/2}$$

"D_i" gives the composite index of development with which ranking of the districts is done.

2.2 Michela Et. Al. Method

Theoretical frame work and methodology is followed from Michela *et.al* (2005). The aggregated values give the composite index of development to rank the districts. A theoretical framework should be developed to provide the basis for the selection and combination of single indicators into a meaningful composite index. The indicators should be selected on the basis of their analytical soundness, measurability, country coverage, relevance to the phenomenon being measured and relationship to each other. The use of proxy variables should be considered when data are scarce.

A multivariate analysis should be done to investigate the overall structure of the indicators, assess the suitability of the data set and explain the methodological choices. The first step is normalization in which the indicators should be normalized to render them comparable and is given by:

$$Z_{ij} = \frac{X_{ij} - \overline{X}_j}{S_j}$$

A correlation study is done to find the redundancy in the indicators, where the correlation co-efficient between the indicators are found by the following formula:

$$r_{zi,zj} = \frac{\sum (z_i - \overline{z_i})(z_j - \overline{z_j})}{\sqrt{\sum (z_i - \overline{z_i})^2} \sqrt{\sum (z_j - \overline{z_j})^2}}$$

We discard the indicators having high correlation co-efficient with other indicators and as such the number of indicators reduces.

Finally weighting and aggregation is done in which the indicators should be aggregated and weighted according to the underlying theoretical framework.

$$\mathrm{A_i} = \sum_{\mathrm{j}} \mathrm{z_{ij}}$$

The aggregated values give the composite index of development to rank the districts.

2.3 PRINCIPAL COMPONENT ANALYSIS METHOD

The steps for computing score by Principal Component Analysis are given below according to Zhu Joe (1998) and Filiz Kardiyen, H Hasan ORKCU (2006).

Step-1: Correlation matrix (R) of the variables are computed.

Step-2: Eigen value and eigen vectors of the Correlation matrix (R) are computed. The eigen values are arranged in decending order of magnitude $\hat{\lambda}_1 \geq \hat{\lambda}_2 \geq . . \geq . \hat{\lambda}_p$ ($\sum_{k=1}^{p} \hat{\lambda}_k$ =p) and the related p eigen vectors ($\hat{l}_1, \hat{l}_2, ...\hat{l}_p$) are obtained.

Step-3: Principal components are computed. Each Principal component is obtained by solving the following equation

$PC_k = \sqrt{\hat{\lambda}_k}\ \hat{l}_k$ (k=1, . . .p)

Step-4: The first m Principal components are selected satisfying $\sum_{k=1}^{m} \hat{\lambda}_k / p$ >0.90

Step-5: t= $\sum_{k=1}^{m} \mathrm{w_k} PC_k$ gives a linear combination weighted with the explanation ratios of m principal components selected in step 4. For determining the signs w_k's, signs of the components of the PC_k are considered. According to this

i) If all the components of the PC_k are negative, then weight w_k is negative, if all the components of the PC_k are positive, then the weight w_k is positive.

ii) If more than half of the components of the PC_k is negative then w_k is negative, otherwise it become positive.

Step-6: To use the principal component scores in ranking, matrix D = $(\underline{d}_1, \underline{d}_2 ... \underline{d}_p)_{nxp}$ is standardized and matrix $D_z = (\underline{d}_{z1}, \underline{d}_{z2} ... d_{zp})_{nxp}$ is obtained.

Step-7: Principal components score are computed with the help of the equation $PC_{score} = D_z.t$ and units are ranked according to values of score.

2.4 Relative Share of Area and Population under Different Level of Development

A simple ranking of district on the basis of composite indices is sufficient but a suitable classification of districts formed on the basis of mean and standard deviation of the composite indices will provide a more meaningful characterization of various stages of development. For relative comparison it appears appropriate to assume the districts having composite index less than or equal to (Mean - SD) as highly developed districts. And the districts having composite index greater than or equal to (Mean + SD) be low developed districts. Similarly districts with composite index lying between (Mean and Mean - SD) are classified as middle level developed district and districts with composite index lying between (Mean and Mean + SD) are classified as developing districts.

2.5 Fixation of Potential Targets

Using the standardized variates $\lfloor Z_{ij} \rfloor$, the economic distance between different districts may be obtained as follows:

$$D_{ip} = \left(\sum_{j=1}^{k} \left(Z_{ij} - Z_{pj} \right)^2 \right)^{1/2} \quad \text{(i=1, 2,…,n and p=1,2,…n)}$$

Here $D_{ii} = 0$ and $D_{ip} = D_{pi}$.

The distance matrix will take the form:

$$\begin{bmatrix} 0 & d_{12} & d_{13}... & d_{1n} \\ d_{21} & 0 & d_{23}... & d_{2n} \\ & & . & \\ d_{n1} & d_{n2} & d_{n3}... & 0 \end{bmatrix}$$

The minimum distance for each row, (d_i , i =1, 2,…,n) will be obtained from the distance matrix for computation of upper and lower limits (C.D.) as indicated below:

$$\text{C. D.} = \bar{d} \pm 2\sigma_d ,$$

where

$$\bar{d} = \sum_{i=1}^{n} \frac{d_i}{n}$$

and

$$\sigma_d = \left(\sum_{i=1}^{n} \frac{(d_i - \bar{d})^2}{n} \right)^{1/2} .$$

The distance matrix can also be used for fixing targets for different districts on each indicator, which would be in the direction of reducing the disparities. The districts should be identified which are homogeneous with a close proximity to each other with the district under consideration, in terms of considered indicators. For setting out the targets, the model districts are to be identified on the basis of composite index and individual distance with districts. The best values among the model districts will be taken as potential target for a particular district for a given indicator. This procedure will be repeated for a given district for all indicators considered. This would give the extent of improvement required in different indicators for balanced development in the district. It also provides avenues to bring about uniform regional development in the state. Such information helps the planners and administrators to readjust the resources to reduce inequalities in level of development among different districts of the state.

The study utilizes data on most of the indicators for development of infrastructure for the year 2013-2014. A total of forty one development indicators have been included in the study.

2.6 Developmental Indicators

Each district faces situational factors of development unique to it as well as common administrative and financial problems. The composite indices of development for different districts have been obtained by using the data on the following indicators.

1. 4-wheeler registered (%).
2. Agricultural Credit Societie (%).
3. Banks (%).
4. Household with banking facility (%).

5. Household with closed drainage system (%).
6. Household with inside cooking kitchen (%).
7. Household with covered well (%).
8. Household with drinking facility (%).
9. Household with education facility (%).
10. Household with electricity as cooking tool (%).
11. Household with using hand pump (%).
12. HMV registered (%).
13. Household with one room (%).
14. Household with two rooms (%).
15. Household with three rooms (%).
16. Household with more than three rooms (%).
17. Household with computer and internet facility (%).
18. Household with television facility (%).
19. Household using kerosene as cooking tool (%).
20. Household with latrine facility using pipe sewage (%).
21. Household with latrine facility using septic tanks (%).
22. Household with LPG as cooking tool (%).
23. Major roads (%).
24. Household with medical facility (%).
25. National highways (%).
26. Number of beds available in hospitals (%).
27. Police stations (%).
28. Postal facility (%).
29. Power supply (%).
30. Pucca house (%).
31. Rural roads (%).
32. Household using solar energy as cooking tool (%).
33. State highways (%).
34. Household with tap water, treated (%).
35. Household with tap water, untreated (%).
36. Household with telephone facility (%).
37. Total road length (%).
38. Transport facility available (%).
39. Household using tube well (%).
40. Household using uncovered well (%).
41. Urban roads (%).

A total of forty one indicators have been included in the analysis. These indicators may not form an all-inclusive list but these are the major interacting components of infrastructural development.

2.7 Comparison of Ranks
We have used Spearman rank correlation co-efficient to test if there is any significant difference in the ranks obtained by the methods. The rank correlation co-efficient is given by Ronald *et.al* (1985).

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)}$$

where d_i is the difference between the ranks assigned by the methods, taken two at a time

We have tested the hypothesis that the correlation between the ranks obtained by the two methods, each paired twice is zero against the alternative that it is greater than zero. At both 0.01 and 0.05 level of significance, it is observed that the methods are correlated and there is no significance difference between the ranks obtained from the three methods.

3. RESULTS AND DISCUSSIONS

3.1 The Level of Development
The districts have been ranked on the basis of the developmental indices. Table 1 presents the ranks of different districts obtained from all the methods. It may be seen from the above table that out of 27 districts of the state, the district of Kamrup-Metro was ranked the first and the district Chirang was ranked last in the overall educational development.

Table-1: Ranks of all the districts of Assam obtained from the three methods

Sl. No.	Districts	Rank by Narain et. al. method	Rank by Michela et. al. method	Ranks by PCA	Sl. No.	Districts	Rank by Narain et. al. method	Rank by Michela et. al. method	Ranks by PCA
1.	Kokrajhar	24	20	25	15.	Karbi Anglong	11	25	21
2.	Dhubri	26	21	19	16.	Dima Hasao	9	26	24
3.	Goalpara	20	19	18	17.	Cachar	10	13	7
4.	Barpeta	15	11	13	18.	Karimganj	17	22	16
5.	Morigaon	18	16	15	19.	Hailakandi	13	12	6
6.	Nagaon	5	4	3	20.	Bongaigaon	16	18	23
7.	Sonitpur	8	7	12	21.	Chirang	27	27	27
8.	Lakhimpur	19	23	22	22.	Kamrup	7	6	4
9.	Dhemaji	23	24	26	23.	Kamrup Metro	1	1	5
10.	Tinsukia	6	9	9	24.	Nalbari	14	8	8
11.	Dibrugarh	4	5	10	25.	Baksa	25	15	17
12.	Sivasagar	3	3	2	26.	Darrang	22	14	14
13.	Jorhat	2	2	1	27.	Udalguri	21	17	20
14.	Golaghat	12	10	11					

It is seen that, for most of the districts, ranks calculated by the three methods are almost same whereas for a few other districts, ranks calculated are very much different. An important aspect of the study is to test whether there is any significant difference in the ranks obtained from the three methods. In this regard, a rank test is carried out. It is a nonparametric measure of association between two variables given by the Spearman rank correlation co-efficient.

3.2 Area and Population in Different Stages of Development

It would be quite interesting and useful to find out the relative share of area and population affected under different levels of development in the State. The area and population covered by the districts falling under different levels of development are presented in Table 2.

Table-2: Area and Population under Different Levels of Development

Sector of Economy	Level of Development	No. of Districts	Population (%)	Area (%)
Education	High (≤ 0.674)	2	7.6	4.8
	Medium (0.674-0.780)	10	45.0	57.0
	Developing (0.780-0.886)	13	39.6	32.8
	Low (≥0.886)	2	7.8	5.4

It is evident from the table that about 4.8% area consisting of about 7.6% population of the state fall in the districts which are high developed in the infrastructure sector. About 57% area and 45% population come from the districts which are medium level developed. About 32.8% area and 39.6% population come from the districts which are developing. The remaining 5.4% area and 7.8% population fall in the districts which are low developed in the infrastructure sector. The low developed districts which have been found in this study are Dhubri and Chirang. List of model districts for these low developed districts is presented in Table 3.

Table-3: Model districts for low developed districts

S. No.	Low Developed Districts	Model Districts
1.	Dhubri	Kamrup-Metro, Jorhat, Karbi-Anglong and Barpeta
2.	Chirang	Jorhat, Sivasagar, Dibrugarh and Kamrup

Model districts are better developed. The district Jorhat is found to be model district for both the low developed districts.

3.3 Potential Targets of Indicators for Low Developed Districts

It would be useful to examine the extent of improvements required in different indicators of the low developed districts for enhancing the level of development. The best values of the indicators of better developed districts will be taken as potential targets for the low developed districts. The extent of improvement needed in various indicators of the low developed districts is given below:

Table-4: Estimate of Potential Target and Actual achievement (given under the bracket).

Indicators	Chirang	Dhubri
1	17.9 (0.4)	10.9 (0.8)
2	3.93(0.2)	8.6 (1.52)
3	13.5 (0.8)	13.5 (4)
4	84.04 (36.94)	56.16 (23.31)
5	22.65 (1.18)	6.22 (1.26)
6	89.14 (56.41)	89.14 (36.75)
7	12.57 (2.26)	1.15 (0.38)
8	0.1 (0.1)	.01 (.01)
9	98.03 (97.6)	98.03 (96.39)
10	86.39 (23.14)	50.08 (17.42)
11	81.55 (34.91)	77.64 (76.03)
12	53.2 (0.6)	7.4 (0.9)
13	49.4 (41.4)	23.8 (59.3)*
14	39.4 (32.7)	34.4 (24.23)
15	27.4 (13.8)	28.9 (6.3)
16	33.8 (9.2)	36.3 (3.7)
17	10.03 (0.77)	3.23 (0.44)
18	73.23 (17.03)	44.6 (10.71)
19	73.84 (73.99)*	59.21 (81.54)*
20	19.41 (2.62)	8.34 (2.6)
21	52.7 (8.93)	22.5 (6.55)
22	76.92 (8.36)	30.73 (6.98)
23	12.8 (4.3)	5.2 (1.2)
24	83.64 (49.3)	63.96 (71.96)*
25	4.6 (0.8)	4.7 (4)
26	59 (15)	75 (25)
27	21 (8)	19 (11)
28	20.4 (7.7)	20.4 (13.4)
29	97 (67.8)	96.5 (75.5)
30	37.94 (11.18)	29.89 (29.56)
31	9.1 (1)	7.9 (2.7)
32	4.78 (1.58)	0.67 (0.83)*
33	5 (0)	4.3 (2.1)
34	27.1 (1.98)	25.7 (1.48)
35	2.86 (1.1)	2.5 (0.42)
36	84.3 (53.4)	87.8 (71.9)
37	91.8 (14.8)	68.9 (27.4)
38	74.7 (46.3)	74.7 (72.2)
39	15.46 (8.49)	23.9 (8.35)
40	37.34 (42.19)*	11.8 (5.13)
41	32.5 (0.5)	6.1 (2.6)

CONCLUSIONS

The broad conclusions emerging from the study are as follow:
The ranking method used in the study is Narain *et.al*, Michela *et.al* and Principal Component Analysis. It is observed that all the methods gave almost the same ranking. A ranking test is carried out and it is observed that there is no significant difference between the ranks obtained from the three methods.

With respect to overall development in the infrastructural progress, the districts of Kamrup-Metro and Jorhat are found to be better developed as compared to the remaining districts of the State. Similarly the districts of Chirang and Dhubri are low developed districts. The level of development in the rest of the districts is of average order but most of these districts are having the tendency to make improvements in the pattern of development.

The economy of Dhubri is rural with lower rate of urbanization over the years. The industrial scenario of the district is not much encouraging. Considering road transport, the average share of road length per thousand populations is dismally low at 34 km. Only about 24 per cent of the PWD roads are surfaced; having more than 75 per cent of un-surfaced roads in the district. The communication system for the rural community in Dhubri district is mainly the postal service. Telecommunication networking has not touched the most of the rural areas. Only 7225 households are having landline telephone connections. In respect of amenities in rural areas, there are facility wise variations. 80 per cent of the villages of Dhubri have already been electrified. However the need of electricity is 12 MW per capita whereas the supply is only 5 MW. Besides, number of police stations and outposts, fire service station and like facilities are not adequately available. Although the pattern of distribution of primary schools in the rural area of the district is satisfactory, more than 50 per cent of the schools do not have pucca structure. The school sanitation scenario in the rural areas of the district, as indicated by the base line survey, is far below the expected level.

As far as infrastructure facilities are concerned, the Chirang district is poor and reflected in the infrastructural development. The main source of earning is agriculture but due to lack of advanced agricultural facilities, the farmers are not able to use advanced farming techniques. The people in this district are mainly villagers and proper sanitisation care and other basic infrastructural facilities should be provided to them. If villages perish we along with our state and country will perish. So development of villages and rural people is a must and this task of rural development is a collective task. There is every possibility of development in the district. It needs a care and guidance only. The politician, local government, State government, central government, educationist, Economists, organisations, well-wishers etc. needs some initiative to make the path of development for the district. Transport and communication is the prerequisite for achieving rapid economic development. It is crucial for attracting investment and essential for marketing agricultural products, and enabling the farmers to get a fair price of their product

In order to reduce the disparities, district level studies or setting the objective in the district level may not be a wise idea. So, looking for the potential areas for development in taluka or block level may be of great importance and emphasis on over all developmental indexes will be of good use to reduce the developmental disparities.

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