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INTER-DISTRICT DISPARITY IN AGRICULTURAL DEVELOPMENT OF ASSAM

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SUMMARY

The level of agricultural development of twenty seven districts of the state has been worked out with the help of a number of developmental indicators. The level of development is estimated with the help of composite index based on optimum combination of all the developmental indicators. The composite indicators are obtained with the help of two different methods. The district-wise data in respect of twenty one indicators are used for twenty seven districts of the State. The data on most of the indicators are for the year 2011-2012.The district Nalbari is ranked first and the district Dima Hasao is ranked last. From the analysis, it is observed that very nominal percentage of total population resides in the developed districts. Wide disparities are obtained in the level of agricultural development among different districts of the state. Ranks of the districts in the level of agricultural development obtained from both the methods are compared. It is observed that there is no significant difference between the ranks obtained from the two methods used. For bringing out uniform regional development, potential targets have been estimated 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.

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

1. INTRODUCTION

Development has been appropriately conceptualized as a process, which improves the quality of life. The programmes of development have been taken up in the country and the main objective of these programmes is to enhance the quality of life of people as well as effecting improvement in their social and economic wellbeing. The economic growth and uniform regional development are the basic objectives of developmental programmes. The Green Revolution in agricultural sector and commendable progress in the industrial front have certainly increased the overall total production in the country, but there is no indication that these achievements have been able to reduce substantially the regional inequality in the level of development.

Realizing the seriousness and importance of the problems of estimation of level of development, the Indian Society of Agricultural Statistics conducted a series of research studies in this direction. The data on socio-economic variables of major 17 states of the country had been critically analysed for the years 1971-72 and 1981-82 by Narain *et al.* (1991) and wide disparities in the level of development were observed by different regions. It was therefore, felt necessary to make a deeper analysis for evaluating the level of development using the district level data on socioeconomic variables. The district level data had so far been analyzed for the states of Orissa (1992, 1993); Andhra Pradesh (1994, 2009); Kerala (1994, 2005); Uttar Pradesh (1995, 2001); Maharashtra (1996); Karnataka (1997, 2003); Tamil Nadu (2000); Madhya Pradesh (2002); Jammu & Kashmir (2005) and Rai *et al.* and Nath *et. al.* for Assam (2004, 2010, 2011) . Evaluation of inter-district variation in economic development was made for the districts of southern region of the country (1999). Disparities in the crop productivity were estimated by analyzing the yield data at tehsil level in Uttar Pradesh (2001). In the present study, an attempt has been made for evaluating the intra-district variation in the level of agricultural development of Assam. The study deals with the evaluation of levels of development of all the twenty seven districts of the state by constructing the composite indices of development at district level. The state of Assam is mostly rural and agrarian. About 85.92% people of the state live in rural areas. As per 2011 population census, the total population of the state was 26780516 which were about 2.5% of total India population. The percentage of workers to total population was about 35.78% against the all India average of about 39.10%. The population density in the state is about 397 persons per square kilometre and the decadal growth rate of the population is about 16.93%. The literacy rate

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in the state is about 73.2% which is slightly below the national average of 74.04%. The state's economy largely depends upon agricultural sector. Major food crops are rice, pulses, potatoes and areca nuts. Important commercial crops grown in the state are tea, sugarcane, cotton, chillies, banana, coconut etc. Major forest products are timber, bamboo and cane. The state occupies a premier position in the production of oil and other petroleum resources.

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 in the present level of development.

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 analyzed 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, viz Narain *et al.* method and Michela *et al.* method.

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:

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

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

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

Let $\left(Z_{ij}\right)$ 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.

$$A_i = \sum_j z_{ij}$$

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

2.3 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.

2.4 Fixation of Potential Targets

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

$$D_{ip} = \left(\sum_{j=1}^{k} \left(Z_{ij} - Z_{pj} \right)^2 \right)^{1/2}$$ (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:

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

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 agricultural indicators for the year 2011-2012. A total of twenty one development indicators have been included in the study.

2.5 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. Percentage of area under fisheries
2. Percentage of area under kharif season crop
3. Percentage of area under rabi season crop
4. Percentage of area under rice
5. Percentage of area under rubber
6. Percentage of area under tea
7. Fertilizer consumption per hectare
8. Fertilizer consumption under kharif season crop
9. Fertilizer consumption under rabi season crop
10. Fish production
11. Percentage of gross area irrigated
12. Percentage of net area irrigated
13. Percentage of net area sown
14. No. of veterinary dispensaries
15. No. of villages electrified
16. Percentage of area under miscellaneous crops
17. Percentage of area sown more than once
18. Percentage of culturable waste land
19. Percentage of forest area
20. Percentage of total cropped area
21. Total livestock

A total of twenty 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 agricultural development.

2.6 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 two 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 two methods and n is the number of pairs of data.

We have tested the hypothesis that the correlation between the ranks obtained by Narain *et. al*. method and the Michela *et. al.* method 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 two methods are correlated and there is no significance difference between the ranks obtained from the two 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 composite indices of development along with the ranks of different districts. It may be seen from the above table that out of 27 districts of the state, the district of Nalbari was ranked the first and the district Baksa was ranked last in the overall agricultural development. The value of composite indices, given by Narain *et al.* method varied from 0.56 to 0.997. This is sufficient for classification of the districts in terms of rank only. A meaningful classification of the districts with an objective of disparity minimization/reduction may be made by using the average level of development and its standard errors.

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

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

It is seen that, for most of the districts, ranks calculated by the two methods are almost same whereas for a few other districts, ranks calculated by the two methods 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 two 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 (%)
Agriculture	High (≤ 0.741)	3	5.8	8.2
	Medium (0.742-0.823)	11	35.2	43.8
	Developing (0.824-0.905)	9	28.6	33
	Low (≥0.906)	4	30.4	15

It is evident from the table that about 5.8% area consisting of about 8.2% population of the State fall in the districts which are high developed in the agricultural field. About 35.2% area and 43.8% population come from the districts

which are medium level developed. About 28.6% area and 33% population come from the districts which are developing. The remaining 30.4% area and 15% population fall in the districts which are low developed in the agricultural sector. The low developed districts which have been found in this study are Sonitpur, Tinisukia, Karbi-Anglong and Dima Hasao. 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.	Sonitpur	Barpeta, Hailakandi, Lakhimpur
2.	Tinisukia	Hailakandi, Nalbari, Kokrajhar
3.	Karbi-Anglong	Kokrajhar, Golaghat, Hailakandi
4.	Dima-Hasao	Kokrajhar, Golaghat, Dibrugarh

Model districts are better developed. The districts of Kokrajhar, Golaghat and Hailakandi were found to be model districts for most of 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. It would also provide avenues to bring about uniform regional development in the State. The best values of the indicators of better developed districts will be taken as potential targets for the low developed districts.

It is found in the agricultural sector, that the districts of Nalbari, Darrang and Udalguri are high developed districts. The districts of Sonitpur, Tinisukia, Dima-Hasao, Karbi-Anglong are low developed districts. The remaining are middle developed and developing districts. The extent of improvement needed in various indicators of the low developed districts is given below:

1) Sonitpur

This district is low developed in agricultural sector. There is limited area of irrigation under rabi seasoned crops. Steps should be taken to increase the net area sown in the district. Fish production is not very satisfactory in the district. The district needs strengthening of infrastructural facilities and establishment of agro-based industries.

2) Tinisukia

The district is rich in forest area. The land in the district is quite not favourable for growing rabi seasoned crops. The possibility of growing tea in the district may be explored more and the developmental programmes should be undertaken for encouraging the cultivation of this crop. Rice productivity is low. Irrigation facilities may be provided for improving rice productivity. There is limited area for sowing. More irrigation facilities should be created and their proper use should be encouraged.

3) Karbi-Anglong

The district is lagging behind in rice production. In general, crop productivity is low because of poor irrigation facilities. Steps should be taken to provide facilities for sowing more area. Proper use of fertilizers may be encouraged for improving crop productivity. Welfare developmental programmes may be enhanced so that the public in general and people belonging to the weaker sections of the society in particular may get benefit of developmental activities.

4) Dima-Hasao

The district is low developed in agricultural sector. There is limited area of irrigation under rabi seasoned crops. Rubber plantation is poor in the district. Steps should be taken to provide facilities for sowing more area. The possibility of growing tea in the district may be explored and the developmental programmes should be undertaken for encouraging the cultivation of this crop. The district needs strengthening of infrastructural facilities and establishment of agro-based industries.

On detailed examination of the level of development, it was found that the entire area of the district is not backward. Some parts of the district are low developed whereas other parts are well developed or average developed. Therefore, for giving area-wise specific recommendations, it would be desirable to examine and evaluate the level of development at a lower level say taluka or block level. This will give an idea regarding the low developed part of the district where major improvements are needed in the developmental indicators. Infrastructural facilities might be created in these areas and location specific technology might be implemented.

4. CONCLUSIONS

The broad conclusions emerging from the study are as follow:

1. Two ranking methods, viz. Narain *et al*. and Michela *et al.* are used to rank the districts of Assam on agricultural and production ground. It is observed that both 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 two methods.
2. With respect to overall agricultural development, the districts of Nalbari, Darrang and Udalguriare found to be better developed as compared to the remaining districts of the State. Similarly the districts of Sonitpur, Tinisukia, KarbiAnglong and Dima Hasao 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.
3. Wide disparities in the levels of development have been observed in different districts. Western and Northern part of the State are found to be better developed whereas some of the Eastern districts of the State were low developed.
4. Better developed districts are found to be thickly populated as compared to low developed districts.
5. This study gives a slightly different agricultural developmental scenario than the previous studies given by Rai *et al.* and Nath*et. at.* (2004, 2010, 2011). The newly formed districts Chirang, Baksa and Udalguri attain higher ranks whereas Kamrup deteriorates its position in the light of agricultural development rankings.
6. For the case with Chirang, Baksa and Udalguri, the districts are mostly formed with all the rural areas in comparison to their complementary parts, leaving most of the urban areas with the other parts. Hence their drifting towards better agricultural indices is well convincing. For the case with Kamrup, both the districts, metro and rural have degraded from previous rank. This could be due to rapid urbanization which compels to shift the occupation pattern of the mass from agriculture to other sectors or for their land use pattern conversion, which may be better estimated by making some urban area rank study among the districts. So the ranks of any other district are consequences of readjustment due change in rank of Kamrup, Chirang, Baska and Udalguri.
7. 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 indices will be of good use to reduce the developmental disparities.

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