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Pattern Of Development Of Agriculture In The North-Eastern Region Of India

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ABSTRACT

The growing inequities in agriculture are one of the main issues for balanced development, especially in those States whose economies are directly or indirectly based on agricultural activity. In comparison to the other regions of India, the North Eastern Region continues to lag behind in the agricultural sector. It is vital to ascertain whether there is any imbalance between the several States in the North Eastern Region in order to analyse the genuine image of the agricultural backwardness of the region. Thus, using the Wroclaw Taxonomic Technique and the best combinations of various agricultural development indicators, the current study evaluates the differences in the level of agricultural development across the States of India's North Eastern Region. In order to determine whether there has been a drop or increase in the disparities in agricultural development over time, state-level data for the two time periods 2004-05 and 2016-17 are taken into account. The States are divided into four groups based on a built development index: highly developed, medium-level developed, developing, and poorly developed. In this study, it was discovered that whereas no North Eastern State fell into the low developed category in the year 2004–2005, Sikkim was discovered to be the sole State in the category in the following year, 2016–17. In order to ensure uniform development across the region, model States for the less developed States have been established, and potential targets for the different indicators have been estimated.

Key Words*:* Agricultural Development, North-Eastern Region, Wroclaw Taxonomic Technique, Model States

Introduction

Since its inception, India's primary source of income has been the agricultural sector. Approximately 49.7% of the population still relies on the agricultural sector for their living, yet it makes up a very small portion of India's GDP—only 15.6%. In India, including the North Eastern Region, regional disparities in agriculture continue to be a severe issue (NER). The NER, which consists of the following 8 States: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, makes up 3.8% of the nation's total population and 7.9% of India's total land area. Compared to the other regions of the nation, the NER's agricultural development falls behind. For a variety of reasons, the Eastern and North Eastern (NE) States have not experienced the Green Revolution, which was mostly confined to the country's North Western regions (Bhattacharya & Sakthivel, 2004). Even though the NER got special attention in agriculture and related activities under the 10th Five Year Plan, the region's agricultural development is still not up to par. The pattern of disparities in agricultural growth amongst the several States of the North-Eastern Region must therefore be identified in order to assess the genuine picture of agricultural development

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in the region. As a result, the current study evaluates the differences in agricultural development between the several States of India's NER during two time periods viz., 2004-05 and 2016-17. The present study is structured as follows

Reviewed Literature

Numerous studies have been conducted to identify discrepancy using various techniques and indicators by academics, professionals, and institutions. Numerous studies examined whether the economies of the States in India were converging or diverging. Their results have been contradictory. For the States of the Indian economy, conditional convergence has been discovered by Dholakia (1994), Cashin & Sahay (1996), Ghosh & Neogi (1998), Nagaraj, et al. (1998 and 2000), and a select few others. While Shaban (2006) finds difference between States in the post-independence period, Rao et. al (1999)12, Singh et. al (2003), Bhattacharya & Sakthivel (2004)4, and Bajpai & Sachs (1996)2 do not. The Gini coefficient, Theil entropy index, coefficient of variation, rank analysis, composite indices employing factor analysis, and other alternative ways of evaluating disparities were utilised by various authors. It is worthwhile to note a few of the significant works: Ahluwalia (2000); Ghosh & Neogi (1998). Almost all studies have discovered significant differences between the States, regardless of the method used to measure inequality. However, very few research have been done on inter-state inequalities in agricultural development and NE States in particular. There is also a severe lack of studies quantifying disparity in India at the disaggregated level. As a result, the current study can try to evaluate the differences in agricultural development between NE States.

Objectives

The objectives of the paper are as follows:

a) To compare the eight NE States of India's agricultural development across the two time periods of 2004–05 and 2016–17 using the best possible combinations of developmental indicators.

b) To assess the agricultural disparities and categorise the States into various stages of development over the two time periods.

c) To determine potential targets for different indicators for low-developed countries.

Data and Methodology

The current analysis is based on secondary data that was gathered from annual reports of the Indian government's ministry of tourism, the NER data bank, journals, and publications about Indian and NE state tourism.

However, the Wroclaw Taxonomic approach was developed by Florek et al in 1952. For combining the impact of multiple indicators, there are several additional approaches to produce the composite index but use of Wroclaw Taxonomic technique is employed in the present analysis. Arief (1982), Narian et al. (2003, 2009, 2012), Bhatia & Rai (2004), Olhan (2013), and Kumar (2016) employed the Wroclaw Taxonomic method earlier in their analysis.

Measuring the level of Development

With I = 1, 2,..., n (number of states) and j = 1, 2,..., k (number of indicators), let $[X_{ij}]$ be

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the data matrix containing the values of the variables of the i^{th} state of the j^{th} indicator.

In k-dimensional space, every district is represented by a vector. Given that the variables under consideration each do not have the same units of measurement, the combined analysis $[X_{ij}]$ is translated to a matrix of standardized indicators $[Z_{ij}]$ as follows:

$$[Z_{ij}] = \frac{X_{ij} - \bar{X}_j}{\sigma_j} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

$$\bar{X}_j = \frac{\sum_{i=1}^{N} X_{ij}}{N} \text{ and } \sigma_j = \left(\sum_{i=1}^{N} (X_{ij} - \bar{X}_j)^2 \right)^{1/2}.$$

……(2) Now, we need to find the best value for the indicators from $[Z_{ij}]$. Let Z_{0j} be the signifier. Depending on how an indicator affects development, the value will either be the greatest value or the lowest value. We need to determine the P_{ij} , to find the pattern of development C_i of the i^{th} state as:

$$\boldsymbol{P_{ij} = (Z_{ij} - Z_{oj})^2} \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (3)$$

The pattern of development is given for each i and j by:

$$C_i = \left[\sum_{j=1}^{k} P_i/(cv_j) \right]^{1/2} \quad \ldots\ldots\ldots\ldots\ldots\ldots$$

… (4) Where cv_j = coefficient of variation of the j_{th} indicator in X_i

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Composite index (D_i) is given by

$$D_i = C_i / C \quad \text{.....(5)}$$

Whe
re,

$$C = \overline{C} + 3\sigma C_i \quad \text{.....(6)}$$

Where,

$$\bar{C} = \frac{\sum_{i=1}^{N} C_i}{N} \quad \text{and} \quad \sigma C_i = \left(\sum_{i=1}^{N} (C_i - \bar{C})^2 \right)^{1/2}$$

..... (7)

The state is more developed the closer D_i is to zero, whereas the district is less developed the closer D_i is near unity. In most instances, the following inequality is true: $0 < D_i < 1$.

Estimation of developmental gap between States

The d_{ip} provides the following development gap between districts i and p:

$$d_{ip} = \left[\sum_{j=1}^{k} (Z_{ij} - Z_{pj})^2 \right]^{1/2} \quad \text{..... (8)}$$

Where $i = 1, 2 \ldots, n$ and $p = 1, 2, \ldots, n$

The distance matrix, which is a symmetric matrix produced by this relationship, is shown below

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$$d_{ip} = \begin{bmatrix} d_{11} & d_{12} & \cdots & d_{1n} \\ d_{21} & d_{22} & \cdots & d_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ d_{n1} & d_{n2} & \cdots & d_{nn} \end{bmatrix}.$$

To determine from the distance matrix minimum distance for each row is computed. Row i's minimum distance is represented by the symbol d_i. Calculate the critical distance as follows:

$$CD = \bar{d} + 2\sigma d_i \quad \text{.....(9)}$$

Where $\bar{d}$ is the mean of d_i and σ is the standard deviation.

Model states Identification and potential targets for development indicators

The model states are located using the CD. The districts in state "A" that have a composite development index that is lower than the State's and a development distance from the state that is less than or equal to the critical distance will serve as the model state. The taxonomy method has a weighing issue as its principal drawback. The creation of the composite index gives equal weight to each variable.

Stages of development

a) States with composite indices less than or equal to (mean-standard deviation) are highly developed states
b) States with composite indices greater than or equal to (mean + standard deviation) are low developed states.
c) States with composite indices between mean and (mean-standard deviation) are medium developed.
d) States with composite indices between mean and (mean+ standard deviation) developing.

Findings and Discussions:

The levels of Development

The agricultural sector has been assessed for the eight States of the NER in order to estimate the level of progress with the help of composite indices. Based on the composite development indices, which are shown in table 1 below, the States have been ranked.

Table 1: Composite agricultural development indexes for the years 2004–05 and 2016–17, as well as State rankings

States	2004-05		2016-17	
	CI	Rank	CI	Rank
Arunachal Pradesh	0.67	4	0.68	4
Assam	0.72	6	0.73	5

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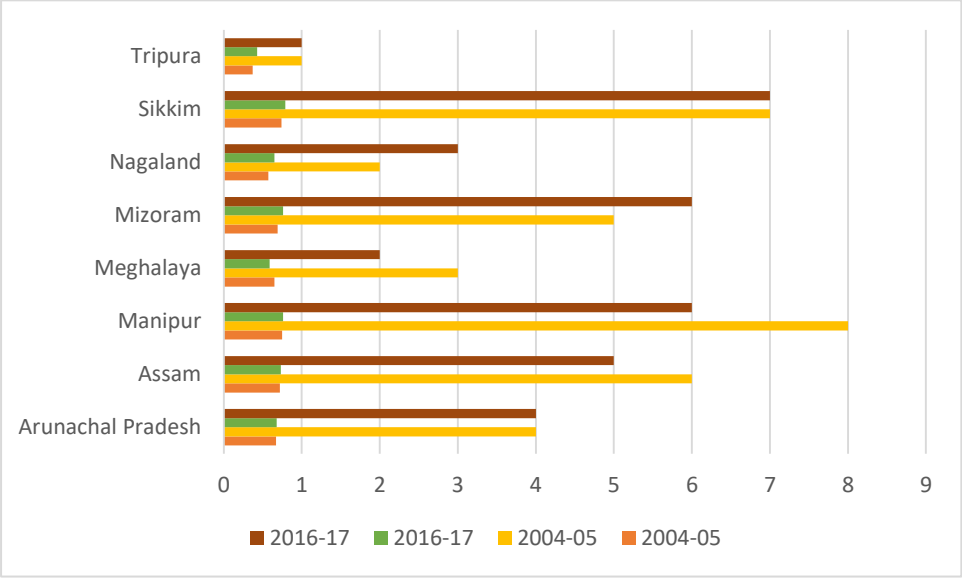
Manipur	0.75	8	0.76	6
Meghalaya	0.65	3	0.59	2
Mizoram	0.69	5	0.76	6
Nagaland	0.57	2	0.65	3
Sikkim	0.74	7	0.79	7
Tripura	0.37	1	0.43	1

Source: Authors own calculations based on information gathered from a variety of sources

Table 1 shows that, in the case of the agricultural sector, in case of agricultural sector Tripura is found to be in the first position in the year 2004-05, followed by Nagaland, while, Manipur was found to be in the last position with a composite index (CI) score of 0.75. It is visible from table 1 that the composite index of agricultural development varies from 0.37 to 0.75 which indicates wide disparities in agricultural sector among the NE States in 2004-05. In the year 2016-17, the composite index of development for agriculture varies from 0.43 to 0.79. Tripura was found to be in the first position again while Sikkim the last. The status of agricultural development is deteriorating over the years as can be seen from the composite index range.

Figure 1: Composite agricultural development indexes for the years 2004–05 and 2016–17, as well as State rankings



Source: Based on Table 1

Comparing levels of development for 2004–05 and 2016–17 as per population and area:

Following the criteria outlined in the data and methodology section, the following classification of the States into various development stages is valid. Table 2 below reveals the results.

Table 2: Levels of Development

Category	2004-05	2016-17

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Highly Developed	$D_i \leq 0.53$	$D_i \leq 0.56$
Medium Developed	$0.54 \leq D_i \leq 0.65$	$0.57 \leq D_i \leq 0.67$
Developing	$0.66 \leq D_i \leq 0.77$	$0.68 \leq D_i \leq 0.78$
Low Developed	$Di \geq 0.78$	$Di \geq 0.79$

Source: Computed by the Authors

As a result, the States are categorised as highly developed, middle level developed, developing, and low developed based on the aforementioned classification. This result is displayed in table 3 below.

Table 3: Comparing levels of development for 2004–05 and 2016–17 as per population and area

Levels of Development	No. of States	Area (%)	Population (%)	No. of States	Area (%)	Population (%)
	2004-05			2016-17		
Highly Developed	1	4.37	8.08	1	4.37	8.08
Medium Developed	2	16.25	10.87	2	16.25	10.87
Developing	5	79.38	81.05	4	76.43	79.71
Low Developed	-	-	-	1	2.95	1.34

Source: Authors own computations.

Only one of the NE States, Tripura, which has a population of 8.08% and a land area of 4.37%, was determined to be well developed in the years 2004–2005, according to Table 3 above. Meghalaya and Nagaland, two States that make up 16.25% and 10.87%, respectively, of the NER's area and population, were deemed to fall under the category of medium development. In contrast, 5 States—Arunachal Pradesh, Assam, Manipur, Mizoram, and Sikkim—were discovered to fall under the developing category, accounting for 79.38% of the total area and 81.0% of the regional population. In 2004–2005, no state fell into the poorly developed category. Tripura was once again discovered to be the sole State in the NER in the highly developed category in 2016–17. While Arunachal Pradesh, Assam, Manipur, and Mizoram were in the developing category, covering 76.43% of area and 79.71% of the population, Meghalaya and Nagaland were once more placed in the medium group. With 2.95% of the total land and 1.34% of the total population, Sikkim was determined to fall under the low developed category. As a result, a significant portion of the NER is still developing agriculturally as of the present, or in 2016–17.

Potential benchmarks for low-income States' developmental indicators

Estimating the amount of improvement required to raise the level of development in low-developed States is helpful since it will aid in properly allocating resources to accomplish the objective of balanced growth. States that are recognised for estimating the possible target model are shown in table 4 below.

Table 4: Model States

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Low developed States	Model States
Sikkim	Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura

Source: Authors own calculation

Based on table 4, it can be concluded that the numerous developmental indicators for the low developed States, as well as the present value (2016–17), are in need of improvement.

Table 5: Potential Targets for the low developed States

Development indicators	Sikkim
1. Percentage of Net Sown Area	0.36(0.11)
2. Net irrigated area to Net Sown Area (%)	30.9(15.6)
3. Cropping Intensity (%)	189.41(176.62)
4. Productivity of Cereals (kg/ha)	2854(1681)
5. Productivity of Pulses(kg/ha)	1446(961)
6. Productivity of total Oilseeds(kg/ha)	1112(909)
7. Productivity of Rice(kg/ha)	4727.38(19.67)
8. Productivity of Wheat(kg/ha)	23.45(0.35)
9. Productivity of Horticultural Crops(kg/ha)	2024.84(25.563)
10. Consumption of fertilizer per hectare	46.11(0)

Source: Authors own computations. (Figures in brackets are actual values)

Conclusion and Suggestions

We may therefore deduce from the analysis that there have been significant differences in the level of agricultural development between the various States of the NER over the two time periods. The differences remained largely unchanged over the periods. Tripura was discovered to be the most developed among the other NE States in both time periods, while Sikkim was discovered to be in last place in 2016–17. Even now, the North Eastern States' agricultural industry is unsatisfactory, and the majority of the region is still in its early years. Therefore, if the government desires an equitable distribution of development, it should pay particular attention to those States whose growth has lagged far behind. Concrete areas must be the focus, and dimension-specific measures are urgently needed. The future development goals are suggested to be accomplished via an agricultural plus strategy. The conditions of agricultural backwardness need to be improved in the states of Arunachal Pradesh, Assam,

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Manipur, and Mizoram. In order to improve Assam's agricultural position and minimise inequality, the flooding problem needs to be addressed. Additionally, Sikkim should implement an appropriate R&D strategy to advance the state's agricultural development.

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