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SPATIO-TEMPORAL DISPARITIES IN AGRICULTURAL DEVELOPMENT - A STUDY ON MAJOR STATES AND ALL INDIA

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ABSTRACT

The issue of widening regional disparities is a growing concern for balanced development across the states as a development strategy. But, the balanced agricultural development is retarded due to wide regional disparity. In view of this, the study has attempted to measure the spatio-temporal disparities by constructing the composite agricultural development index (CADI) of the 17 major states and all India by assigning different weights to the indicators of agricultural development. This study also attempts to classify states according to their status of agricultural development. Wide disparities in the level of agricultural development had been observed across the states. But the coefficient of variation showed the declining trend indicating a convergent trend in the inter-state levels of agricultural development and narrowing down the disparities level across the states. Most of the states progressed between the early period of Green Revolution (1971-72) and the period of post Green Revolution (1985-86). It was observed that the states had changed their relative rank and absolute indices but holding the same category all the period except Assam, Jammu and Kashmir and Maharastra. The large imbalances exist in the agricultural development indicators across the states, which is the barrier for accentuating balanced development. Thus, for minimizing the inter-state disparities and to promote the balanced agricultural development, the resources should be distributed on the basis of equity, efficiency, productivity and sustainability.

I. INTRODUCTION

Agricultural development is a multidimensional concept consisting of technological advancement, effective management of the available resources and organizational set-up (Naregal and Togarsi, *1992;* Ram, *1989).* Though the main objective of national policy is balanced development of the states but still after five decades of development planning presents a picture uneven development across the states (Chelliah, *1996).* A number of studies on regional development in India have shown that the regional disparities have increased over the plan period - irrespective of whether they are measured in per capita state domestic product or growth rates of net state domestic product (Mahendradev, *1987;* Sarker, *1994;* Kurian, *2000;* Ahluwalia, *2000,* Dasgupta *et al., 2000).* Since, the issue of widening regional disparities is a growing concern for balanced development across the states as a development strategy. Subsequently, agriculture is the largest sector of the Indian economy, its balanced development is crucial for reducing inter-state disparities. But, the balanced agricultural development is retarded due to wide regional disparity in agricultural resources, lack of infrastructural support, capital inadequacy and growth potential in the region. Further, the uneven propagation of new agricultural technology has augmented the increased regional disparities. It is often argued that the inter-state disparities in agricultural, infrastructural and

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socio-economic factors have been propounded differences in agricultural development. Various studies have found regional disparities to be diverging with the process of economic growth, nevertheless not a single study analyzed agricultural development in depth. Keeping in view these facts, a detailed investigation into the level of disparities in agricultural development across the states is aim of this study. This study also attempts to classify states according to their status of agricultural development. Hence, the study was undertaken to measure the spatio-temporal disparities by constructing the composite agricultural development index (CADI) of the 17 major states and all India by assigning different weights to the indicators of agricultural development. This paper is based on the findings of a comprehensive study to find out spatial and temporal disparities in agricultural development across the states.

The study was undertaken to meet the following specific objectives:

1. To examine the temporal and spatial disparities in agricultural development across the states;
2. To classify the states according to their status of agricultural development.

II. METHODOLOGY

Agricultural development is quantified by constructing the CADI based on 22 agricultural development indicators as a weighted approach combined in an optimum manner. The procedure essentially calls for selection of appropriate development indicators; conversion of the original values of the indicators into some scaled values; and construction of the composite indices by taking the weighted sum of the scaled values. The steps involved in the computation of composite index of agricultural development are as follows:

Firstly, the selected indicators data have been transformed in the scaled values by the following equation:

$$y_{is} = \frac{X_{is} - \text{Min}\ (X_{is})}{\text{Max}\ (X_{is}) - \text{Min}\ (X_{is})} \qquad (1)$$

where, $i = 1,2,3 \ldots \ldots \ldots, n = 22$ indicators of agricultural development;
$s = 1,2,3, \ldots \ldots \ldots, N = 17$ major states and all India;
y_{is} = scaled value of the i^{th} indicator in the s^{th} state;
X_{is} = value of the i^{th} indicator in the s^{th} state

$\text{Min}(X_{is})$ and $\text{Max}(X_{is})$ are, respectively, the minimum and maximum values out of X_{i1}, $X_{i2}, \ldots \ldots \ldots X_{iN}$.

If, however, X_i is negatively associated with development then above can be written as:

$$y_{is} = \frac{\text{Max}\ (X_{is}) - X_{is}}{\text{Max}\ (X_{is}) - \text{Min}\ (X_{is})} \qquad (2)$$

For the present analysis, it has been postulated that all indicators are positively associated with agricultural development. Obviously, the scaled values, y_{is}, vary from zero to one.

Secondly, from the matrix of scaled values $Y = ((y_{is}))$, the measure for the level of agricultural development for different states and all India has been constructed as follows:

$$\bar{y}_S = w_1 y_{1s} + w_2 y_{2s} + \ldots\ldots\ldots + w_n y_{ns} \qquad (3)$$

Where, the w's ($0<w_i<1$ and $w_1 + w_2 + ... + w_n = 1$) are arbitrary weights reflecting the relative importance of the individual indicators.

However, a more rational view has been taken by assuming that the weights vary inversely as the variation in the respective indicators of agricultural development. More specifically, it assume:

$$w_i = \frac{m}{\sqrt{Var\ (y_i)}} \qquad (4)$$

$$\text{where} \quad m = \left[\sum_{i=1}^{n} \frac{1}{\sqrt{Var\ (y_i)}} \right]^{-1} \qquad (5)$$

The overall state index, $\bar{y}_S$, also varies from zero to one. Also, if $y_1, y_2, ..., y_n$ are independent, then

$$Var\ (\bar{y}_s) = \sum_{i=1}^{n} w_i^2\ Var\ (y_i) \qquad (6)$$

This method is a simpler and probably a better alternative to the conventional approaches (Moris and Liser, 1977, Mukherjee, 1980, Iyenger and Sudarshan, 1982). The choice of the weights in this manner ensures that large variation in any one of the indicators will not unduly dominate the contribution of the rest of the indicators and distort inter-state comparisons.

In this study, twenty-two variables were selected as the agricultural development indicators that could be broadly classified into three groups, namely, agricultural, infrastructural and socio-economic variables.

Agricultural Indicators

The agricultural indicators were as follows: cropping intensity (per cent), irrigation intensity (per cent), net sown area (per cent of reported area), net irrigated area (percent of NSA), area under HYVs (per cent of cropped area sown), fertilizer consumption (Kg/ha of GCA), fooograin productivity (Kg/ha of GCA), agricultural workers (no. / thousand ha of GCA), livestock density (no/ hundred ha of GCA).

Infrastructural Indicators

The infrastructural andicators were as follows: pumset (no./ 10 thousand ha of NSA), tractor (no./ 10 thousand ha of NSA), regulated market (no./ 10 thousand SQKM of area), electrified villages (per cent of total villages), electricity consumption in agriculture (per cent of total electricity consumption), density of rural roads (per cent of 1000 SQKM area), primary agricultural cooperative society (no./ 1000 SQKM area).

Socio-economic Indicators

The socio-economic indicators were as follows: rural literacy (per cent of total population), net value of agricultural production (Rs./ha of GCA), expenditure on agricultural research and education (Rs./ha of GCA), expenditure on extension (Rs./1000 rural population), share of AgNSDP (per cent), per capita AgNSDP (Rs.).

The relevant data on the above indicators have been compiled from various secondary sources published by the different organizations and institutions. The data were collected for 1970-71 to 1972-73 (early Green Revolution), 1984-85 to 1986-87 (post Green Revolution) and 1994-95 to 1996-97 (post reforms). Then, the triennium central average data considered for the analysis as a weighted approach.

The study has chosen the following periods for measuring the agricultural development in the state level and all India as considered important of the period.

Period-I : 1971-72 – Early Green Revolution Period

Period II : 1985-86 – Post Green Revolution Period

Period III : 1995-96 – Post Reform Period

Furthermore, the indices have been used to classify the states in different categories. A meaningful characterization of the different stages of agricultural development would be in terms of suitable fractile classification from an assumed distribution of the mean of CADIs (y). It appears appropriate to assume that the mean (y) has a Beta distribution in the range zero to one. The Beta distribution is generally skewed, and is relevant to characterize positive-valued random variables.

A random variable, Z has a Beta distribution in the interval (0,1) if its probability density function f(z) can be written as (Abramowitz and Stegun, 1970):

$$f(z) = \frac{1}{\beta(a,b)} z^{a-1}(1-z)^{b-1} \quad 0<z<1 \text{ and } a, b > 0 \qquad (7)$$

where, β(a,b) is the integral.

$$\beta(a,b) = \int_0^1 z^{a-1}(1-z)^{b-1}\,dz \qquad (8)$$

Let $(0, z_1)$, (z_1, z_2), (z_2, z_3) and $(z_3, 1)$ be linear intervals, such that each interval has the same probability weight of 25 per cent. These quartile groups can be used to characterize the various stages of agricultural development. In this study, the states have been classified into four groups based on level of agricultural development as defined below:

A. Less Developed States	if $0 < \bar{y}_S \leq z_1$
B. Developing States	if $z_1 < \bar{y}_S \leq z_2$
C. Moderately Developed States	if $z_2 < \bar{y}_S \leq z_3$
D. Developed States	if $z_3 < \bar{y}_S < 1$

The parameters (a, b) in the assumed Beta distribution can be estimated by solving the simultaneous equations:

$$(1-\bar{y})a - \bar{y}b = 0$$

$$(\bar{y} - m_2)a - m_2 b = m_2 - \bar{y} \qquad (9)$$

where, $\bar{y}$ is the overall mean of the state indices and m_2 is given by

$$m_2 = S_{\bar{y}}^2 + \bar{y}^2 \qquad (10)$$

Where, S_y^2 is the variance of the state indices. The cut-off points z_1 to z_3 can be obtained from tables of incomplete Beta function or from table of the F-distribution with degrees of freedom (2a, 2b), which are readily available.

If $F_{n_1,n_2;p}$ is the value of the F-Statistic with n_1 and n_2 degrees of freedom corresponding to probability p, i.e.,

$$\Pr(F \leq F_{n_1,n_2;p}) = p \tag{11}$$

then,

$$F_{n_1,n_2;p} = \frac{n_2}{n_1}\frac{1-z_p}{z_p} \tag{12}$$

where, z_p is the p^{th} fractile of the corresponding Beta distribution.

$$z_p = \frac{1}{1+\frac{b}{a}F_{n_2,n_1;p}} \tag{13}$$

since, $n_1 = 2a$, $n_2 = 2b$.

Extensive tables are available for computing the fractile points on the F-distribution for selected values of (n_1, n_2) and p (Pearson and Hartley, 1976). For values of F not readily available in the tables a two-way interpolation is needed. A straightforward procedure would be as follows:

For values of p less than 0.5, let $F_{n_{2k},n_{1k}}$ be the tabulated value of the F-ratio with degrees of freedom (n_{2k}, n_{1k}) for a given fractile point on the distribution. Taking k = 1 and k = 2, F_{n_2,n_1} is computed for values of (n_2, n_1).

Where, $n_{21} < n_2 < n_{22}$ and $n_{11} < n_1 < n_{12}$.

The interpolation formula is given as:

$$F_{n_2n_1} = F_{n_{21},n_{11}} + \frac{n_2-n_{21}}{n_{22}-n_{21}}(F_{n_{22},n_{11}} - F_{n_{21},n_{11}}) + \frac{n_1-n_{11}}{n_{12}-n_{11}}(F_{n_{21},n_{12}} - F_{n_{21},n_{11}}) + \frac{(n_2-n_{21})(n_1-n_{11})}{(n_{22}-n_{21})(n_{12}-n_{11})}\left[F_{n_{21},n_{11}} + F_{n_{22},n_{12}} - F_{n_{21},n_{12}} - F_{n_{22},n_{11}}\right] \tag{14}$$

However, for p > 0.5 the following result holds:

$$F_{n_1,n_2;p} = \frac{1}{F_{n_1,n_2;1-p}} \tag{15}$$

Hence, the above calculation has been done to estimate the z_p which is the p^{th} fractile of the corresponding Beta distribution and according to the z_p value the states are placed in different categories of agricultural development as mentioned previously.

III. RESULTS AND DISCUSSION

Spatio-temporal Level of Agricultural Development Disparitks

Agriculture provides sustenance, nutrition and occupation to large proportion of the population of India. It provides raw material to industries, and sustains the very fabric of the city life. Hence, agriculture is and shall continue to be the most important basis of Indian economy. However, there are inter-state variations in agricultural development, which is influenced by a number of factors. Therefore, to measure the agricultural development, the CAM have been constructed with the help of weighting method for *17* major states and all India at the three different periods.

Weightage of the Agricultural Development Indicators

Any index of development based on multivariate data has its own limitations. A major limitation arises from the assumptions made about the indicators themselves and their weightage in the aggregate index. It might be believed that any inter-state comparison of levels of development would be more efficient when the variability in the composite index is stabilized. Therefore, the study adopts the weighting method for constructing the CADI.

Tablel shows the weightage of agricultural development indicators at different time periods. The weightage is more or less uniform though every time periods it had changed their values according to the variability of the scaled values in that period. It reveals that the highest weightage is for rural literacy *(0.0516)* and foodgrain productivity *(0.0504)* in *197172,* whereas regulated market *(0.0534),* fertilizer consumption *(0.0524),* foodgrain productivity *(0.0524),* primary agricultural cooperative society *(0.0523),* rural literacy *(0.0509),* and per capita AgNSDP *(0.0504)* in *1985-86;* and regulated market *(0.0510),* per capita AgNSDP *(0.0523),* and share of AgNSDP *(0.0501)* receive more weightage in *1995-96* respectively.

The total weightage assigned to agricultural indicators has increased from *0.4038* in *1971-72* to *0.4138* in *1985-86* and *0.4113* in *1995-96.* While the weightage of infrastucture indicators had gone down and the weightage of socio-economic indicators marginally decreased in *1985-86* though it increased in *1995-96* (Table 1). It has shown the priority of the broad sectors at different time period.

The indicators of rural electrification, i.e., the percentage of villages electrified and electricity consumption in agriculture got the lowest score over the time periods, whereas the regulated market and rural literacy got more weightage than other indicators. However, the weightage of all the indicators marginally increased or decreased over the time periods. It clearly reflects that priorities have shifted with the change of time span.

Dimension of Disparity Level of Agricultural Development

The CADIs of the major states and all India are presented in the Table *2,* that clearly portraits the spatio-temporal disparities across the states. The CADIs of most of the states showed an increasing trend with the exception of three states Assam, Himachal Pradesh and Kerala where the indices: showed the declining trend. It was also observed that the CADIs were large variation across the states all the time period. Since, the temporal situation was also very discerning, where large variations existed in CADIs across the states. The CADIs of Punjab was the highest which is *67.30, 74.01* and *73.59* in *1971-72, 1985-86* and *1995-96*

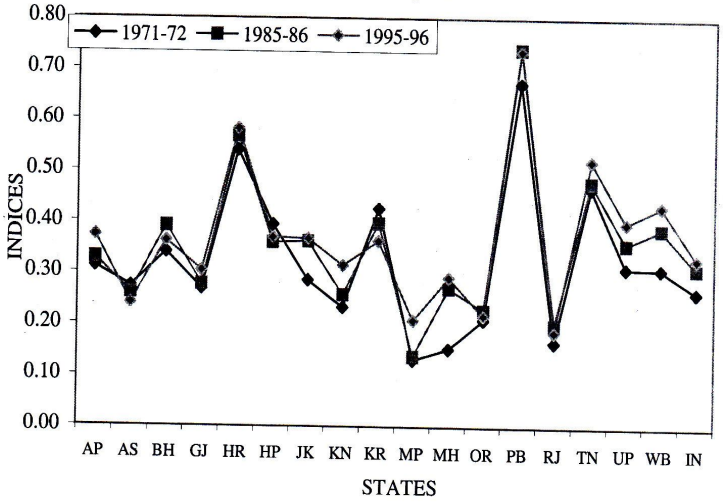
respectively, but the lowest was Madhya Pradesh in 1971-72 is 13.15 and 1985-86 is 13.85 whereas Rajasthan was the lowest in 1995-96 is 18.73. It clearly indicates that the disparities level of agricultural development across the states is quite high. Though the coefficient of variations of CADIs showed declining trend, which indicates the disparities are narrowing down. The CADIs across the states at three-time period have been shown in Figure 1, which depicted the variations of indices and disparity level of agricultural development across the states. It also depicted level of disparities across the states and most of the states moved forward at the time span. The coefficient of variation declined from 43.36 per cent in 1971-72 to 37.43 percent in 1995-96 indicating a convergent trend in the inter-state levels of agricultural development.

Table 1. Weightage for the agricultural development indicators at different time periods

Agricultural Development Indicators	1971-72	1985-86	1995-96
Cropping Intensity	0.0455	0.0388	0.0423
Irrigation Intensity	0.0489	0.0445	0.0460
Net Sown Area	0.0445	0.0473	0.0456
Net Irrigated Area	0.0462	0.0469	0.0444
Area under HYVs	0.0404	0.0455	0.0477
Fertilizer Consumption	0.0441	0.0524	0.0439
Foodgrain Productivity	0.0504	0.0524	0.0490
Agricultural Workers	0.0406	0.0429	0.0431
Livestock Density	0.0432	0.0442	0.0494
All Agricultural Indicators	**0.4038**	**0.4148**	**0.4113**
Pumpset	0.0481	0.0442	0.0428
Tractor	0.0488	0.0421	0.0448
Regulated Market	0.0489	0.0534	0.0510
Electrified Villages	0.0387	0.0339	0.0399
Electricity Consumption in Agriculture	0.0404	0.0383	0.0337
Density of Rural Roads	0.0477	0.0462	0.0404
Primary Agricultural Cooperative Society	0.0477	0.0523	0.0463
All Infrastuctural Indicators	**0.3203**	**0.3103**	**0.2988**
Rural Literacy	0.0516	0.0509	0.0497
Net Value of Agricultural Production	0.0413	0.0458	0.0441
Expenditure on Agricultural Research and Education	0.0467	0.0468	0.0481
Expenditure on Extension	0.0423	0.0396	0.0456
Share of AgNSDP	0.0475	0.0414	0.0501
Per Capita AgNSDP	0.0464	0.0504	0.0523
All Socio-economic Indicators	**0.2759**	**0.2748**	**0.2899**

The relative change of CADIs during 1985-86 compared to 1971-72 was the maximum in case of Maharashtra (77.18 per cent), followed by Jammu and Kashmir, West Bengal (25.50 per cent), Rajasthan (20.42 per cent) and all India (17.32 per cent). In comparison to 1985-86 and 1995-96, this relative change was the maximum in case of Madhya Pradesh (50.83 per cent), followed by Karnataka (22.17 per cent) and Andhra Pradesh. Between the periods, the change was decline trend in case of Assam (-7.66 per cent), Bihar (-7.53 per cent), Kerala (-8.77 per cent), Orissa (-4.85 per cent) and Punjab (-0.56 per cent).

Figure 1. Disparity level of agricultural development across the states at different time period



It was observed that the relative change of CADIs was higher between the early Green Revolution period and post Green Revolution and was lower between the post Green Revolution and post reforms period in case of most of the states. But, it was higher in the next period in that states; those states were lower CADIs in previous period. Moreover, those states belonged to high CADI in early period of Green Revolution, the relative change of CADIs was low between the two periods such as Haryana, Punjab and Tamil Nadu. It was evident that the states lagging far behind have progressed better than other states though Orissa was quite more or less static.

Table 2. Composite agricultural development indices and coefficient of variations of the indices of the major states and all India at different time periods

States	CADI(%)			Percentage change of CADI	
	1971-72	1985-86	1995-96	(1971-72 to 85-86)	(1985-86 to 95-96)
Andhra Pradesh	31.17	32.84	37.24	5.35	13.41
Assam	27.26	26.03	24.03	-4.52	-7.66
Bihar	34.01	39.14	36.19	15.09	-7.53
Gujarat	26.90	27.73	30.45	3.11	9.79
Haryana	53.99	56.73	58.18	5.09	2.55
Himachal Pradesh	39.47	35.91	36.93	-9.01	2.82
Jammu and Kashmir	28.58	36.20	36.74	26.69	1.50
Karnataka	23.32	25.81	31.53	10.68	22.17
Kerala	42.66	39.77	36.28	-6.79	-8.77
Madhya Pradesh	13.15	13.85	20.89	5.37	50.83
Maharastra	15.32	27.14	29.24	77.18	7.75
Orissa	21.05	22.93	21.81	8.94	-4.85
Punjab	67.30	74.01	73.59	9.98	-0.56
Rajasthan	16.70	20.11	18.73	20.42	-6.85
Tamil Nadu	46.86	47.97	52.13	2.37	8.66
Uttar Pradesh	31.22	35.88	40.01	14.94	11.51
West Bengal	31.03	38.94	43.32	25.50	11.24
All India	26.56	31.16	33.07	17.32	6.12
Coefficient of variations	43.36	39.88	37.43		

Agricultural Development Stages of the States and All India

Ranking is the simplest method to measure the relative position of the states but is not useful for classifying the states according to their level of development. To classify the states, the study employed Beta distribution assuming that mean of the states indices (y) has a Beta distribution in the range zero to one. The Beta distribution is used for graduating the state indices because of their skewness and its finite range. However, this study used both the techniques to examine status of the states and all India.

Based on the CADIs the states were ranked which helps to assess relative position of the states. It may happen that absolute value of state indices has gone up but its relative position may change or may not.

Table 3 shows the rank of the 17 major states and all India at different time periods. Punjab, Haryana, and Tamil Nadu hold first, second and third position respectively during the study period. Over the period 1971-72 to 1995-96, Andhra Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Uttar Pradesh and West Bengal showed convergent trend in respect of both rank and CADIs. Assam, Bihar, Gujarat, Himachal Pradesh, Kerala, Orissa, and Rajasthan showed divergent trend in respect of rank, whereas divergent trend in respect of CADIs was observed only in Assam, Himachal Pradesh and Kerala. All India showed converging trend in CADIs and held the same ranking position at 11

except in the initial year *1971-72*, when it ranked 13. In the middle period also the states has changed theirs ranking position. It was observed that the states changed their rank due to change in their absolute indices during the study periods. Hence, it does not provide actual development status of the states and may be mislead to the interpretation regarding status of the states.

Beta distribution is used to know the status of development of the states. The states were classified in four categories, namely developed, moderately developed, developing and less developed states according to their z^{th} fractile values. Table 4 shows the Beta distribution estimated parameters and fractile values of classification of the states.

Table 3. **Ranking of the major states and all India at different time periods**

States	Ranking		
	1971-72	1985-86	1995-96
Andhra Pradesh	*8*	*10*	*6*
Assam	11	14	15
Bihar	*6*	5	10
Gujarat	*12*	*12*	*13*
Haryana	*2*	*2*	*2*
Himachal Pradesh	5	*8*	*7*
Jammu and Kashmir	10	*7*	*8*
Karnataka	14	15	*12*
Kerala	4	4	*9*
Madhya Pradesh	*18*	*18*	*17*
Maharastra	*17*	13	14
Orissa	15	*16*	*16*
Punjab	1	1	1
Rajasthan	*16*	*17*	*18*
Tamil Nadu	3	*3*	*3*
Uttar Pradesh	*7*	*9*	5
West Bengal	*9*	*6*	4
All India	13	11	11

According to z^{th} fractile values, the states were grouped in four categories at different time periods, which are shown in Table *5*. Punjab, Haryana and Tamil Nadu belonged to the developed group, while Madhya Pradesh, Orissa, and Rajasthan remained in the less developed group in all the periods. Bihar, Himachal Pradesh, Kerala, Uttar Pradesh and West Bengal belonged to moderately developed group and Gujarat, Karnataka, and all India were in developing group in all three periods. On the other hand, Assam and Jammu & Kashmir and Maharashtra moved in opposite direction of development. Jammu & Kashmir had come up from developing group to moderately developed group and Maharashtra had come up from less developed group to developing group in *1985-86* and onwards and Assam had gone down from developing group to less developed group after *1985-86*. However, Andhra Pradesh was categorized in moderately developed group in *1971-72* and next period it had gone down in developing group, though it revived again moderately developed group in *1995-96*. Since, several states changed their ranking and CADIs but stages of agricultural development remained same all over the three periods.

Table 4. Estimated parameters of Beta distribution and fractile values of classification at different time periods

Year	Estimated Parameters		Degree of Freedom		Fractile value		
	a	b	n_1	n_2	z_1	z_2	z_3
1971-72	3.2948	6.9921	6.5897	13.9842	0.2156	0.3082	0.4469
1985-86	3.7287	6.8883	7.4575	13.7767	0.2467	0.3416	0.4722
1995-96	4.1526	7.1662	8.3053	14.3323	0.2653	0.3588	0.4818

Hence, in the early period of Green Revolution (1971-72), Punjab, Haryana and Tamil Nadu adopted the modern agricultural technologies and developed their infrastructure, which have promoted the states as developed category from the initial period. The other states had lagged far behind from these states though among these states also prevailed disparities in agricultural development all the three periods. Most of the states showed better performance between the early period of Green Revolution and post Green Revolution. In the post reform period a few states declined the CADIs like Assam, Bihar, Kerala, Orissa, Rajasthan and even Punjab also. Since, less developed states had not been able to capture the Green Revolution advantages by their existing resources and also mostly affected by the economic reforms in the front of agricultural development.

Agricultural development took place in all the states but it was very sluggish in few states, whereas Assam, Himachal Pradesh and Kerala showed decelerating progress. It was unevenly distributed across the states all through the time periods. The main reason for the extreme position of these states is prevalence of lower level and growth of considered indicators of agricultural development was not satisfactory level in comparison to other states. Thus, it may be inferred that the strategy of agricultural development has played a positive role in reducing the inter-state disparities during the study period.

Table 5. Agricultural development stages of the major states and all India at different time periods

Year	Stages of Agricultural Development			
	Developed	**Moderately Developed**	**Developing**	**Less Developed**
1971-72	Haryana, Punjab and Tamil Nadu	Andhra Pradesh, Bihar, Himachal Pradesh, Kerala Uttar Pradesh, and West Bengal	Assam, Gujarat, Jammu & Kashmir, Karnataka and **All India**	Madhya Pradesh, Maharashtra, Orissa, and Rajasthan
1985-86	Haryana, Punjab and Tamil Nadu	Bihar, Himachal Pradesh, Jammu & Kashmir, Kerala, Uttar Pradesh, and West Bengal	Andhra Pradesh, Assam, Gujarat, Karnataka, Maharashtra and **All India**	Madhya Pradesh, Orissa, and Rajasthan
1995-96	Haryana, Punjab and Tamil Nadu	Andhra Pradesh, Bihar, Himachal Pradesh, Jammu & Kashmir, Kerala, Uttar Pradesh and West Bengal,	Gujarat, Karnataka, Maharashtra and **All India**	Assam, Madhya Pradesh, Orissa and Rajasthan

Imbalances of Agricultural Development Indicators

It is observed from the previous results and discussions that sharp disparities prevailed across the states from the beginning (1971-72). Though, it is difficult to identify specific reasons for disparities in agricultural development because of its biological nature and dependency on agro-climatic factors. The factors considered in the analysis are not exhaustive, because development is a result of interlinkage effect of many factors. However, the measure of the coefficient of imbalances for indicators across the states gives a clue for disparities of agricultural development.

Table 6 shows the co-efficient of imbalances for agricultural development indicators which is coefficient of variations of the indicators across the states at the beginning and ending period of the study. Out of the total 22 indicators, only 7 indicators showed the divergent trend, while the remaining 15 showed converging trend. The degree of divergences varied from 0.42 to 24.53, while that for convergent varied from -0.26 to -560.34 among the indicators. The maximum divergent trend was shown by livestock density, followed by cropping intensity and agricultural workers, while the maximum convergent trend was shown by electrified villages, followed by area under high yielding varieties, pumpset, electricity consumption in agriculture, expenditure on agricultural research and education, and fertilizer consumption and so on.

The major indicators, which showed maximum degree of imbalances were tractor, regulated markets, expenditure on extension, expenditure on agricultural research and education, pumpset, primary agricultural cooperative society, electricity consumption in agriculture, density of rural roads, livestock density and fertilizer consumption in 1995-96. It was found that electrified villages had shown the least degree of variations (10.38 per cent) and it was followed by the cropping intensity (16.23 per cent), and irrigation intensity (17.83 per cent) in the year 1995-96. The coefficient of imbalance had been found varying from 10.38 in case of electrified villages to 163.34 in the case of tractor in this period. While tractor, pumpset, expenditure on agricultural research and education, regulated markets, expenditure on extension, fertilizer consumption, electricity consumption in agriculture, primary agricultural cooperative society, area under HYVs and electrified villages showed the maximum degree of imbalances in 1971-72. Though, the imbalances had reduced for most of the indicators from 1971-72 to 1995-96, but tractor, regulated markets, expenditure on agricultural research and education, expenditure on extension, pumpset and electricity consumption in agriculture had shown the wide imbalances during both period.

Table 6. Coefficient of imbalances for agricultural development indicators across the major states and all India during 1971-72 and 1995-96

Agricultural Development Indicators	Coefficient of imbalance (per cent)		Relative change (per cent)
	1971-72	1995-96	
Cropping Intensity	12.30	16.23	24.23
Irrigation Intensity	22.69	17.83	-27.24
Net Sown Area	35.98	36.13	0.42
Net Irrigated Area	64.97	54.79	-18.57
Area under HYVs	70.52	22.67	-211.02
Fertilizer Consumption	81.90	55.70	-47.05
Foodgrain Productivity	37.87	39.45	4.01
Agricultural Workers	36.20	45.11	19.76
Livestock Density	43.64	57.82	24.53
Pumpset	143.37	81.21	-76.55
Tractor	175.72	163.34	-7.58
Regulated Market	120.78	112.99	-6.89
Electrified Villages	68.53	10.38	-560.34
Electricity Consumption in agriculture	97.40	63.26	-53.97
Density of Rural Roads	62.54	60.76	-2.93
Primary Agricultural Cooperative Society	77.18	67.34	-14.60
Rural Literacy	38.27	30.64	-24.88
Net Value of Agricultural Production	35.36	35.27	-0.26
Expenditure on Agricultural Research and Education	124.14	82.66	-50.19
Expenditure on Extension	109.94	94.22	-16.69
Share of AgNSDP	18.76	21.54	12.89
Per Capita AgNSDP	34.24	39.86	14.11

The extent of variability in the coefficient of imbalances for some of the indicators in 1995-96 is almost the same as in 1971-72. These indicators were net sown area, foodgrain productivity, net value of agricultural production, and share of AgNSDP. The most interesting finding emerges from Table 6 is that the relative imbalance in the percentage change of electrified villages had declined drastically (-560.34 per cent), followed by the area under HYVs and pumpset. The imbalances in critical inputs directly influence the productivity, growth and ultimately on agricultural development. However, it is very difficult to identify the specific sector, which is responsible for the disparities, because there is high degree of interlinkages among the different sectors. Moreover, the factors considered in the analysis are not exhaustive. Hence, it gives a clue of disparities across the states. It is the major obstacle for balanced agricultural development in the state and all India.

IV. CONCLUSION AND POLICY IMPLICATIONS

This study has constructed the CADI based on the 22 agricultural development indicators as a weighted approach to measure the disparities in agricultural development quantitatively across the states. Hence, the present exercise brings out the quantitative changes in the agricultural development achieved by the different states and their position on the ladder of stages of development over the time span. The key findings that emerged are as follows:

Wide disparities in the level of agricultural development had been observed across the states all the period. But the coefficient of variation showed the declining trend, which indicates a convergent trend in the inter-state levels of agricultural development and narrowing down the disparities level across the states. Most of the states progressed their indices between the early period of Green Revolution (1971-72) and the period of post Green Revolution (1985-86). But, less developed states had not got much more benefit by the Green Revolution which is indicated by their indices. It was observed that the states had changed their relative rank and absolute indices but holding the same category all the period except Assam, Jammu and Kashmir and Maharastra. Jammu and Kashmir had come up from developing group to moderately developed group and Maharashtra from less developed group to developing group while Assam had gone down from developing group to less developed group. Since, performance of the states was not quite satisfactory in agricultural development. The large imbalances exist in the agricultural development indicators, which is the barrier for accentuating balanced development across the states.

The findings of the study have several policy implications for balanced agricultural development of the country. For minimizing the inter-state disparities and to promote the balanced agricultural development, the resources should be distributed on the basis of equity, efficiency, productivity and sustainability. In the equity concern, developing and less developed states should be given special priority to bridge-up the immense development disparities across the states by the proper agricultural policy. Moreover, the level of indicators has not reached at the critical minimum level for significantly contributing to agricultural development in a few states. For this purpose low index based states desired specific policy strategies to improve their productivity through increased the level of indicators. To promote the balanced agricultural development of the states, government intervention is required for build-up of the infrastructural facilities and to provide the modern agricultural technologies at farmers level. In the less developed and developing states government intervention should be directed to develop infrastructure, assure modern inputs supply and ensure price of the agricultural commodities. Furthermore, in developed and moderately developed states the existing facilities should be ensured for proper functioning in the state development process, which have shown decelerating, performance in agricultural development. The recent slowdown in agricultural development suggests the need for sustaining balanced agricultural development across the states. In these aspects appropriate policy needs to be formulated at the state level and national level for agricultural development.

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