

Research Article

Inter-district disparities in agricultural development in Amravati division of Maharashtra

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SUMMARY : The present study on the inter district disparities in “Agricultural development was conducted in Amravati division. The data were collected from different public records of State Governments, co –operatives and private institutions. There was good agricultural development in Amravati and Akola district while decrease in Yavatmal and Buldhana district. Amravati was identified as model district over a period of time. The rank of Amravati was 1st and remains constant. The rank of Akola district came down to 2nd in 1996-97 to 2001-02. The rank of Buldhana district came down to 3rd in 2001-02 to 4th in 2006-07. The rank of Yavatmal district was improved from 3rd to 2nd but came down from 3rd in 2006-07 to 2nd in 2010-11. Amravati district was classified as ‘most developed’ in 1989-90 and 1996-97 and ‘developed’ in 2001-02, 2006-07 and 2010-11. Akola, Yavatmal and Buldhana district were classified as ‘moderately developed’ in 1989-90 and 1996-97. In 2010-11 Akola and Yavatmal district were classified as ‘under developed’ and Buldhana district was classified as ‘Backward’. Agricultural development of model district (Amravati) was significantly superior, over all other districts in all five time points. Agricultural development of district significantly differed from each other over a period of time (26 years).

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Agricultural development, Composite index, Inter-district disparities

BACKGROUND AND OBJECTIVES

Development is a process, which improves the quality of life. It requires a balanced human resource development in the country. Development of social sector along with technology absorption in agriculture and industry, which are the principal sectors of our economy, could be considered as the primary objective of any economic development efforts.

Agriculture is the backbone of Indian economy contributing 28 per cent of the Gross Domestic Product, engaging 67 per cent of our human forces. Agriculture being the predominant sector of economy, the pace of economic development of the country has been and still continues to be significantly influenced by the pace of its agricultural development.

Maharashtra is basically agricultural state.

From last two decades, farmers in Maharashtra are adopting new technologies like improved seeds, fertilizers, irrigation systems etc. The traditional agricultural practices are gradually being replaced by new technologies. Agricultural growth pattern exhibit notable variation between crops, districts and even from year to year. The variation in agricultural growth among districts having infrastructural facilities like irrigation, power, road, hospitals, regulated markets and agricultural processing units developed rapidly.

The studies relating to backwardness of agriculture have pointed out some major problems of the agriculture sector but have failed to compare the variations in performance of different regions and the reasons thereof. Among the works that investigate causes of backwardness of agriculture/ crisis of agriculture in the state and in selected regions. Vakulabharanam (2005 and 2008) has

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argued that the reduction of domestic support in terms of subsidy and credit on the one hand and drastic price fall of agricultural commodities in the international market on the other hand, has led to distress in the farming class of the state. Mishra (2007), Reddy and Mishra (2008) emphasise that crisis in agriculture was well underway by the 1980s and economic reforms in the 1990s have only deepened it. Decline in the supply of electricity to agriculture has been regarded as major cause of distress by Chand *et al.* (2007); Chand (2005); Chand and Kumar (2005).

Narayanamoorthy (2007) argues that fall in wheat and rice production is not due to technology fatigue rather due to extensive mono crop cultivation and high use of fertilisers and faulty agricultural pricing. Lack of allocation of funds to irrigation development after liberalisation has also resulted in the stagnation of net area irrigated.

The present study will indicate the rate of development has been uniform or their area any imbalances in Amravati division. The measurement of distance in different districts will help in classification of districts according to agricultural development. The identification of model district and identifying target for various indicators which will help to formulate future policies for balanced agricultural development in remaining districts.

RESOURCES AND METHODS

The Amravati division of Vidarbha region was purposively selected for the study. Amravati division includes Amravati, Yavatmal, Buldhana and Akola (including Washim). Amravati division covers Western Vidarbha region hence, selection of all districts in this division was done. Composite index of agricultural development suggested by Prem Narain was calculated at different time points, 1989-1990 (end year of VIIth five year plan), 1996-1997 (end year of VIIIth five year plan), 2001-2002 (end of IXth five year plan), 2006-2007 (end of Xth five year plan), 2008-2009, 2009-2010 or 2010-2011 (depend on availability of data) was studied.

On the basis of growth rates and composite index, agricultural development of different districts of Amravati divisions was studied. The data thus collected was analyzed for simple arithmetic averages and index number of indicators of development. Further the standard deviation (S.D.), coefficient of variation (C.V.) was calculated.

Composite Index of development:

$$\text{Standard level} = \frac{\text{Actual level of indicator} - \text{Mean}}{\text{Standard deviation}} \text{ i.e. } Z_{ij} = \frac{X_{ij} - \bar{X}_j}{S_j}$$

where,

\bar{X}_j = mean level of the indicator and

$$S_j^2 = \frac{\sum_{i=1}^n (X_{ij} - \bar{X}_j)^2}{n} \quad X_j = \frac{\sum_{i=1}^n \bar{X}_{ij}}{n}$$

where,

$i = 1, 2, 3, \dots, n$ and $j = 1, 2, 3, \dots, k$ and $[z_{ij}]$ = matrix of standardized indicators.

For each indicator, the ideal level of development will be identified from the level of different districts and its normalized value will be taken as "standardized level z_{oj} ".

The pattern of development for the i^{th} district will be given as:

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

The composite index of development will be worked out as:

$$D_i = \frac{\bar{C}_i}{C} \quad \text{where, } c = c + 2s$$

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

The value of composite index is non-negative and it lies between 0 and 1. The value of composite index closer to zero indicates the higher level of development, while the value of index closer to 1 indicates the lower level of development of the respective district.

Table A: Criteria for classification of district on basis of the composite index

Sr. No.	Level of development	Range of composite index
1.	Most developed	Below (Mean - 2 SD)
2.	Developed	(Mean - 2SD) to (Mean - SD)
3.	Moderately developed	(Mean - SD) to (Mean)
4.	Under developed	(Mean) to (Mean + SD)
5.	Back ward	(Mean+ SD) to (Mean + 2 SD)
6.	Most backward	Above (Mean + 2 SD)

Identification of model district:

The model districts will be identified on the basis of composite index of development. District having Composite Index lower than that of other district will serve as model district for district.

Statistical comparison of model districts with other district:

$$CD = d \pm 2SD$$

where,

d = mean, SD = Standard deviation.

Change in development levels:

$$\frac{2}{F} = \frac{12}{np(p+1)} \sum_{j=1}^p C_j^2 - 3n(p+1)$$

where,

n = number of years under study, p = number of districts

under study, C_j = total of ranks in the j^{th} column, $j = 1, 2, p$, χ_p is approximately distributed as χ^2 with $(p-1)$ d.f. If χ^2_p (Calculated) $\geq \chi^2$ (tabulated) with $(p-1)$ d.f. at chosen level of significance then the null hypothesis will be rejected, otherwise it will be accepted.

OBSERVATIONS AND ANALYSIS

The experimental findings obtained from the present study have been discussed in following heads:

Composite index, ranks and level of development:

It is observed from Table 1 that, in the year 1989-1990 and 1996-97 the 'di' values for Amravati district was 0.532986 and 0.438492, respectively and ranked 1st which came under category "Most developed" while, other three districts (Akola, Yavatmal and Buldhana) came under the category 'Moderately developed' except Amravati, which was categorized as "Most developed."

In the end year 2001-2002, 2006-07 and 2010-11 the 'di' values for Amravati district was 0.443654, 0.372885 and 0.31776, respectively with rank 1st which came under category "Developed." The 'di' values of Yavatmal district was 0.549863, 0.541346 and 0.545584, respectively with rank 2nd which came under category "Moderately developed." The Buldhana district was ranked 3rd under the category of "Under developed" with 'di' value 0.61615, 0.626462, respectively in the year 2001-2002 and 2006-07. The Akola district was ranked

4th with 'di' value 0.721264 under the category of "Backward" in the year 2010-11.

Classification of four districts on the basis of composite index (i.e. Di values):

It was observed from Table 2 that, in the end year 2010-2011, the di values for Amravati district was 0.31776 and ranked 1st which came under category "Developed."

Therefore, it can be concluded that, there was a good agricultural development in Amravati district followed by Buldhana district, Yavatmal district remains at constant level and decreased agricultural development was found in Akola district from moderately developed to under developed over a period.

All four districts (Amravati, Akola, Buldhana and Yavatmal) of Amravati division were classified in to various categories on the basis of agricultural development i.e. Most developed, Developed, Moderately developed, Under developed, Backward, Most backward. This classification was based on the range of Di values. This classification was done for five years i.e. viith iiith ixth xth and xith five year plans ending years i.e. 1989-1990, 1996-1997, 2001-2002, 2006-2007 and 2010-2011, respectively.

Comparison of model district with other districts:

It is observed that in the year 1989-90, 1996-97, 2001-02, 2006-07 and 2010-11 Amravati district was served as model district with consistent growth over the 26 years of time period

Table 1: Composite index, ranks and level of development of Amravati division

Years		Districts			
		Amravati	Akola	Buldhana	Yavatmal
1989-1990	CI	0.532986	0.693933	0.810029	0.685635
	Rank	1	3	4	2
	Category	Most developed	Moderately developed	Moderately developed	Moderately developed
1996-1997	CI	0.438492	0.570801	0.63722	0.60262
	Rank	1	2	4	3
	Category	Most developed	Moderately developed	Moderately developed	Moderately developed
2001-2002	CI	0.443654	0.721264	0.61615	0.549863
	Rank	1	4	3	2
	Category	Developed	Backward	Under developed	Moderately developed
2006-2007	CI	0.372885	0.626462	0.648123	0.541346
	Rank	1	3	4	2
	Category	Developed	Under developed	Under developed	Moderately developed
2010-2011	CI	0.31776	0.538475	0.639614	0.545584
	Rank	1	2	4	3
	Category	Developed	Under developed	Backward	Under developed

(Where, CI=Composite index)

Table 2 : Classification of four districts of Amravati division on the basis of composite index (i.e. Di values)

Year	Range of Di	Category	Districts
1989-1990	0 - 0.483808895	Most developed	Amravati
	0.483808895 - 0.58222736	Developed	
	0.58222736 - 0.680645825	Moderately developed	Akola, Yavatmal, Buldhana
	0.680645825 - 0.77906429	Under developed	
	0.77906429 - 0.877482755	Backward	
1996-1997	0.877482755 - 0.999989	Most backward	
	0 - 0.411818951	Most developed	Amravati
	0.411818951 - 0.48705095	Developed	
	0.48705095 - 0.56228295	Moderately developed	Akola, Buldhana, Yavatmal
	0.56228295 - 0.63751495	Under developed	
2001-2002	0.63751495 - 0.712746949	Backward	
	0.712746949 - 0.999989	Most backward	
	0 - 0.380913	Most developed	
	0.380913 - 0.481823	Developed	Amravati
	0.481823 - 0.582732	Moderately developed	Yavatmal
2006-2007	0.582732 - 0.683642	Under developed	Buldhana,
	0.683642 - 0.784551	Backward	Akola,
	0.784551 - 0.999989	Most backward	
	0 - 0.330667	Most developed	
	0.330667 - 0.438935	Developed	Amravati
2010-2011	0.438935 - 0.547203	Moderately developed	Yavatmal
	0.547203 - 0.655471	Under developed	Akola, Buldhana
	0.655471 - 0.763739	Backward	
	0.763739 - 0.999989	Most backward	
	0 - 0.274068	Most developed	
2010-2011	0.274068 - 0.392213	Developed	Amravati
	0.392213 - 0.510358	Moderately developed	
	0.510358 - 0.628502	Under developed	Akola, Yavatmal
	0.628502 - 0.766647	Backward	Buldhana
	0.766647 - 0.999989	Most backward	

Table 3: Comparison of model district with other districts in Amravati division

Year	Districts			
	Amravati	Akola	Buldhana	Yavatmal
1989-90	0.5329 (1)	0.6939 (2)	0.8100 (4)	0.6856 (3)
1996-97	0.4384 (1)	0.5708 (2)	0.6372 (4)	0.6026 (3)
2001-02	0.4436 (1)	0.7212 (4)	0.6161 (3)	0.5498 (2)
2006-07	0.3728 (1)	0.6264 (3)	0.6481 (4)	0.5413 (2)
2010-11	0.3177 (1)	0.5384 (2)	0.6396 (4)	0.5455 (3)

as the 'Di' values (0.5329, 0.4384, 0.4436, 0.3728 and 0.3177, respectively) was small as compared to other district.

Statistical significance between different time points for each district:

After calculating composite index of development at a

given point of time, *i.e.* 1985-2011. The statistical significance of development was tested by non-parametric Friedman's test. The test is given below. The years were arranged in row and districts were arranged in column. The ranks of district of each year were arranged in Table 4.

Table 4: Statistical significance between different time points for each district (Freedman's test)

Year	District (with rank)			
	Amravati	Akola	Buldhana	Yavatmal
1989-90	0.5329 (1)	0.6939 (2)	0.8100 (4)	0.6856 (3)
1996-97	0.4384 (1)	0.5708 (2)	0.6372 (4)	0.6026 (3)
2001-02	0.4436 (1)	0.7212 (4)	0.6161 (3)	0.5498 (2)
2006-07	0.3728 (1)	0.6264 (3)	0.6481 (4)	0.5413 (3)
2010-11	0.3177 (1)	0.5384 (2)	0.6396 (4)	0.5455 (3)
Ci	5	13	19	13

Table 4a : Statistical comparison of model district with other districts of Amravati division for year (1989-90)

Districts	Amravati with Akola	Amravati with Buldhana	Amravati with Yavatmal
Difference in Di-values	-0.1609	-0.277	-0.1526
C.D. values	0.1555	0.1555	0.1555
Result	Significant	Significant	Significant

Table 4b : Statistical comparison of model district with other districts of Amravati division for year 1996-97

Districts	Amravati with Akola	Amravati with Buldhana	Amravati with Yavatmal
Difference in Di-values	-0.1323	-0.1987	-0.1641
C.D. values	0.1189	0.1189	0.1189
Result	Significant	Significant	Significant

Table 4c : Statistical comparison of model district (Amravati) with other districts of Amravati division for year 2001-02

Districts	Amravati with Akola	Amravati with Buldhana	Amravati with Yavatmal
Difference in Di-values	-0.2776	-0.1724	-0.1062
C.D. values	0.1595	0.1595	0.1595
Result	Significant	Significant	Significant

Table 4d : Statistical comparison of model district (Amravati) with other districts of Amravati division for year (2006-07)

Districts	Amravati with Akola	Amravati with Buldhana	Amravati with Yavatmal
Difference in Di-values	-0.2535	-0.2752	-0.1684
C.D. values	0.1711	0.1711	0.1711
Result	Significant	Significant	Significant

Table 4e: Statistical comparison of model district (Amravati) with other districts of Amravati division for year (2010-11)

Districts	Amravati with Akola	Amravati with Buldhana	Amravati with Yavatmal
Difference in Di-values	-0.2207	-0.3218	-0.2278
C.D. values	0.1867	0.1867	0.1867
Result	Significant	Significant	Significant

where,

n = number of years under study, p = number of districts under study, C_j = total of ranks in the j^{th} column and $j = 1, 2, \dots$ and " p " is approximately distributed as with $(p-1)$ d.f.

The value of $t_{(\text{calculated})}$ was obtained 77.88.

Hence, $t_{(\text{calculated})} > t_{(\text{tabulated})}$ and Null hypothesis is rejected.

Thus, results shows that development of different district of Amravati division was significantly differ from each other.

In other words we can say that agricultural development of model districts was significantly superior, over all other districts in all four time points. This results confirms the Freedman's test results presented later. The results are also in accordance with the finding Narain *et al.*, 1993, 1994, 1997, 1999, 2000 and 2002.

Conclusion:

Agricultural development was observed more in Amravati district. There was good agricultural development in Amravati and Akola district. There was decrease in agriculture development in Yavatmal and Buldhana district. Amravati district had achieved first position in 30 indicators out of 66 indicators under study and classified as 'developed' and ranked 1st for the year 2001-2002. Amravati was identified as model district for the year 1989-90, 1996-97, 2001-2002, 2006-2007 and 2010-2011. The rank of Amravati district was 1st and remains constant over the period of time. Agricultural development of district significantly differed from each other over a period of time (26 years).

The results of statistical comparison of model district with other districts in each time period show that there was a significant difference in agricultural development in each district with model district. The non-parametric Freedman's test was applied to test the significance of development over a time period of 18 years (1984-1985 to 2001-2002) and it was found significant. It has been concluded that, Amravati district was served as model district with consistent growth over the 26 years of time period.

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