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Regional inequalities in the agrarian development of Kerala: a multivariate approach to the causative factors

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ABSTRACT

The regional inequality in agrarian development in Kerala was obtained with the help of composite index based on optimum combination of forty nine indicators by assigning weights to the indicators by the method of principal component analysis. The districts were classified into three groups based on the development and factors affecting the agricultural development across districts obtained by multivariate analysis of variance (MANOVA) technique. The factors namely area under paddy and high yielding varieties (HYVs), net sown area, area under total cereals, rainfall, credit flow from regional rural banks (RRBs), marine fish landing, fertilizer consumption and percentage of coastal line were significantly different across three categories of districts.

Keywords: Composite index; principal component analysis; MANOVA; HYV; RRBs

INTRODUCTION

Agriculture occupies an important place in the economic life of Kerala people as it provides the key to economic growth and fluctuations therein; overall economic growth of the state is greatly influenced by growth achieved in agricultural sector. In Kerala only 57 per cent of the total geographical area is under cultivation with 74 per cent of total population living in rural areas. Out of the total working population 7 per cent are cultivators and 15.8 per cent are agricultural labourers in Kerala and agriculture and allied sectors contribute nearly 15 per cent to gross state domestic product (GSDP). Agriculture in the state has remained stagnant even after the implementation of several plan programmes.

It was quite interesting and useful to study the factors affecting the agricultural development at district level since there has been a growing consensus about the need of micro-level planning in the country.

Knowledge of the factors affecting agricultural development at district level would help in identifying where a given district stands in relation to others and where to give more emphasis to boost up the agricultural sector. There were various factors affecting the agricultural development of the state. But being a small state with only 14 districts it was difficult to include all the variables in the study. Therefore a few variables were selected based on some statistical tools and were considered for the present study.

METHODOLOGY

For the purpose of the study secondary data from 49 indicators related to agriculture which included input, infrastructure, socio-economic, output, livestock and fisheries related indicators were collected from Department of Economics and Statistics, Government of Kerala, for a period of 8 years from 2003-2011. Principal component analysis (PCA) was employed on standardized averaged indicators for data reduction and for the construction of agricultural development index for the districts of the state.

Using the factor loading weights the index was determined by the following formula:

$$I_j = \frac{\sum_{i=1} X_i W_i}{\sum_i W_i}$$

where

Wi is the weight of the variable = $\sum |L_{ij}|E_j$, I_j is the index for j^{th} district, X_i is the i^{th} indicator, L_{ij} is the factor loading of i^{th} variable on j^{th} factor and E_j is the eigen value of j^{th} factor.

The districts were classified into three groups based on the composite index as backward, medium developed and developed districts by adopting (Mean ±1/ 2 SD). MANOVA was carried out for the factors having higher factor loading in PCA namely area under paddy and high yielding varieties (HYV), net sown area, total cereal area, rainfall (mm), regional rural bank (RRB) credit, marine fish landings (MT), fertilizer consumption per hectare and percentage of coastal line for ascertaining the factors affecting agricultural development at district level. Following formula was used:

$$X_{lj} = ì + ô_l + e_{lj}$$

where ì is the mean vector, $ô_l$ represents the treatment effect vector and e_{lj} is the error vector.

In this model each component of the observation vector X_{lj} satisfies the univariate model. The MANOVA was tested by test statistic, Wilks's lambda.

$$E = |W| / |B + W|$$

where B is the between treatments sums of squares and cross products (SSCP) matrix and W is the within treatments SSCP matrix.

Individual indicators effect in different district groups could be tested by using univariate analysis of variance (ANOVA).

RESULTS and DISCUSSION

Principal component analysis technique was used to assign weights to indicators and based on these weights the indices for the development were calculated. In all eight principal components were constructed that captured nearly 90.72 per cent of variation among the 49 indicators considered for the study.

It can be seen from the Table 1 that the indices ranged from 0.27 to 0.51. These indices represented the development of the district. Higher index indicated higher development. The highest index was recorded for Palakkad district and was considered as highly developed district in respect of agricultural sector and lowest index was recorded by Pathanamthitta district which was the least developed district. A suitable classification of the districts from the assumed distribution of the mean of the composite indices provided a more meaningful characterization of different stages of development (Narain et al 1996).

The number of districts falling in different categories of development is also shown in Table 1. The first group was classified as the group of less developed districts which included six districts viz Pathanamthitta, Alappuzha, Kottayam, Idukki, Kozhikode and Kasaragod. The moderately developed districts included Thiruvananthapuram, Kollam, Wayanad and Kannur. Four districts were classified as highly developed districts viz Ernakulam, Thrissur, Palakkad and Malappuram.

The results of multivariate analysis of variance for three groups (less developed, moderately developed and highly developed), the test statistic and degrees of freedom are presented in Table 2. The value of Wilks's lambda (0.001) was turned out to be significant at five per cent level of significance. Hence the mean vectors of low, moderately and highly developed groups of districts differed significantly. The result of MANOVA was significant indicating that there was considerable difference in level indicators across high, moderate and less developed districts (Johnson and Wichern 2007).

Tests between subject effects were tested by univariate ANOVA and are shown in Table 3. The results indicated that all the indicators considered to carry out MANOVA viz area under paddy and HYV, net sown area , area under total cereals, rainfall, credit flow from RRBs, marine fish landing, fertilizer consumption and

Table1. Composite index and classification of districts

District	Index
Forward districts >(Mean + 1/2SD)	
Palakkad	0.512003
Ernakulam	0.449569
Thrissur	0.417876
Malappuram	0.401871
Moderately developed (Mean - 1/2SD to Mean + 1/2SD)	
Thiruvananthapuram	0.354246
Wayanad	0.327912
Kollam	0.311762
Kannur	0.310917
Less developed <(Mean - 1/2Sd)	
Kasaragod	0.305134
Idukki	0.301171
Alappuzha	0.295233
Kozhikode	0.292937
Kottayam	0.292548
Pathanamthitta	0.275416

Table 2. Testing significance of MANOVA (Wilks's lambda)

Effect	Value	F value	df for H	df for E	P value
Wilks's lambda	0.001*	2.929	27	9.404	0.044

*Significant at 5% level

Table 3. Tests between subject effects

Dependent variable	Type III sum of squares	Df	Mean square	F value	P value
Area under paddy	8.656E9	3	2.89E + 09	5.159	0.018
Area under HYV	1.779E10	3	5.93E + 09	5.212	0.018
Net sown area	3.230E11	3	1.08E + 11	59.219	0
Total Cereal area	8.711E9	3	2.90E + 09	4.675	0.024
Rainfall	1.819E8	3	6.06E + 07	12.754	0.001
RRB credit	549692.660	3	183230.9	4.681	0.024
Marine fish landings	7.579E11	3	2.53E + 11	3.75	0.045
Fertilizer consumption	3.422E9	3	1.14E + 09	20.419	0
Coastal line (%)	724.804	3	241.601	5.955	0.012

percentage of coastal line were significantly different across three categories of districts. This means that these factors significantly affected the development of agricultural sector across the districts in the state (Ayyoob et al 2013). Among the indicators the net sown area, fertilizer consumption and rainfall were significant at one per cent and remaining variables were significant at five per cent level of significance. All the indicators were significantly different which means that these indicators contributed differently to developmental process across three categories of districts. Hence it can be inferred that an improvement in these indicators in less developed and moderately developed districts would help them to come forward in the process of development. Enhancement in cereal area, area under paddy and RRB credit might help to reduce the intra-regional disparity in the state and to bring underdeveloped and medium developed districts to the level of highly developed districts in the pace of agricultural development (Ayyoob et al 2013). RRB credit shows significant contribution in the level of development. Hence the advancement of more credits in agricultural sector in less and moderately developed districts would enhance them to move forward in the pace of development and then to reduce the regional inequality (Chakraborty 2009).

The rainfall and percentage of coastal line are the natural causes of the development but the judicial planning of the uses of other resources like cropping area, cropping pattern etc would help to bring the developmental process in a forward direction (Narain et al 1994).

The marine fish landing showed significant effect in the pace of development (Ayyoob et al 2013). Hence an increase in fish capture in coastal area districts belonging to less developed and medium developed districts might bring them forward in the agricultural sector. There is need to readjust these factors especially in districts that fell in less developed category to enhance the agricultural development in the state.

CONCLUSION

Even though the total geographical area of the state is so small there was wide inequality in the pace of development. The different factors affecting the agricultural development were identified as net sown area, area under paddy and HYV, marine fish landing, rainfall, RRB credits etc. An enhancement in these factors can bring the low developed districts to developed state. High emphasis should be given to increase area under paddy cultivation in the state which is crucial factor in improving agricultural development in majority of the districts. There is a need to prepare detailed sectoral plan at district level for better utilization of available resources to achieve desired growth and to bring uniform development within the state.

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