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Disparities in Agriculture Development of Haryana: An Analysis of Inter-district variations

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Abstract:

India remains one of the largest agriculture producer globally even after seventy eight years of independence. Regional disparity of development in India continued to remain a serious problem regardless of the regional and economic planning effort by the state as well as central Government. Haryana is a small state in terms of geographical area (44212 Sq Km) which is 1. 3 percent of the total geographical area of India but still it contributes 3.7 percent to the national Gross State Domestic product of India.with this backdrop in, the present study is attempt to analyze the inter-district variations in agriculture development as district wise analysis is very essential in assessing the progress of agriculture development in Haryana.The present study is based on cross -sectional data and analyzed the data on agriculture variables for the year 2021-22. Twelve indicators have been used to achieve the objective of the study. Composite index of agriculture development for twenty one districts of Haryana has been constructed with the help of PCA. The findings of the study indicated that wide disparities in agriculture development indicators found in the districts of Haryana. District Srisa of the Haryana State topped the ranking with an index value of .985 which indicates that Srisa is the most developed district in terms of agriculture development. Sirsa district ranked first followed by Hisar, Bhiwani, Jhejjar and Karnal (ranking, second, third, fourth and fifth respectively).

I. Introduction: India's economy has consistently been one of the fastest growing economies of the world and achieved a impressive growth in recent past. India remains one of the largest agriculture producer globally even after seventy eight years of independence. There are many success stories of agriculture as a powerful engine of growth especially in the development process of third world economies and also helpful in achieving social and economic goals. While share of agriculture sector in India's GDP (Gross Domestic Product) has declined over the years still 45 percent of population of India is engaged in agriculture sector for their livelihood directly or indirectly. It indicates that agriculture continuous to be cornerstone of Indian Economy. The ongoing research in the filed of agriculture found that major challenge faced by agriculture sector is the regional imbalances

which may be attributed to the availability of natural resources, human resources and difference in policy perspectives. The research on agricultural development play an utmost important role to identify the main problems of any region which is appropriate for the indication to the agriculturalist or policy maker to take remedial measures for correcting imbalances in a proper manner *(Ohlan, 2013).* Regional disparity of development in India continued to remain a serious problem regardless of the regional and economic planning effort by the state as well as central Government *(Krishan,, 1992 and Singh 2006).*

Since 1980s, the regional disparities in agricultural growth and productivity has continuous and gradually increases between the underdeveloped and developed states in India (Chand & Chauha, 1999). Policy makers, political leaders, development analysts and other concerned citizens are increasingly attention on the disparities in level of development between different sectors in India. (Bhattachyra and Sakthivel, 2004, Nirvikar et. al, 2003).

The state of Haryana was created on Ist November, 1966 after the reorganization of state of Punjab on linguistic and cultural basis. Haryana is a state in northern India and shares its boarders with Punjab, Himachal Pradesh, Uttarkhand, Rajasthan and Uttar Pradesh. Though Haryana is a small state in terms of geographical area (44212 Sq Km) which is 1. 3 percent of the total geographical area of India but still it contributes 3.7 percent to the national Gross State Domestic product of India (Economic Survey of Haryana, 2022-23). Now days, Haryana emerged as one of the highly economically developed and industrial state of India. It contributes significantly to the national production of wheat, rice, sugarcane which helped India to achieve self sufficiency and major contributor to the *Hari Kranti*. It has a total population of 2.54 crore according to 2011 census and increased by 20 percent compared to 2001 census., Approximately 65.12% of the population of the economy lives in villages. Haryana is among the top ten producers of food grains and stands at sixth place with a total production of 16.38 Million Tones from an area of 4.47 Million Hectares. Further total food grains produced in the state, contribution of wheat and rice was 11.3 and 4.15 Million tons respectively in 2017-18. Haryana is the 4th largest producer of wheat in a country with approximately 12 percent of total wheat production while the state stands at 10th place in total rice production as well as coarse cereals, jowar, bajra are also produced in the state. (Source: Ministry of Agriculture and Farmers' Welfare). Geogrphically the state of Haryana can be divided into four zones: northern, western, central and southern. Southern zone has better irrigation facilities and good overall infrastructure. Western zone is having major area under millet, rapeseed and mustard. This zone is suitable for arid –horticulture. Mewat area is more suitable for agro- forestry, sheep and goat rearing.

Given this background it is very important to analyze, whether all the district of Haryana are equally developed or not in terms of agriculture development. In the present paper attempt has been made to analyze the inter-district variations in agriculture development as district wise analysis is very essential in assessing the progress of agriculture development in Haryana.

This paper has been divided into five sections. Section I provides introduction of the problem . Section II deals with the review of literature. Section III explains the data base and methodology. Section IV highlights the results and discussion and in Section V conclusion of the study has been presented.

II. Review of Literature: Since 1960's number of studies have been carried out to examine the regional variations in agriculture development at the national and international level. Mrutyunjay and Das (2000) analyzed the regional disparities among the districts of Orissa in the pre and post reform period. The study found that districts with good irrigation facilities and plain land perform better in agriculture growth. Narian et al. (1991, 1992, 1994, 1996, 2003 and 2005) studies the level of agriculture developemnt at the district level for the states of Orissa, Andhra Pradesh, Kerela, Uttar Pradesh and Maharashtra. They found that disparities among the different regions prominent, but underdeveloped region did not mean all its indicators were underdeveloped. Gaur (2010) analyzed the inter-state disparities in India for the period 1980-2002 with the help of inequality indices. The study found that there are huge gap between active and vibrant regions of the country. Hasmi and Iqbal (2010) examined the inter-state disparities in Indian Agriculture. The study revealed that agriculture disparity is positively associated with variation in the level of infrastructure , fertilizer consumption and farm mechanism. Devi & Mehala et. al (2016) examined the level of agriculture development of different districts of Haryana with the help of composite Index for the year 2013-14. The findings of the study suggested that the district of Sirsa ranked first and the district of Mahhendgrah in ranked last in the agriculture development among the twenty one districts of the state. Das, Arasikha et.al (2016) analyzed the regional imbalances in the level of agriculture development in West Bengal for the time period of 2009 to 2012. they applied the method of Principal Component Analysis and the method of unequal weight with Beta distribution. They found that regional imbalances being a complex multi-dimensional phenomena. Baig, Imran Ali et.al (2019) examined the regional disparities in agriculture development at the block level in Aligarh districit of Uttar Pradesh during the time period of 2017-18. They used Principal Component analysis and fifteen indicators of agriculture development. The findings of the study demonstrated that three blocks named as Akrabad, Khair and Ganda are most developed blocks in Aligarh districit of Uttar Pradesh.

III. Data Base and Methodology: The present study is based on cross -sectional data and analyzed the data on agriculture variables for the year 2021-22. As we all aware about the fact that development is a multi-dimensional process and it can not be judged by a single indicator. Therefore, 12 indicators have been used to achieve the objective of the study. The selection of variables is based on previous studies conducted to examine the disparities in agriculture development among different regions *(Baig et. al, 2019, Devi et.al 2016).* All the required data has been collected from statistical Abstract of Haryana, Economic Survey of Haryana , Published by Government of Haryana, and Handbook of Statistics of Indian States, Published by Reserve Bank of India. Composite index of agriculture development have been obtained by using the following indicators:

Notation	Indicator
X_1	Area Under Food-grains (in 000 hectares)
X_2	Production of foodgrains
X_3	Net area sown as a percentage to total cultivable area
X_4	Percentage of net irrigated area total Net area sown
X_5	Per hectare consumption of Fertilizers (Tonnes)
X_6	Number of tractors per thousand hectares of net sown area
X_7	Irrigation intensity
X_8	Number of pumps and tube-wells per thousand hectares of net sown area
X_9	Percentage of forest area to total geographical area
X_{10}	Percentage of agriculture workers to total workforce
X_{11}	Agriculture credit by co-operative banks
X_{12}	Average size of operational holdings

A composite index is a comprehensive and simple measure of development by reducing the dimensionality of data. It refers to the aggregation of selected variables into one score. Composite index can be written as follows:

$$\sum_{i=1}^{N} W_i V_i / \sigma_i$$

W_i - Weight of respective variable

V_i= Variable

N= number of variables

Normalization of data is an essential component in the construction of Index as measurement units of different indicators are different. To convert data into a specified range Linear scaling Technique' also known as 'Min-Max' techniques has been used. After normalization of data the selected variables ranged between 0 and 1.

$$Sd_i = \frac{Indicator\ Value - Minimum\ Value}{Maximum\ Value - Minimum\ Value}$$

Further in order to construct composite Index the multivariate statistical technique PCA (principal Component Analysis) has been applied. PCA is mathematically defined as an orthogonal linear transformation that transforms the data to a new coordinate system such that the greatest variance by some projection of the data comes to lie on the first coordinate [called the first principal component (PC-1)], the second greatest variance on the second coordinate, etc (Das et al. 2016).

It is based on the assumption that correlation among the variables has to be higher than 0.30 percent to provide significant results. But if, most of the correlation score near about zero, then method lose its usefulness (Mooi and Sarsteds 2011, Hoque, 2014). To test the valadity of data for PCA analysis KMO measure of Sampling Adequacy and Bartletr's test of Spectrulity has been used with the help of SPSS software.

Manly (1994) suggested the following generalized form of PCA:

$$Z_1 = a_{11}x_1 + a_{12}x_2 + - - - - a_{1n}x_n$$
$$Z_2 = a_{21}x_1 + a_{22}x_2 + - - - - a_{2n}x_n$$
$$Z_3 = a_{n1}x_1 + a_{n2}x_2 + - - - - a_{nn}x_n$$

Z_1, Z_2, Z_3 are the number of extracted principal components.

a_{ij} shows the factor lodgings & X_j represents the indicator on a principal component analysis

IV. Results and Discussion: This section displays the major findings of the study. The correlation among selected indicators has been shown in Table 2. The value of correlation among variables determine that whether the application of PCA will be meaningful or not. It has been observed from the table the correlation between indicators are found to be significant at 1 percent and 5 percent level of significance. Table 2 also gives the summary of KMO Statistic a measure used to verify whether the correlation between variables can be explained by other variables in the data set. The reported findings indicate d that data is suitable for PCA as KMO statistic is higher than 0.50. Bartlett's test statistic also supports the applicability of PCA which is found to be significant at 5 percent level of significance.

Table 2: Correlation Matrix, KMO &Bartlett's test statistic

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
X_1	1.00	-.540	-.213	.131	.726**	.669***	.419	.828**	-.475	.571**	.552**	.348
X_2	.540*	1.00	.412	.245	-.043	-.162	-.206	-.308	.142	.071	.319	.275
X_3	-.213	.412	1.00	.007	.152	-.064	-.242	-.184	-012	.089	.050	.135
X_4	.131	.245	.007	1.00	.293	.061	.429	.295	.179	.122	.558**	.345
X_5	.726	-.043	.152	.293	1.00	.796**	.468*	.766***	-.681**	.845**	.754**	.413
X_6	.669**	-.162	-.064	.061	.796**	1.00	.390	.788**	-.810**	.677	.553**	.468*
X_7	.419	-.206	-.242	.429	.468*	.390	1.00	.395	-.152	.421	.283	.184
X_8	.828**-	-.308	-.184	.295	.766**	.788**	.395	1.00	-.552**	.557**	.601** -.365	.408
X_9	-.475	.142	-.012	.179	.681**	-.810**	.552**	-.152	1.00	-.636**	-.365	-.351
X_{10}	.571	.071	.089	.122	.875**	.677**	.557**	.421	-.636**	1.00	.681**	.094
X_{11}	.552**	.319	.050	.558**	.754**	.553**	.601**	.283	-.365	.681**	1.00	.208
X_{12}	.348	-.275	.135	.345	.413	.468*	.184	.184	-.351	.094	.208	1.00

KMO and Bartlett's Test		
Kaiser -Meyer-Olkin Measure of Sampling Adequacy	KMO Measure	.663
	Approx. Chi Square	159.4
	df.	66
Bartlet's Test of Sphericity	Sig.	.000

*Source: Author's calculation using SPSS, ** &* indicates that values are significant at 5% & 1 % respectively*

According to the PCA technique factors with eigen values greater than one were extracted . from the findings of Table 3 it is clear that only four components have the eigen values greater than 1 (4.986, 2.017,1.603, 1.097) and thus 12 indicators are reduced to four set of components. In order to get clear picture about retained components rotation has been performed .Results indicate that there are four component with eigen values 4.538,1.961.1.898 and 1.307 which are different from initial eigenvalues but their total is same as the initial eigen values have. Cumulatively these components explain 80.86 percent of variation which are above the suggested percentage which is 60 percent *(Gorsuch, R. (1983), Cox & Dale (2001), Majors & W.E Sedlacek (2001).*

Table 3 displays the loading of four components on the selected indicators in the original dataset. It is observed from the table that first factor explains 38. 1 percent of the inequalities in the agriculture infrastructure of all the districts of Haryana.

Table 3 Rotated Component Matrix

Component				
Indicator	1	2	3	4
X_1	**.825**	-.404	-.165	.109
X_2	-.145	**.887**	.228	-.234
X_3	.109	**.688**	-.215	.360
X_4	.144	.245	**.850**	.172
X_5	**.904**	.183	.212	.111
X_6	**.827**	-.082	.117	-.202
X_7	.162	-.135	**.886**	.026
X_8	**.823**	-.271	.232	.170
X_9	**-.666**	-.082	.228	-.352
X_{10}	**.867**	.297	.046	.137
X_{11}	**.614**	.498	.219	-.164
X_{12}	.170	-.045	.221	**.909**

Bold value indicates the highest factor loading of a variable on components, Source: Authors' calculation using SPSS

It is clear from the above table that most significant factor is the fertilizer consumption (.904) followed by percentage of agriculture workers to total workforce (.867), number of tractors per thousand hectares of net sown area (.827), Number of pumps and tube-wells per thousand hectares of net sown area (.823), Percentage of forest area to total geographical area (-.666) & Agriculture credit by co-operative banks (.614). The second factor accounts for 16.33 percent of total inter-district disparities. It contains indicators such as production of food grains, Net area sown percentage to total cultivable area with factor loading values of (.887,.688) respectively. The third factor explains 15.81 percent of all inter-district

variations in agriculture development. Number of cold storage facilities with a factor loading of .886 is the most significant factor loaded on third component.

Table 4 shows that district Srisa of the Haryana State topped the ranking with an index value of .985 which indicates that Srisa is the most developed district in terms of agriculture development. The district Sirsa has received highest agriculture development score due to the fact that district has largest area under food-grains, highest number of tube-wells and pumps. Sirsa district ranked first followed by Hisar, Bhiwani, Jhejjar and Karnal (ranking, second, third, fourth and fifth respectively).

Table: 4 Composite Index of Agriculture Development

Districit	***Comosite Index***	**Ranking**
Ambala	0.439	11
Bhiwani	0.697	3
Fardibad	0.70	20
Fatehbad	0.611	7
Gurugram	0.130	17
Hisar	0.832	2
Jhejjar	0.694	4
Jind	0.614	6
Kathal	0.522	9
Karnal	0.637	5
Kurukshtera	0.504	10
Mehendragarh	0.107	18
Nuh	0.100	19
Palwai	0.282	15
punchKula	0.060	21
Panipat	0.320	14
Rewari	0.269	16
Rohtak	0.427	12
Sirsa	0.985	1
Sonipat	0.581	8
Yamunagar	0.416	13

Source: Author's calculation using SPSS, in Vertical column (iii), 1st rank represents a relatively better position of a district, while 20th rank represents the worst position of a district in terms of Agriculture Development

As depicted a Table 4, the findings reveal that Panchkula, Fardibad, Mehandraj and Gurugram are ranked 21st, 20th, 19th, 18th respectively with a composite index value of .060 . Puanchkula ranked last out of all the districts. There are two factors contributed for the underdevelopment Puanchkula in terms of agriculture sector. Firstly during the last few

years it has seen rapid growth in its population and secondarily has largest area under forest coverage compared to other districts.

V. Summary and conclusion: From the above discussion it can be concluded that wide disparities in the level of agriculture development have been found in the districts of Haryana. Some districts performed better in agriculture development while some found to be less developed in agriculture development. The findings of the study suggested that there is a need to provide equitable access of credit and insurance to farmers in less developed regions. Government of the state should take initiatives to promote programme that create awareness among the farmers towards the updated technology especially in those districts that have low level of agriculture development. Efforts should be made by the Government to encourage farmers in backward regions to diversify their crops according to region's climate, soil and market demand particularly in rain fed areas of South Haryana. There is a need to establish agriculture research institutions focus on region specific challenges and develop crops and methods suitable for conditions like soil quality, climate and water availability. In underdeveloped districts formation of farmer cooperative societies and self help groups. Government should ensure equitable distribution of subsides in seeds, fertilizers and machinery to the farmers in the more backward districts. Moreover, policies should be made to promote micro- irrigation techniques like drip and sprinkler irrigation in the drier southern districts like Mahendgrah , Bhiwani and Rewari in order to enhance water use efficiency. The government should take proper steps to establish ago-processing industries in backward regions which can create jobs and reduce regions disparities by increasing local income. All these measures will be helpful in promoting agriculture development Haryana and bridging the gap between developed and underdeveloped regions.

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