Spatial Pattern of Agricultural Development in Dharwad District: A Geographical Analysis

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Abstract: ***The purpose of this article is to assess the level of agricultural development in Dharwad district using the Z score technique, which had 15 variables. Agriculture's progress should be assessed not only in terms of output, but also in terms of inputs like fertilizers, improved seed varieties, and irrigation. Agriculture development indicates the effectiveness of a region's agricultural system. Dharwad district is situated in the northwestern part of Karnataka state. It comprises 4263 square kilometers and is surrounded by Belgaum District in the north, Haveri District in the south, Gadag District in the east, and Uttara Kannada District in the southwest. The main objective of this article is to determine the high and low levels of agricultural development in regions. Navalgunda & Alnavar talukas have good facilitated by irrigation, agriculture land holdings, fertilizer consumption, and rainfall. Annigeri, Dharwad, Hubballi & Kalgatagi talukas are need improve proper cropping techniques, appropriate use of agriculture land, & adopt rainwater harvesting techniques. Hubbali Nagara is an urban area which focused on secondary and tertiary economic activities, resulting in a continuous loss of agricultural land and Kundagla taluka's poor irrigation management can lead to a variety of issues such as water loss, water quality degradation, crop failure, soil pollution, and so on.***

Keywords: Agriculture Development, Z score, Composite Standard Score, Crop Intensity, Irrigation Intensity, Agriculture Density,

INTRODUCTION

The word "agricultural development" refers to the growth and overall changes in agriculture that lead to vertical expansion. Agriculture's development should be measured not just in terms of production but also in terms of inputs such as fertilizers, improved seed types, and irrigation (Sharma, 1970). Agriculture development reflects the quality of a region's agricultural system. Agriculture is one of man's most significant pursuits. It offers not only food, but also a large amount of industrial raw materials.

In India, around 58% of the population relies on agriculture for a living. Secondly, 70 percent of poor families are found in rural areas. Third, India's food security is dependent on cereal crop production, as well as boosting fruit, vegetable, and milk production to fulfil the demands of a growing population with rising incomes. The growth of national output is dependent on agricultural development. Agriculture plays a key part in economic development by providing food for the country, increasing exports, transferring labor to non-agricultural sectors and securing markets for industrialization.

Study Area

Dharwad district encompasses 15°02′ to 15°42′ north latitude and 74°43′ to 75°35′ east longitudes. It covers 4263 square kilometres and has a population of 1,847,023 (as of the 2011 census), with a population density of 434 people per square kilometre. The district is bordered by Belgaum District in the north, Haveri District in the south, Gadag District in the east, and Uttara Kannada District in the southwest.

The Malaprabha river (Krishna basin 87%) sub-basin covers the eastern section of Dharwad district, while the Kali river (west flowing river) basin covers the west. Both rivers are non-perennial. The district's main watersheds are the Bennihalla River (Krishna basin) and the Bedthi and Shalmala Nadis (west flowing rivers).

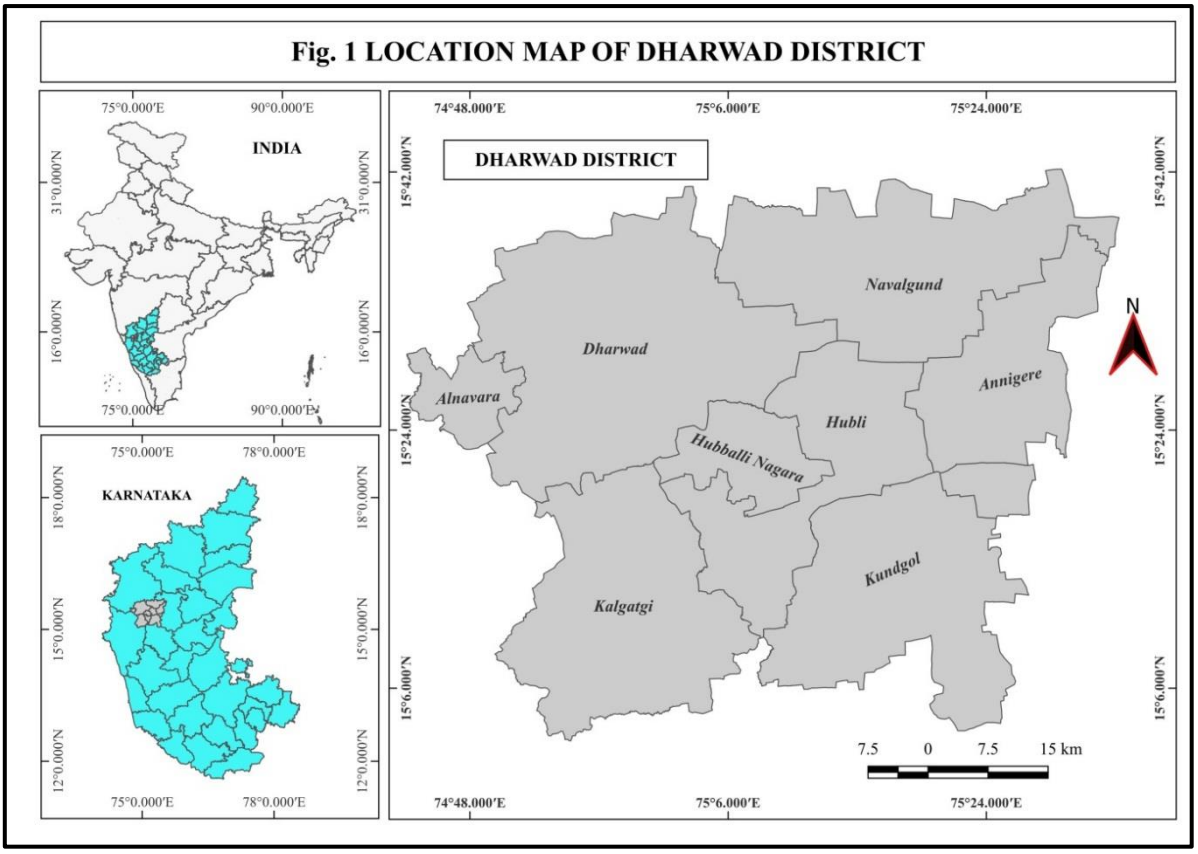


Fig. 1 LOCATION MAP OF DHARWAD DISTRICT

The soils of the Dharwad district are formed from the mixture. Dharwad district soils are composed of by a variety of decomposed material and rocks and they are found across the district. According to the National Bureau of Soil Survey Organization and Land Use Planning, soils are classed as Usterts-Ustalfs and Usterts-Tropepts. Ustrerts are deep black earth. Ustalf soils are classified as high base status red loamy, red sandy, or alluvial. Tropepts are shallow black, brown, and alluvial soils in the southern region. The majority of the district is covered in black soil, followed by brown and red soils. The Navalagund, eastern Hubballi, and eastern Kundagol talukas are all covered in black soil. Brown soil covers the eastern part of Dharwad and the western part of Hubballi talukas. Red soil can be found on hills, slopes, and ridges throughout the district, particularly in the west. (Fig 1)

OBJECTIVES

i. Assess cropping patterns in the research region.
ii. Evaluate regional variations in agricultural development in the study region.
iii. Analyze the variables influencing agricultural development.

DATA BASE & METHODOLOGY

The research is based on secondary sources of information. The data was obtained from the Department of Economics and Statistics in Dharwad, with census data collected from the Census of India website. The district's agricultural development has been calculated using the composite Z-Score technique for the year 2021-22. The levels of agricultural development were assessed using 17 parameters. They are given in table 1.

The present study, all the parameters of agricultural development are analysed using the z-score technique.

1. Z-Score Formula: $Z_{ij} = \frac{X_{ij} - X_i}{\delta X_i}$

[Where: Z_{ij}= Standardize value of the variable *i* in taluka *j*, X_{ij}= Actual value of variable *i* in taluka *j*, X_i= Means value of variable *i* in all the taluks, δX_i=Standard deviation of variables *i* in all taluks.]

To assess overall levels of agricultural development, the results of standard scores gained for all indicators are added taluka-wise and the average is taken for all indicators, which is known as composite standard score (CSS) for each taluka which expressed as;

2. C.S.S. Formula: $C.S. = \frac{\sum Z_{ij}}{N}$

[Where: $C.S$= Composite Score, $\sum Z_{ij}$='z' score of all variables *i* in district *j*, and N= No. of variables.]

A z-score is a statistical measure that reflects how far a data point varies from the distribution's mean. Z-scores may be positive, negative, or zero, and they are interpreted as follows: Positive: The data point exceeds the mean. Negative: The data point falls below the mean. Zero: The data point equals the mean.

Table No 1. Parameters of Agricultural Development

Parameters	Definition of Parameters
X1	Crop Intensity.
X2	Irrigation Intensity
X3	Average size of agriculture land holdings.
X4	Fertilizers consumption in kg per hectare.
X5	Percentage of net sown area to total geographical area.
X6	Percentage of net irrigated area to net sown area
X7	Percentage of cultivators to total workers.
X8	Percentage of agriculture labours to total workers.
X9	Percentage of gross cropped Area to total geographical area.
X10	Average Annual Rainfall (In mm)
X11	Literacy rate.
X12	Chemical Fertilizers Distribution (In Percentage)
X13	Seed Distribution (In Percentage)
X14	Total Livestock (In Percentage)
X15	Agriclture Density

RESULTS AND DISCUSSION

The agricultural development indicates optimum use of existing land resources with the help of scientific agricultural practices and the applications of modern inputs. The final results are outcome from table no. 2 & 3 is that agricultural development in the taluks of Dharwad district. The main objective of agricultural development is usually to increase the output per hectare.

Agriculture Development Regions

The agricultural development of Dharwad is identify with the help of 15 indicators, they have been cauterised into three groups which is seen in table no. 4 & fig 2.

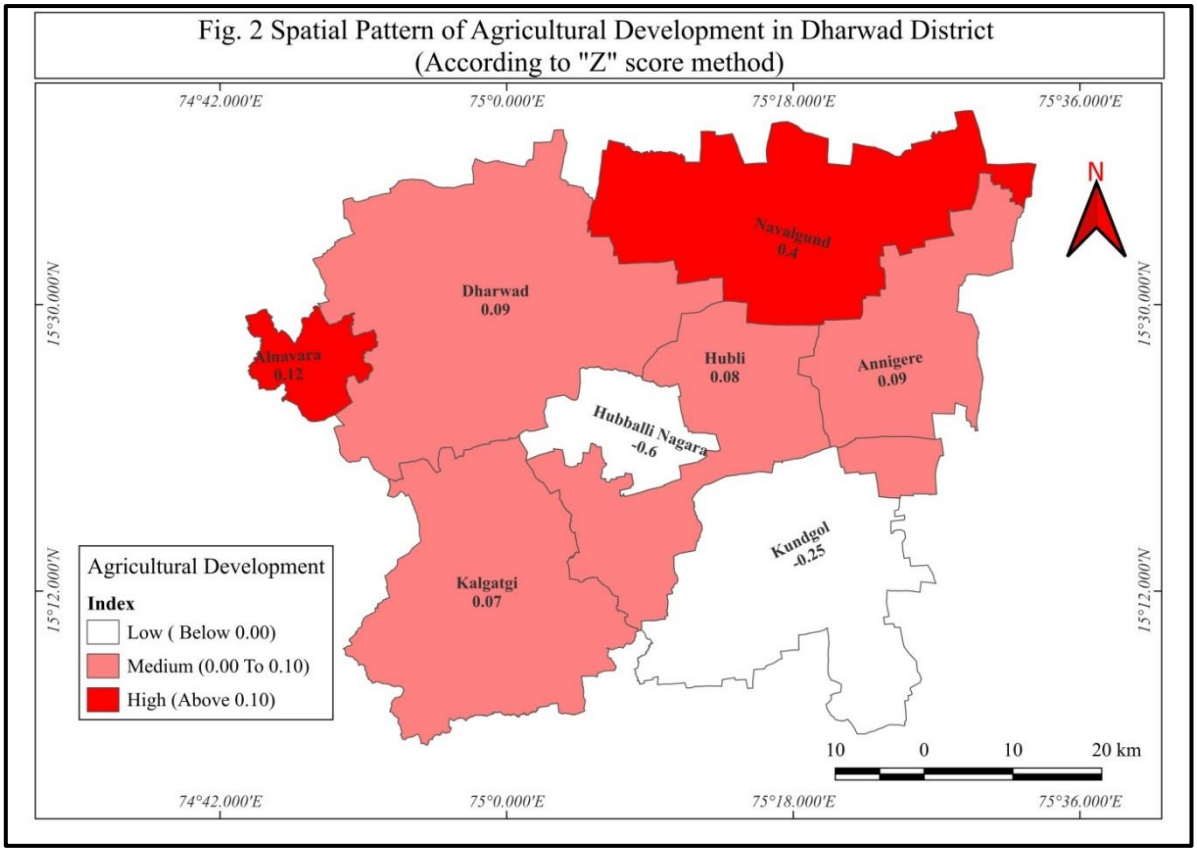
Table No.4 Spatial Classification of Agricultural Development in Dharwad District

Sl. No	Index	Range	Talukas
1	Low	Below 0.00	Kundagol & Hubballi Nagara
2	Medium	0.00 - 0.10	Annigeri, Dharwad, Hubballi & Kalgatagi
3	High	Above 0.10	Navalgunda & Alnavar

Source: Personal Computation.

High agricultural development has identified in Navalgund and Alnavar because of irrigation intensity, agriculture land holdings, fertilizers consumption, net sown area, and rainfall are positively support to develop these areas.

Medium development talukas are Annigeri, Dharwad, Hubballi & Kalgatagi talukas well in crop intensity, agriculture land holdings, net sown area, fertilizers and seed distribution and need to concentrate on right irrigation method, proper use of fertilizers and Harvest rainwater. Low development talukas are Kundagol & Hubballi Nagara. Here Hubbali Nagara is the urban area which is more concentrate on secondary and tertiary economic activities. But agriculture development can be achieved through right irrigation method, use of HYV seeds, sustainable agriculture, water conservation and rural development.



CONCLUSION

The agricultural development confirms that, it is not homogeneous among the all taluks of Dharwad district. The main concept of this article is to find out the high and low levels of agricultural development regions. High agricultural development areas have good facilitated by irrigation, agriculture land holdings, fertilizer consumption, and rainfall. Medium development talukas need enhance good crop techniques, proper use of agriculture land, & harvest rainwater. Hubbali Nagara is the urban area which is more concentrate on secondary and tertiary economic activities which leads to a continuous loss of agricultural land and Kundagla taluka facing poor irrigation management it can lead to a number of issues, including water loss, water quality degradation, crop failure, soil pollution etc.

Table No.2 Taluka Wise Agricultural Development Parameters.

Sl. No	Talukas	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
1	Alnavar	128.35	43.50	1.96	400.56	53.80	55.84	27.40	32.89	69.06	1267.00	74.46	7.02	0.37	1.61	0.94
2	Annigeri	181.67	10.20	2.48	54.05	93.17	14.83	37.39	44.54	169.27	650.00	76.25	7.28	7.29	8.69	0.39
3	Dharwad	149.53	11.51	1.99	71.69	77.23	17.05	16.75	20.90	115.48	776.00	81.01	16.98	41.14	27.22	0.45
4	Hubballi	143.03	6.93	2.12	262.54	84.52	7.31	32.64	41.52	120.89	771.00	73.68	36.63	11.23	10.55	0.50
5	Hubballi Nagara	124.47	8.46	1.78	313.45	63.28	7.62	2.67	4.39	78.77	745.00	86.47	9.02	6.26	7.93	0.53
6	Kalgatagi	202.15	25.46	1.78	40.51	59.48	31.49	36.03	42.38	120.23	978.00	68.81	6.91	12.28	15.38	0.71
7	Kundagola	139.34	1.82	2.07	34.30	90.59	1.17	32.38	49.49	126.23	661.00	74.50	5.79	11.03	12.91	0.45
8	Navalgunda	182.73	29.95	2.60	41.38	95.47	41.82	39.95	42.45	174.46	630.00	73.66	10.36	10.40	15.70	0.37
	Mean	156.41	17.23	2.10	152.31	77.19	22.14	28.15	34.82	121.80	809.75	76.11	12.50	12.50	12.50	0.54
	SD	26.81	13.33	0.28	139.03	15.32	17.89	11.75	14.11	34.86	201.30	5.02	9.70	11.41	7.01	0.18

Source: Dharwad District At A Glance 2021-22.

Table No.3 Z-Score and Composite Standard Score (C.S.S) Calculation.

Sl. No	Talukas	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	SUM	C.S.S
1	Alnavar	-1.05	1.97	-0.49	1.79	-1.53	1.88	-0.06	-0.14	-1.51	2.27	-0.33	-0.56	-1.06	-1.55	2.23	1.86	**0.12**
2	Annigeri	0.94	-0.53	1.37	-0.71	1.04	-0.41	0.79	0.69	1.36	-0.79	0.03	-0.54	-0.46	-0.54	-0.83	1.42	**0.09**
3	Dharwad	-0.26	-0.43	-0.37	-0.58	0.00	-0.28	-0.97	-0.99	-0.18	-0.17	0.98	0.46	2.51	2.10	-0.52	1.31	**0.09**
4	Hubballi	-0.50	-0.77	0.09	0.79	0.48	-0.83	0.38	0.47	-0.03	-0.19	-0.48	2.49	-0.11	-0.28	-0.25	1.27	**0.08**
5	Hubballi Nagara	-1.19	-0.66	-1.14	1.16	-0.91	-0.81	-2.17	-2.16	-1.23	-0.32	2.06	-0.36	-0.55	-0.65	-0.07	-8.99	**-0.60**
6	Kalgatagi	1.71	0.62	-1.14	-0.80	-1.16	0.52	0.67	0.54	-0.04	0.84	-1.45	-0.58	-0.02	0.41	0.91	1.01	**0.07**
7	Kundagola	-0.64	-1.16	-0.09	-0.85	0.87	-1.17	0.36	1.04	0.13	-0.74	-0.32	-0.69	-0.13	0.06	-0.50	-3.82	**-0.25**
8	Navalgunda	0.98	0.95	1.77	-0.80	1.19	1.10	1.00	0.54	1.51	-0.89	-0.49	-0.22	-0.18	0.46	-0.97	5.96	**0.40**

Source: Personal computation.

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