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# Regional Variations and Emerging Concerns in Agricultural Development of Hadauti Region

Dr.Sandeep Yadav<sup>1</sup>, Dr.Zuber Khan<sup>2</sup>, Dinesh Kumar Sharma<sup>3</sup>

Associate Professor, Department of Geography, Govt. College, Bundi, India<sup>1</sup>

Assistant Professor, Department of Geography, Govt. College, Bundi, India<sup>2,3</sup>

**ABSTRACT:** Higher levels of development in the agricultural sector have made a positive contribution to the economic situation and the security of farmers' livelihoods. In India, more than 60% of the people live in villages, and they rely heavily on agriculture for their social and economic welfare. Agricultural development is one of the biggest challenges facing the country's least developed areas, as people in these areas are in poverty in terms of natural resources and socio-economic aspects. The study area Hadauti region has more than 60% of the rural population which mainly depend on agriculture for their livelihoods. In this study, 8 selected indicators processed by the composite index method were used to find the levels in agricultural development in the region. The research uses secondary data sources on various indicators, which are combined into groups, representing the extent of agriculture, fertilizer use and planting intensity, irrigation status, and the availability of tools and modern technologies.

**KEYWORDS:** Agriculture, Irrigation, Disparities, Composite Index, Hadauti

## I. INTRODUCTION

India is an agrarian country. Agriculture is the largest economic activity performed in the world and the biggest use of land by men (Foley, 2011). Agriculture accounts for 26 per cent of the country's GDP. About 70 per cent of the population depends on agriculture for their livelihood, which is why agriculture is called the backbone of the Indian economy. Land is the resource that is the necessity for human beings. Man uses and exploits it under changed conditions. Science and technology have made amazing changes in nature and human relations and activities. Vegetation sites have been converted into vegetationless, non-tribal areas in population, mountains, mines, river valleys into industrial areas. All this is the result of the strong development of the cultural environment of human beings.

Population and land resources have interdependent relations. Today, because of the increasing population, the gap between population and resources is increasing day by day. Thus, the supply of foodgrain requirements of the growing population is a problem with limited land resources. To address this problem, many geographers have submitted development plans to meet the purpose. Based on the state concept, the subject elements can be identified and studied on the earth's surface. The concept of the region helps in organizing and arranging the information received. The vision is not the creation of nature but the concept of the brain of geographers.

There is regional difference in climate, height, soil, population, social and economic structure on the earth's surface, so it is natural to find regional differences in agriculture as well. After the Green Revolution, due to scientific and technological development, agriculture progressed a lot, resulting in promotion of human life, however, there were huge disparities in these changes in different parts which led to regional imbalances.

## II. STUDY AREA

Study area is located in the south-eastern part of Hadauti Plateau in Rajasthan, between 24°25'N to 25°51'N North latitudes and 75°15'E to 76°45'E East longitudes. The total geographical area of this state is 14481.6 square kilometers. The east to west length of the region is 155 km and north to south length is 180 km. This region includes the entire Bundi district, the entire Kota district except Ramganj Mandi tehsil, the entire Baran district except Chhabra Kishanganj and Shahbad tehsils and Khanpur tehsil of Jhalawar district. There are 15 tehsils in this region, in which there are 2278 inhabited villages and 19 towns, the main ever flowing river of this region is Chambal, whose tributaries are Kali Sindh, Parvan, Parvati and Mej. The climate here is semi-arid and sub-arid. Agriculture is the main occupation of the population here. Hadauti Region is an important industrial and agrarian region in the State of Rajasthan.



III. METHODOLOGY

The data has been collected as per the framework and objectives. This study is conducted at the block level. As mentioned above, the district comprises of 15 tehsils, and 14 blocks, therefore, a block is a viable unit of analysis. Data at the block level is easily available from government sources, therefore, chosen as a viable scale of study. In the present study, from a wide range of indicators, 8 indicators have been selected to reflect the agricultural development. Various secondary data used in the research work has been analysed by table, map, and statistical methods. we have applied “Kundu’s method of normalization of data through calculation of composite index” (Kundu, 1975). At the block level, the information on 8 indicators is computed. The composite index method has been used to determine the level of agricultural development.

IV. RESULTS AND DISCUSSION

Indicators of Agricultural Development

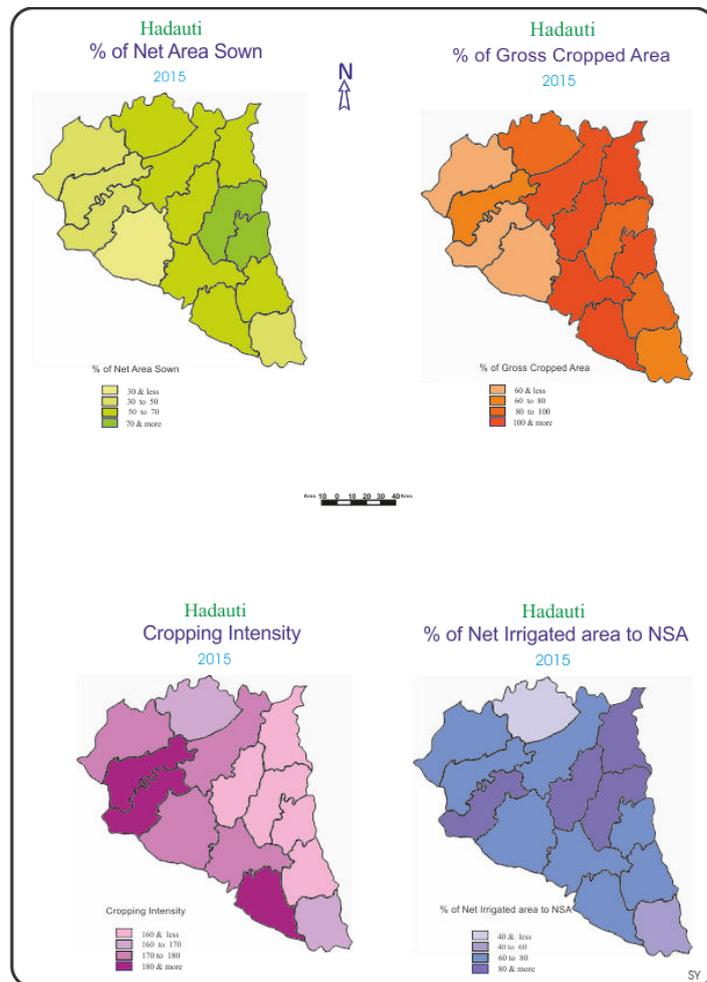
All the chosen indicators, to measure the overall status of agricultural development, are discussed below:

Percentage of Net Area Sown

The totalNSA of the region is 54.62 percentage. It ranges from 78.24 percent (Baran) to 25.32percent in Ladpura. Two blocks that have a very high percentage of the NSA are Baran and Anta both located in the eastern part of the Hadauti region. Here wheat and rice crops are dominantly grown by the local farmers. The northern and southwestern parts have moderately high percentage of NSA while Ladpura block in the western part of Hadauti have lowest 25.32 percentage of NSA (Map 2).

Percentage of Gross Cropped Area

The percentage of Gross cropped area(GCA) has an average of 88.54 in the region. It ranges from 110.08 percent in Khanpur to 43.94 percent in Ladpura. Six blocks Keshoraipatan, Sultanpur, Itawa, Sangod, Baran and Khanpur have over 100 percent of GCA. While Talera, Ladpura and Hindoli have less than 60 percent of GCA. This is due to plateau terrain in Talera and Ladpura while undulating hilly tracks of Hindoli block (Map 2).



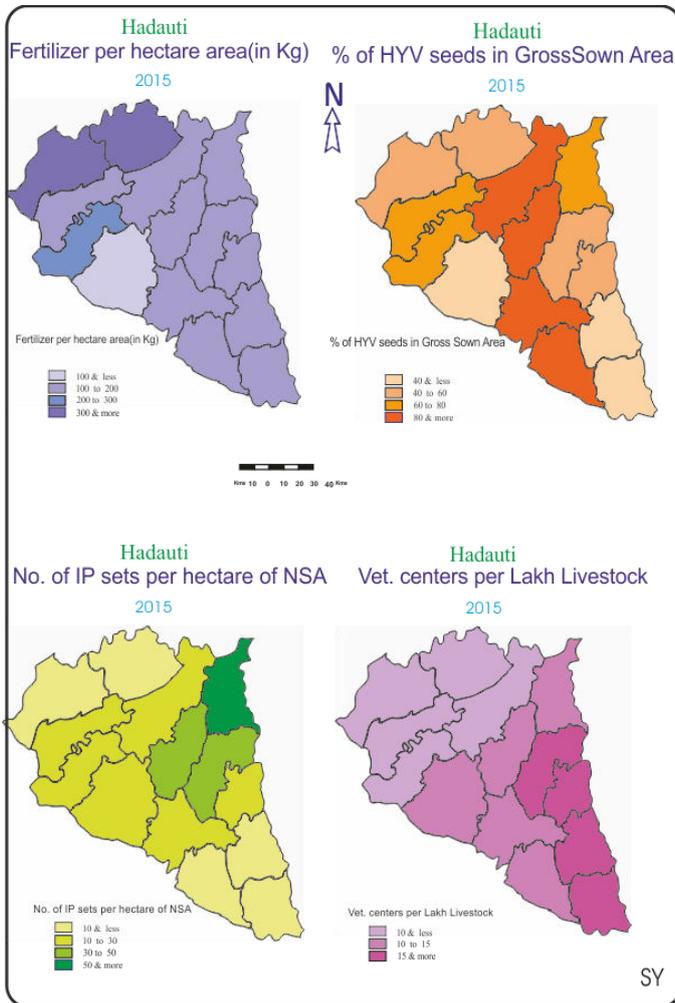
Map 2

Cropping Intensity

The cropping intensity of the Hadauti region is 165.81 which ranges from 187.94 in Talera to 137.29 in Anta block. Three blocks of Talera, Khanpur and Bundi have over 180 percent of cropping intensity. The entire eastern region comprising of five blocks have less than 160 percent of cropping intensity. The eastern part sows comparatively less crops in their fields as other parts of the region (Map 2).

Percentage of Net Irrigated area to NSA

The percentage of net irrigated area to NSA of the Hadauti region is 71.70 which ranges from 31.42 in Nainwan to 88.12 in Sultanpur block. Eight blocks have more percentage of net irrigated area than the region’s average while six blocks have less percentage of net irrigated area than the regions average(Map 2).



Map 3

**Fertilizer per Hectare of area**

Fertilizers are used for enhancing productivity and production. It was found that per hectare average consumption of chemical fertilizers in Hadauti region is 202.18 Kg per hectare which ranges from 614.4 Kg in Nainwan to 66.57 Kg in Ladpura. Overall, high consumption of chemical fertilizers is found in northern parts of the district than in the east. Higher consumption of fertilizer is attributed to the fact of high cropping intensity. High cropping intensity reduces soil fertility which makes it necessary to use fertilizer to keep the soil productive. Therefore, it poses a great challenge to the farmers to keep the soil sustainable for the future (Map 3).

**Percentage of HYV in GSA**

The percentage of High Yielding Varieties (HYV) in gross cropped area varies from 98.88 in Khanpur to 37.59 in Ladpura. The southeastern parts and western parts of the region have lowest use of HYV in GSA. The use of irrigation and that of fertilizer is also low in this area which are essential for HYV as per green revolution (Map 3).

**Number of Irrigation Pump sets per hectare of NSA**

The number of IP sets per hectare of net sown area has an average of 19.16 in Hadauti region which varies from 2.94 in Chipabarod to 79.42 in Itawa. The figures match the data of percentage of net sown area. The northern and southern parts of the region have low numbers of IP sets per hectare of NSA (Map 3).

**V. LEVELS OF AGRICULTURAL DEVELOPMENT**

The Statistical Method of composite Index (Kundu, 1975) has been used for agricultural regionalization of the study area. In this method, the mean price is subtracted from the actual value and divided by the standard deviation. Thereafter, collective indices are obtained by dividing their sum by the total number of variable values. The variable pattern in agricultural land use has been done by analysing the variable values and thus forming regions. To assess the relative levels of development of the 14 blocks in Hadauti region, we selected 8 indicators of agriculture development which are displayed in Table 1. Indicators taken for study are:

- Y = Average of all indicators
- $X_1$  = % of Net Area sown
- $X_2$  = % of Gross cropped area
- $X_3$  = Cropping intensity
- $X_4$  = % of Net irrigated area to Net Sown Area
- $X_5$  = Fertilizer per ha of area
- $X_6$  = % of High Yield Varieties in Gross Sown Area
- $X_7$  = No. of Irrigation Pump sets per ha. of Net Sown Area
- $X_8$  = Vet. Centres per lakh livestock

Table 1 Agriculture Variables in Hadauti Region

Blocks	Average	% of Net Area sown	% of Gross cropped area	Cropping intensity	% of Net irrigated area to NSA	Fertilizer per ha of area	% of HYV in GSA	No. of IP sets per ha of NSA	Vet. Centers per lakh livestock
Bundi	80.50	43.85	79.12	180.45	75.2	181.71	63.89	15.4	4.37
Hindoli	105.24	34.34	59.82	174.2	66.11	446.25	51.03	4.84	5.36
Nainwan	129.66	57.51	97.69	169.86	31.42	614.4	54.21	9.6	2.57
K.Patan	85.05	57.26	101.36	177.02	69.48	167.47	86.21	12.87	8.74
Talera	81.61	31.31	58.85	187.94	86.77	203.27	66.3	14.09	4.37
Khanpur	80.71	60.28	110.08	182.62	69.3	102.35	98.88	8.44	13.74
Itawa	93.32	68.45	103.76	151.6	80.79	175.38	74.38	79.42	12.79
Sultanpur	92.12	68.23	104.21	152.74	88.12	175.54	93.06	44.78	10.3
Ladpura	55.68	25.32	43.94	173.48	74.88	66.57	37.59	10.87	12.77
Sangod	87.26	62.03	109.8	176.99	75.3	160.71	87.51	12.92	12.8
Baran	81.67	78.24	109.13	139.48	72.22	158.57	52.95	13.9	28.88
Anta	78.65	72.47	99.5	137.29	87.25	135.57	41.68	30.43	24.99
Atru	72.56	59.99	91.5	152.51	69.88	132.23	38.86	7.71	27.78
Chipabarod	63.33	45.37	74.93	165.15	57.13	110.46	26.94	2.94	23.75
Mean	84.81	54.62	88.84	165.81	71.70	202.18	62.39	19.16	13.80
sd	17.790	16.169	21.772	16.266	14.509	147.353	22.822	20.447	9.043
cv	20.976	29.604	24.508	9.810	20.235	72.883	36.579	106.728	65.529

We have used coefficient of variation to observe the level of disparity regarding selected indicators. As may be seen from Table 1, the coefficients for the first four indicators are very low and are between 0 and 25 percent, indicating negligible level of disparities, but remaining four varies between 25 and 110 percent thus indicating significant level of disparities.

Table 2 Correlation Matrix 2015

	Y	X1	X2	X3	X4	X5	X6	X7	X8		Ua2	(Ua2) <sup>2</sup>
Y	1	0.228	0.316	0.047	0.484	0.903	0.295	0.151	0.538		10.711164	114.729
X1	0.228	1	0.933	0.708	0.094	0.098	0.307	0.439	0.498		19.504317	380.418
X2	0.316	0.933	1	0.413	0.016	0.046	0.543	0.338	0.287		21.247747	451.467
X3	0.047	0.708	0.413	1	0.193	0.149	0.322	0.444	0.726		7.555061	57.079
X4	0.484	0.094	0.016	0.193	1	0.668	0.273	0.458	0.160		2.5934638	6.726
X5	0.903	0.098	0.046	0.149	0.668	1	0.063	0.133	0.538		1.313978	1.727
X6	0.295	0.307	0.543	0.32	0.27	-	1	0.312	-		16.26681	264.609



				2	3	0.06			0.43		3	
				-	-	-			-			
X7	0.151	0.439	0.338	0.44	0.45	0.13			0.02		12.81642	
				4	8	3	0.312	1	8		3	164.261
X8	-			0.72	0.16	0.53			-		0.527733	
	0.533	0.498	0.287	6	0	8	0.433	0.028	1		6	0.279
Ua <sub>1</sub>				-	-	-			-			
	1.923	2.693	2.943	0.96	0.62	0.50			0.31			1441.29
				7	4	5	2.556	2.093	1			4
Ua <sub>1</sub> <sup>2</sup>				0.93	0.38	0.25			0.09	32.19		
	3.698	7.254	8.660	5	9	5	6.531	4.380	7	9	5.674	
Va <sub>1</sub>				-	-	-			-			
	0.339	0.475	0.519	0.17	0.11	0.08			0.05			
				0	0	9	0.450	0.369	5			
NF <sub>1</sub>												
=	5.674											
NF <sub>2</sub>												
=	37.96			or (NF <sub>2</sub> ) <sup>1/2</sup> =	6.16					Eigen value = 37.946		
F <sub>1</sub>				-	-	-			-			
=Va <sub>1</sub> xNf <sub>2</sub>	2.088	2.924	3.195	1.05	0.67	0.54			0.33			
<sup>1/2</sup>				0	7	8	2.774	2.272	8			
F <sub>1</sub> <sup>2</sup> =				1.10	0.45	0.30			0.11	37.94		
	4.358	8.549	10.20	2	8	1	7.697	5.161	4	6		
Eigen Vector W	12.85	18.01	19.67	-	4.17	3.37	17.09	13.99	-			
	9	1	9	6.46	1	8	0	5	2.08			
				6					0			

While the coefficient of variation just reflects the relative extent of disparities regarding individual indicators, it does not tell us anything about the position of individual blocks about agriculture levels of development. The method of 'First Principal Component' has been used to develop the composite index (Table 3) required for the study.

**Table 3 Composite Index of Hadauti Region**

	Y	X1	X2	X3	X4	X5	X6	X7	X8	C.I.
Bundi	-3.118	-11.994	-8.781	-5.820	1.005	-0.469	1.122	-2.572	2.169	<b>-28.458</b>
Hindoli	14.769	-22.587	-26.225	-3.336	-1.608	5.595	-8.508	-9.800	1.941	<b>-49.758</b>
Nainwan	32.417	3.221	8.004	-1.610	11.581	9.450	-6.127	-6.542	2.583	<b>29.815</b>
K.Patan	0.173	2.943	11.321	-4.457	-0.639	-0.796	17.835	-4.304	1.164	<b>23.241</b>
Talera	-2.313	-25.962	-27.102	-8.798	4.331	0.025	2.926	-3.469	2.169	<b>-58.191</b>
Khanpur	-2.964	6.307	19.202	-6.683	-0.691	-2.289	27.323	-7.336	0.014	<b>32.884</b>
Itawa	6.151	15.407	13.490	5.649	2.612	-0.614	8.977	41.246	0.232	<b>93.150</b>
Sultanpur	5.285	15.162	13.897	5.195	4.719	-0.611	22.965	17.537	0.805	<b>84.954</b>
Ladpura	-									-
	21.060	-32.634	-40.578	-3.049	0.913	-3.109	-18.572	-5.673	0.237	<b>123.525</b>
Sangod	1.768	8.256	18.949	-4.445	1.034	-0.951	18.809	-4.269	0.230	<b>39.381</b>
Baran	-2.270	26.312	18.344	10.467	0.148	-1.000	-7.070	-3.599	-3.468	<b>37.864</b>
Anta	-4.456	19.885	9.640	11.337	4.469	-1.527	-15.510	7.715	-2.573	<b>28.981</b>
Atru	-8.858	5.984	2.409	5.287	-0.524	-1.604	-17.621	-7.835	-3.215	<b>-25.978</b>
Chipabaro	-									-
d	15.525	-10.301	-12.568	0.262	-4.190	-2.103	-26.547	-11.100	-2.288	<b>-84.360</b>

The agricultural value was determined to calculate the collective index based on the above variable values and the collective index has been calculated from it.

### Highly developed agricultural region

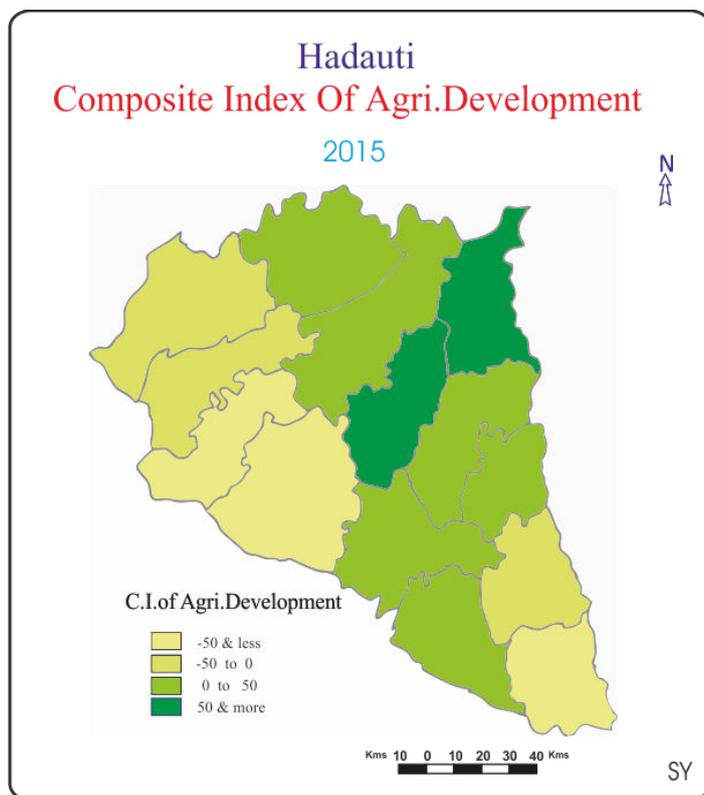
Itawa and Sultanpurblocks of Hadauti come under this category. In this regard, the value of composite index of various agricultural variables is more than 50. There is a high proportion of agriculture land, improved varieties of seeds, chemical fertilizers, power pumps, etc. The irrigated area has a high proportion of the region. The highest position of this purpose in terms of power pumps, diesel engines indicate improved irrigation system and mechanization here. The level of agricultural development of this area is of a very advanced quality as compared to the entire region (Map 4).

### Medium developed agricultural region

Nainwan, Keshoraipatan, Anta, Baran, Sangod and Khanpur blocks come under this category. In this regard, the value of composite index of various agricultural variables falls between 0 and 50. There is a medium ratio in terms of net sown area, high use of improved varieties of seeds, and chemical fertilizers. The level of change in land use of this area is moderate in the region.

### Low developed agricultural region

Hindoli, Bundi and Atru blocks come under this category. (Map 4) The value of composite index of various agricultural variables in these blocks is between 0 to -50. The percentage of net sown area, use of improved varieties of seeds, use of chemical fertilizers, irrigated area, power pump, etc. are comparatively less in these blocks. The irrigated area is less than the production and agriculture is mostly dependent on rainfall.



Map 4

### Very low developed agricultural region

Ladpura, Talera and Chipabarod blocks come under this category. The value of composite index of various agricultural variables in these blocks is less than -50. There is a moderate ratio in the number of the power pumps while the rest of the agricultural variables has a low ratio. The main reason for having a medium ratio in power pumps is electrification of villages and towns in these blocks. The low ratio is because Ladpura block has a highly urbanized area and most of the block has Mukundara hills, while Talera and Chipabarod have a plateau region thus making them less suitable for agriculture.

## VI. CONCLUSION

The above analyses clearly explain the variations in agricultural development with the help of selected indicators. Based on the selected indicators like net sown area, cropping intensity, fertilizer consumption, irrigation and modern technology, the agricultural development is identified at the block level in the Hadauti region of Rajasthan. Finally, it can be said that different forms of agriculture develop due to variation in natural environment and variation in technical development levels. Unbalanced agricultural land use has led to regional disparities. As a result, the rich have become richer, and the poor have become poorer. At the same time, many social and political problems have arisen. Therefore, to identify the advanced and backward areas, it is necessary to assess the regional disparities in the agricultural land use level. So that necessary concrete steps can be taken for utilization of balanced agricultural land.



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