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in Odisha*

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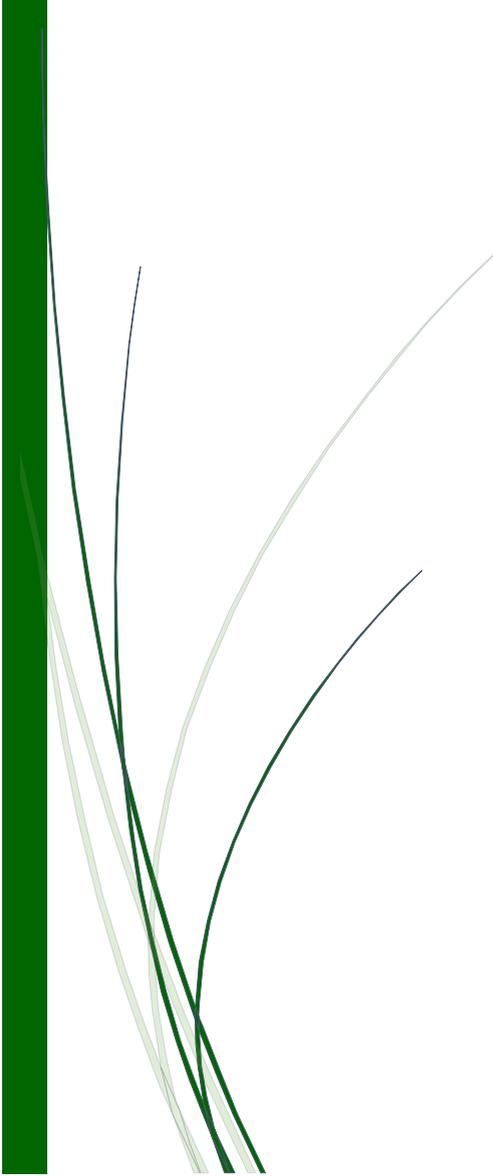
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 C A R A S

# Spatial Pattern of Agricultural Development in Odisha

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## ABSTRACT

The agricultural development of a region can be evaluated and quantified with the association of various agricultural attributes relating to physical, social, economic, technological, and organizational production system and so on. Thus, the development refers to a qualitative improvement of all the attributes of the agriculture. The present research paper is an attempt to identify the spatial pattern of agricultural development in Odisha at district level for the period of 2011-12 to 2014-15. Eight variables have been selected for analyzing the spatial pattern of agricultural development in the state. The analysis revealed that the coastal districts of the state have high level of agricultural development and districts of northern and southern Odisha shows less and least developed in terms of agricultural development is concerned.

**Key words:** Agricultural development, Z- score, Composite index of development, Odisha

Agriculture sector is the mainstay of the Indian economy, contributing about 15 per cent of national Gross Domestic Product (GDP) and more importantly, more than half of India's population is wholly or significantly dependent on agriculture and allied activities for their livelihood [1]. Agriculture plays an essential role in the process of economic development of less developed countries like India. Besides providing food to nation, agriculture releases labor, provides saving, contributes to market of industrial goods and earns foreign exchange [2]. Agricultural development is an integral part of overall economic development. The concept of agricultural development may be taken to imply an overall improvement in the quality of agricultural inputs used, agricultural practices performed and agricultural products enhanced in a region. The agricultural development of a region can be evaluated and quantified with the association of various agricultural attributes relating to physical, social, economic, technological, and organizational production system and so on. Thus, the development refers to a qualitative improvement of all the attributes of the agriculture. In short, "development is a "totality" which is to be understood as a multi-dimensional process."

In Odisha, agriculture provides employment opportunities to more than 70 percent of the state population

and more than 80 percent of the production depends on it directly or indirectly. Hence the economy of Odisha is agricultural and cornerstone of its economic development lies in the development of agricultural economy. It is, therefore, imperative that our development plans should continue to give more priority to agricultural development in rural Odisha. The transformation of economic and social conditions of our rural population, which is overwhelmingly dependent on agriculture, has to receive priority and precedence in all schemes of our national development. A well sustained economic development requires continuously expanding production of agriculture so as to meet the requirements of alarmingly growing population.

Regional disparity was existed since the last three decades in the regions of Maharashtra (Western Maharashtra, Konkan, Marathwada, and Vidarbha) out of which Western Maharashtra shows high level of agricultural development in comparison to other regions. The reason for this high level of development is due to increasing agricultural modernization, development of agricultural market and agro-processing industries [3]. Another work by [4] focuses on study of inter block disparity in levels of development of Birbhum district of West Bengal. They have calculated development index by taking 20 indicators by using Z-Score method. Blocks lying in middle part of the study region have high levels of development while the blocks lying on the northern boundary of the district or near to Ghaziabad are agriculturally less developed because of industrialization and due to influence of National Capital Region [5].

Regional disparities have moderated in the post-reform period (1991-1999) because of implementation of backward area development programmes by the government [6-7]. The period 1980-81 to 1992-93 also point to uneven

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performance across districts, the coastal districts and Sambalpur district of western region exhibiting better performance than others [8]. The regional disparity in agricultural development in different districts and zones of Odisha during the benchmark years 1980 and 2000 [9]. 7 out of 30 districts of Odisha have come under the category of backward districts, 8 districts underdeveloped, 6 districts developing and 9 districts in developed categories, showing there by those large regional disparities exist in levels of agricultural development in the State [10].

The aim of this piece of research is to study the spatial pattern of agricultural development in Odisha. Despite the fact that various policies of regional planning have been introduced in India, uneven in agricultural development are still very common at several level (state, district and block). Odisha is one such state having disparities in various aspects of agriculture.

## MATERIALS AND METHODS

Odisha lies between 17° 49' N and 22° 34' N latitude and form 81° 29' E to 87° 29'E longitude on the eastern coast of India, bounded by West Bengal in the northeast, Jharkhand in the north, Andhra Pradesh in the south, Chhattisgarh in the west and Bay of Bengal on the east. It covers an area of 1, 55,707 sq. km, with a coastline of about 480 km on the Bay of Bengal. Odisha is the 9<sup>th</sup> largest state with an area of 155,707 km<sup>2</sup>, and 11<sup>th</sup> largest in terms of population.



Fig 1 Location of study area

The study is mainly based on secondary sources of data for the year (2011-12 to 2014-15) collected for spatial analysis of agricultural development. Agricultural data related to area and production are averaged for 3 years. The district level has been collected from the documentary sources of the Directorate of Economics and Statistics of Government of Odisha that is from the Statistical Abstract of Odisha and Primary Census Abstract, 2011. The list of

selected variable for computing composite index (Z score) in the study are given as follows:

### List of variables used

- X<sub>1</sub>: Percentage of gross cropped area to net sown area
- X<sub>2</sub>: Intensity of cropping (in percent)
- X<sub>3</sub>: Net irrigated area to net sown area (in percent)
- X<sub>4</sub>: Area under food grains to total gross cropped area (in percent)
- X<sub>5</sub>: Area under HYV to total cropped area (in percent)
- X<sub>6</sub>: Consumption of fertilizers kg/ha.
- X<sub>7</sub>: Number of cultivators to total workers (in percent)
- X<sub>8</sub>: Rural literacy (in percent)

To determine the overall levels of agricultural development and its uneven distribution in the study area the data of the all variables have been transformed into indices using Z-score technique for the data (average of 3 years 2011-12-2014-15). Z-Score technique has been explained as follows:

$$Z_{ij} = \frac{X_i - \text{Mean}}{\text{SD}}$$

Where;

Z<sub>ij</sub> = Standard score of the *i*<sup>th</sup> observation

X<sub>i</sub> = Original value of the observation

Mean = Mean for all the values of X

SD = Standard deviation of X

Further, the results of the standard score obtained for different indicators, were aggregated by composite standard score (CSS) so that regional disparities in the levels of agricultural development of districts are obtained on a mean and standard deviation scale. The composite score may be algebraically expressed as

$$\text{CSS} = \frac{\sum Z_{ij}}{N}$$

Where;

CSS = Composite Standard Score,

Z<sub>ij</sub> = Z-score of an indicator *j* in district *i*,

N = Number of indicators.

Mean and standard deviation method has been used for grouping the districts to show the variations in levels of development. After that districts are grouped in to four categories i.e. High, Medium, Low and Very Low. For showing the spatial variation in levels of agricultural development, choropleth map has been prepared with the help of GIS by using Arc GIS-10.02 software.

## RESULTS AND DISCUSSION

### Status of variables of agricultural development

In order to understand the spatial variations in the indicators of agricultural development. The selected 8 indicators are analyzed and presented in the following section.

### Percentage of gross cropped area to net sown area

The Net Sown Area (NSA) and Gross Cropped Area (GCA) during the year 2011-12 to 2014-15 were 52.92 lakh ha and 88.01 lakh ha respectively. The net sown area can be defined as the total area sown in a year. Higher the net sown area, higher will be the crop production and in turn will be reflected in agricultural development. Gross cropped area specify to that net agricultural area on which crops are own more than two times in a year. The higher percentage (more than 200) of gross cropped area to net sown area found in 5 districts namely Jagatsinghpur (203.91), Puri (216.22),

Gajapati (218.52), Deogarh (230), and Cuttack (230.97). The medium percentage (175-200) of gross cropped area to net sown area include 10 districts. The districts are Kandhamal (172.6), Boudh (176.23), Nayagarh (176.42), Khordha (180.45), Angul (180.92), Ganjam (184.11), Dhenkanal (186.87), Kendrapara (189.80), Sonepur (190.98) and Jajpur (196). The low percentage (150-175) of gross cropped area to net sown area found in 11 districts. The districts are Koraput (151.11), Sambalpur (151.75), Keonjhar (152.36), Baragarh (153.19), Bhadrak (153.57), Nabarangpur (157.41), Balasore (159.88), Malkangiri (163.50), Rayagada (166.41), Kalahandi (167.54) and Nuapada (171.60). Very low (less than 150) have only in 4 districts. The districts are Sundergarh (128.81), Jharsuguda (133.96), Bolangir (140.41) and Mayurbhanj (143.05).

#### *Cropping intensity*

The intensity of crop refers to the use of a field several times during a cropping year. It is a measure of land efficiency. This is defined as the extent to which the net area sown is cropped or sown. Higher percentage of cropping intensity found only in four districts. Cuttack (231) is the highest percentage of cropping intensity among 30 districts. The other districts are Puri (216), Gajapati (212) & Jagatsinghpur (204). The medium (180-200) cropping intensity recorded in 7 districts. The districts are Jajpur (196), Sonepur (191), Kendrapara (190), Dhenkanal (187), Ganjam (184), Angul (181) & Khordha (180). Low (160-180) category of cropping intensity found in 9 districts. The districts are Balasore (160), Malkangiri (164), Rayagada (166), Kalahandi (168), Nuapada (172), Deogarh (172), Nayagarh (176), Kandhamal (176) & Boudh (176). There are 10 districts comes under very low (less than 160) category of cropping intensity. The districts are Sundergarh (130), Jharsuguda (134), Bolangir (134), Mayurbhanj (143), Koraput (151), Sambalpur (152), Keonjhar (152), Bargarh (153), Bhadrak (154) and Nabarangpur [11].

#### *Net irrigated area to net sown area*

Irrigation is necessary for almost all kind of agricultural development and pre requisite for the success of modern technology in agriculture. The need of additional and artificial water supply is always felt in successful farming operation. Irrigation plays a significant role in entire agriculture sector. The changing trends in the intensity of irrigation, portrays men's attempt to overcome environmental limitations to transform the potential of the area into agricultural resources. The total irrigated has been calculated as percent of the net irrigated area to net sown area. The high level (more than 65%) of irrigation has been available in only four districts namely Cuttack, Bhadrak, and Puri and Jagatsinghpur. The medium (45-65%) level of irrigation has been found in Khordha (48.56%), Baragarh (50.62%), Dhenkanal (51.13%), Balasore (57.66%), Kendrapara (60.51%) and Sonepur (62.19%). The low level (25-45%) of irrigation has been observed in 14 districts. The districts are Sundergarh (25.68%), Nuapada (26.87%), Keonjhar (28.71%), Koraput (30.80%), Kalahandi (31.69%), Boudh (32.03%), Mayurbhanj (33.66%), Nayagarh (34.65%), Sambalpur (35.80%), Deogarh (36.08%), Gajapati (36.3%), Ganjam (42.06%), Malkangiri (43.14%) and Jajpur (43.52%). There are six districts which come under very low (less than 25%) level of irrigation. The districts are Bolangir (15.56%), Nabarangpur (19.80%),

Jharsuguda (21.01%), Kandhamal (21.88%), Rayagada (23.71%), and Angul (23.74%).

#### *Percentage of area under food grains to gross cropped area*

Area under food grains to total gross cropped area is high in five districts. It is highest in Bargarh (86.38%) district followed by Kendrapara (82.3%), Nabarangpur (81.67%), Bhadrak (80.68%) and Ganjam district. There are 15 districts which fall under medium (70-80%) category. The districts are Jajpur (70.41%), Khordha (71.38%), Sambalpur (72.78%), Sundergarh (73.72%), Jharsuguda (73.86%), Nayagarh (74.30%), Kalahandi (75.12%), Boudh (76.26%), Balasore (76.54%), Nuapada (76.96%), Jagatsinghpur (77.31%), Puri (78.25%), Mayurbhanj (78.69%), Cuttack (78.96%) and Sonepur (79.77%) district. Maximum district comes under this category. Low percentage (60-70%) of area under food grains to total gross cropped area found in seven districts. The districts are Rayagada (62.37%), Angul (62.62%), Dhenkanal (63.95%), Gajapati (64.56%), Koraput (65.77%), Keonjhar (68.32%) and Bolangir (69.50%) district. Very low percentage of area under food grains to total gross cropped area are Deogarh (47.31%), Kandhamal (48.55%) and Malkangiri (56.81%) district [12].

#### *Percentage of area under HYV to gross cropped area*

The high yield variety (HYV) of seeds are the most important factor in agricultural production under the new technique. The success of this programme has revolutionized agriculture and brought about a phenomenal and rapid increase in the food grain production in India and Odisha. The coverage under high yielding varieties crops grown during (2011-12 to 2014-15) is 36.19 lakh hectare. The area under high yielding varieties of seeds in different districts of the state are categorized into four groups. In high category (more than 50%) there are five districts namely Sambalpur (50.50%), Bhadrak (55.48%), Nabarangpur (56.82%), Sonepur (59.31%), Balasore (59.83%) Bargarh (68.19%). Eight districts have been falling in medium category (40-50%). The districts are Kalahandi (40.13%), Puri (40.76%), Jagatsinghpur (41.3%), Ganjam (41.27%), Keonjhar (43.9%), Mayurbhanj (45.53%), Boudh (46.15%) and Jharsuguda (46.99%). There 12 districts under low category. The districts are Koraput (30.07%), Malkangiri (30.81%), Gajapati (31.48%), Nayagarh (32.13%), Sundergarh (32.52%), Nuapada ((34.22%), Kendrapara (34.60%), Dhenkanal (34.97%), Jajpur (35.60%), Khordha (35.71%), Bolangir (36.31%) and Cuttack (36.81%). Remaining four districts are under very low level (less than 30%) are Kandhamal (12.53%), Rayagada (26.48%), Deogarh (28.71%) and Angul (29.36%).

#### *Fertilizer consumption*

For improving the yield rate timely and adequate provision of inputs like fertilizer, HYV seeds and insecticides is of prime importance. Chemical fertilizers have played their crucial role in increasing food grain production and solving the problem of low yield in India. Due importance is being given on use of balanced fertilizers in line with Integrated Nutrient Management (INM) principles, which not only enhances production but also maintains the fertility of the soil. High levels of consumption of fertilizers (more than 70 kg/hectare) have been recorded in 7 districts namely Khordha (73.21kg.), Jharsuguda (89.41kg.), Balasore (117.4kg.), Bhadrak

(121.25kg.), Baragarh (127.92kg.), Sambalpur (139.37kg) & Nabarangpur (175.48kg.). There are 6 districts having medium level (50-70) of consumption of fertilizer; Mayurbhanj (50.29kg), Jajpur (54.5kg.), Ganjam (55.41kg.), Kalahandi (57.43kg.), Cuttack (68.04kg.), Puri (69.34kg.). The low level of (30-50kg.) fertilizer consumption recorded in 14 districts of the state, namely Keonjhar (30.16kg), Dhenkanal (32.07kg.), Nuapada (33.33kg.), Gajapati (33.68kg.), Nayagarh (35.95kg.), Sundergarh (38.5kg.), Malkangiri (39.13kg.), Rayagada (39.89kg.), Sonapur (44.51kg.), Deogarh (45.42kg.), Koraput (46.86kg.), Jagatsinghpur (48.79kg.), Bolangir (49.45kg.) & Boudh (49.48kg.). Remaining three districts have very low (less than 30 kg/hect.) level of fertilizer consumption. The districts are Kandhamal (17.3kg.), Angul (23.16kg.) and Kendrapara (27.48kg.).

#### Number of cultivators to total workers

The broad categories of economic activities also known as fourfold classifications are cultivators, agricultural labourers, household industries and other workers. The

cultivators and agricultural labourers broadly show the workers engaged in the agriculture sector except those engaged in Plantation activities, which over the censuses have been considered as a part of the “other worker”. In 2011 census, out of 175.42 lakh workers, 41.04 lakh were cultivators & 67.04 lakh agricultural labourers. Highest number of cultivators (more than 30%) has been found in 5 districts namely Nuapada (31), Balasore (31), Kendrapara (32), Bolangir (33.3) and Malkangiri (48.7). Under medium category (25-30) there are 9 districts. The districts are Sonapur (25.8), Keonjhar (25.8), Deogarh (25.8), Jagatsinghpur (27.6), Puri (27.8), Nabarangpur (28.3), Baragarh (28.4), Bhadrak (29) & Koraput (29.9). Low percentage (0-5) of cultivators to total workers has been found in 8 districts namely Angul (20.4), Sundergarh (21.1), Rayagada (21.3), Jajpur (21.9), Gajapati (22.1), Kandhamal (22.3), Boudh (23.1) and Nayagarh (24.2). Remaining 8 districts namely Khordha (11.7), Cuttack (14.8), Dhenkanal (16.4), Jharsuguda (16.5), Sambalpur (17.2), Ganjam (19), Kalahandi (19.3) and Mayurbhanj (19.5) are under very category [13].

Table 1 Composite score of selected variables of Agricultural development

S. No	District	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	Composite Z-score
1	Angul	0.24	0.361	-0.934	-0.973	-0.898	-0.969	-0.573	0.52	-0.403
2	Balasore	-0.54	-0.488	0.83	0.497	1.67	1.457	0.905	0.78	0.639
3	Baragarh	-0.788	-0.771	0.465	1.536	2.376	1.728	0.543	0.35	0.68
4	Bhadrak	-0.774	-0.73	1.693	0.934	1.304	1.556	0.626	1.076	0.711
5	Bolangir	-1.262	-1.538	-1.36	-0.247	-0.312	-0.292	1.226	-0.488	-0.534
6	Boudh	0.067	0.159	-0.503	0.467	0.517	-0.292	-0.197	0.157	0.047
7	Cuttack	2.096	2.381	1.364	0.752	-0.27	0.186	-1.354	1.099	0.782
8	Deogarh	2.06	-0.003	-0.292	-2.589	-0.954	-0.396	0.18	0.224	-0.221
9	Dhenkanal	0.461	0.603	0.491	-0.833	-0.425	-0.74	-1.131	0.661	-0.114
10	Gajapati	1.635	1.613	-0.284	-0.768	-0.719	-0.699	-0.336	-1.392	-0.119
11	Ganjam	0.359	0.482	0.019	0.866	0.106	-0.139	-0.768	-0.08	0.106
12	Jagatsinghpur	1.093	1.29	2.552	0.578	0.103	-0.309	0.431	1.321	0.882
13	Jajpur	0.799	0.967	0.095	-0.15	-0.373	-0.162	-0.364	0.817	0.204
14	Jharsuguda	-1.501	-1.538	-1.076	0.214	0.588	0.736	-1.117	0.506	-0.399
15	Kalahandi	-0.256	-0.164	-0.521	0.347	0.01	-0.087	-0.727	-0.844	-0.28
16	Kandhamal	0.066	0.159	-1.031	-2.458	-2.318	-1.378	-0.308	-0.532	-0.975
17	Kendrapara	0.57	0.724	0.979	1.087	-0.456	-0.858	1.045	1.21	0.538
18	Keonjhar	-0.818	-0.811	-0.676	-0.371	0.335	-0.789	0.18	-0.162	-0.389
19	Khordha	0.223	0.32	0.357	-0.048	-0.363	0.319	-1.787	1.062	0.01
20	Koraput	-0.865	-0.851	-0.567	-0.641	-0.838	-0.359	0.752	-1.948	-0.665
21	Malkangiri	-0.405	-0.326	0.075	-1.587	-0.776	-0.558	3.374	-1.674	-0.235
22	Mayurbhanj	-1.164	-1.175	-0.418	0.724	0.465	-0.271	-0.699	-0.554	-0.387
23	Nabarangpur	-0.631	-0.609	-1.139	1.039	1.417	2.952	0.529	-1.837	0.215
24	Nayagarh	0.074	0.159	-0.367	0.261	-0.665	-0.64	-0.043	0.824	-0.05
25	Nuapada	-0.105	-0.003	-0.772	0.541	-0.489	-0.708	0.905	-0.94	-0.196
26	Puri	1.549	1.775	2.028	0.678	0.063	0.22	0.459	1.15	0.99
27	Rayagada	-0.298	-0.245	-0.936	-1	-1.141	-0.539	-0.448	-1.8	-0.801
28	Sambalpur	-0.841	-0.811	-0.307	0.1	1.053	2.023	-1.02	0.291	0.061
29	Sonapur	0.613	0.765	1.066	0.838	1.627	-0.42	0.18	0.365	0.629
30	Sundergarh	-1.655	-1.7	-0.833	0.199	-0.632	-0.574	-0.476	-0.154	-0.728

#### Rural literacy

Literacy rate indicates the quality of human resources. It is very important for promoting the level of economic development. Wide variations in rural literacy rates of different districts also indicate their regional imbalances. Odisha has also very high variation of literacy among district. There are some districts which have rural literacy rate less than 50% and some districts have more

than 80%. The districts which have high percentage (more than 80) of literacy include Jagatsinghpur (86.5), Kendrapara (85), Puri (84.2), Cuttack (83.5), Bhadrak (83.2) and Khordha (83). The districts fall under medium category (65-80) are Keonjhar (66.5), Sundergarh (66.6), Ganjam (67.6), Boudh (70.8), Deogarh (71.7), Sambalpur (72.6), Baragarh (73.4), Sonapur 73.6), Jharsuguda (75.5), Angul (75.7), Dhenkanal (77.6), Balasore (79.2), Jajpur (79.7) and

Nayagarh (79.8). Maximum districts come under medium category of rural literacy rate. There are five districts which fall under low category (50-65) of rural literacy rate. The districts are Nuapada (56), Kalahandi (57.3), Mayurbhanj (61.2), Kandhamal (61.5) and Bolangir (62.1). Remaining five districts namely Gajapati (49.9), Malkangiri (46.1), Rayagada (44.4), Nabarangpur (43.9) and Koraput (42.4) fall under very low category (less than 50) of agricultural development [14].

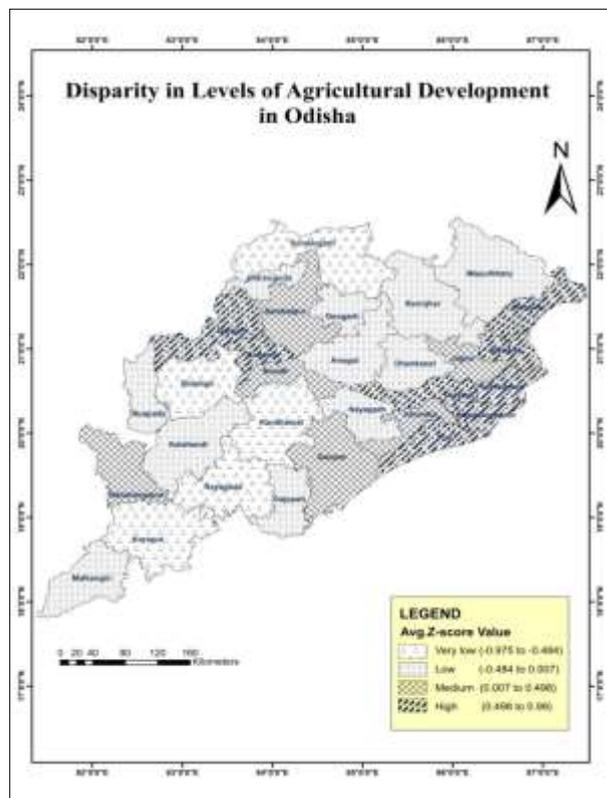


Fig 2 Disparity in levels of agricultural development

#### Spatial pattern of agricultural development

To assess the level of agricultural development in districts of Odisha, all the eight variables have been aggregated. The Z-score value of 8 variables transformed and combined with the help of Z-score and composite score was prepared as presented in (Table 1). Then the grouping of the districts in to four categories were done and presented in (Table 2). The composite score ranges from +0.99 (highest) in Puri district to -0.975 (lowest) in Kandhamal district. Puri is the most developed district in Odisha and Kandhamal is at the bottom. On the basis of composite z-score, the district have been categorised into four grouped viz., high, medium, low and very low, which clearly shows

the spatial variation in level of agricultural development in Odisha.

#### More developed districts

The districts which fall under average composite score value in between (0.498 to 0.99) is included in this category. On an aggregate eight districts namely, Puri (0.99), Jagatsinghpur (0.882), Cuttack (0.782), Bhadrak (0.711), Bargarh (0.68), Balasore (0.639), Sonepur (0.629), Kendrapara (0.538) which ranges their composite z-score above 0.498, are more developed districts. Among these districts except Bargarh and Sonepur other six districts are located in the coastal region. All six districts have a very good status of all the selected indicators. In particular all six coastal district have good quality soil, better irrigation facilities and socio-economic conditions of people are better than other parts which indirectly help in agricultural development. The other two district although are not coastal district but have better soil, and availability of irrigation facilities leads to agriculturally more developed.

#### Moderately developed districts

Six districts come under moderately developed category having their composite z-score ranging from +0.007 to +0.498. The districts are Khordha (0.01), Boudh (0.047), Sambalpur (0.061), Ganjam (0.106), Jajpur (0.204) and Nabarangpur (0.215). All these six districts are also better in terms all the selected indicators. Except Nabarangpur, other districts have mostly plain terrain which facilitates provision of irrigations. Khordha, Jajpur and Ganjam are coastal districts so, like other coastal districts these districts have also better in irrigation and soil type, consumption of fertilizer is also better.

#### Less developed districts

Highest number of districts were under this category. Out of thirty districts, ten districts fall under less developed category, having their composite z-score ranging between -0.484 to 0.007 and these are Jharsuguda (-0.399), Keonjhar (-0.389), Mayurbhanj (-0.387), Kalahandi (-0.28), Malkangiri (-0.235), Deogarh (-0.221), Nuapada (-0.196), Gajapati (-0.119), Dhenkanal (-0.114), and Nayagarh (-0.05). All these districts have hilly terrain, low soil fertility, low consumption of fertilizers and low percentage of area under irrigation. Based on the indicators all these districts have low rural literacy level particularly in Malkangiri, Nuapada, Kalahandi and Gajapati which leads to low average Z-score of the districts. Other districts like Jharsuguda, Keonjhar and Mayurbhanj are industrial and mining district, most part of land areas of these districts are devoted to mining activity and people get employed in that sector than engaging themselves in agriculture [15].

Table 2 Agricultural development regions based on composite Z-Score value of selected indicators

Category and Composite score	No. of districts	District Name
Least Developed or Very low (-0.975 to -0.484)	06	Kandhamal, Rayagada, Sundergarh, Koraput, Bolangir, Angul
Less Developed or Low (-0.484 to 0.007)	10	Jharsuguda, Keonjhar, Mayurbhanj, Kalahandi, Malkangiri, Deogarh, Nuapada, Gajapati, Dhenkanal, Nayagarh,
Moderately Developed or Medium S (0.007 to 0.498)	06	Khordha, Boudh, Sambalpur, Ganjam, Jajpur, Nabarangpur
More Developed or High (0.498 to 0.99)	08	Kendrapara, Sonepur, Balasore, Bargarh, Bhadrak, Cuttack, Jagatsinghpur, Puri

*Least developed districts*

Remaining 6 districts having their composite z-score below -0.484 are included in least developed category and these are Angul (-0.403), Bolangir (-0.534), Koraput (-0.665), Sundergarh (-0.728), Rayagada (-0.801) and Kandhamal (-0.975) that show very low level of agricultural development. Among these district Angul is a mining and industrial district, most of the agricultural land were acquired by industries also agricultural land located nearby industries are severely affected due to release of pollutants and industrial ash, fertilizer consumption, percentage of irrigated areas are also low. Similarly, Koraput and Kandhamal district due to its hilly terrain, the percentage of irrigated area is low, fertilizer consumption and low level of rural literacy is a hindrance to agricultural development.

**CONCLUSION**

The study reveals that the status of variables affecting agricultural development is not uniform in Odisha. It provides a very significant information about the pattern of agricultural development in districts of Odisha. The study highlights that majority of the district come under the high category of agricultural development (more developed). Most of the district of high category are situated in the

coastal plain of Odisha. Very low level of agricultural development found in the Western parts and Parts of Northern plateau region. For development there is a need for re-structuring of the agriculture which has to be done within certain limits of economic, social, and political factors, as well as the national goal; and to making the agricultural society more dynamic. To conclude it may be said that agricultural occupies the major share as far as the land utilization is concerned. This is so because this happens to be the major source of sustenance of people in Odisha. Though, geographical factors such as relief, soil, rainfall and other climatic conditions play significant role in spatial variation of production and productivity. Irrigation, technology and other innovations in the field of agriculture further add to variations in spatial pattern. In line with the present study, in order to know the spatial variations of agricultural production as many as four categories of areas—more developed, moderately developed, less developed and least developed may be identified. This divisions may help in formulating the strategies for development of less and least developed areas. The physio-cultural situation of these areas requires sustained planning effort to accelerate the process of agricultural development, in particular in a hilly terrain region like the northern plateau region, western parts and southern region of Odisha.

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