Regional Imbalance in Agricultural Crop Productivity & Agricultural Development: A Regional Level Study of Purba Medinipur District, West Bengal, India.

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ABSTRACT: The present study is an attempt to understand the existing regional imbalance in agricultural crop productivity and agricultural development in Purba Medinipur district, West Bengal. Crop productivity has been estimated in monetary term (*Rs./hectare*), while the agricultural development has been measured based on standard statistical method like, *'Z'*- score. To find out the relationship between dependent variable (crop productivity) and its independent variables and the inter correlation between variables of agricultural development, Karl Pearson's correlation coefficient and student's't'-test have been adopted. The analysis shows that irrigation intensity is the prime factor of regional imbalances in crop productivity.

Key Words: Agricultural development, Crop Productivity, Cropping intensity, Composite Score.

INTRODUCTION

Agriculture plays a crucial role in India's economy. About 55 per cent of the people depend on agriculture & allied activities which account for 14.4 percent of national income. The study of agricultural production and productivity and development of agricultural is a crucial aspect of geography. The main issue on agricultural front is how to increase agricultural production and productivity, which in turn depend on the inputs used. While the former is represented by agricultural output, the latter is determined by a set of agricultural inputs like irrigated area, fertilizer use, available bank credit, mechanization and use of electricity. Agricultural productivity is simply the ratio of output in terms of production and inputs used for that production, which is measured in per unit of land area devoted for that production. In other words, it is the output-input ratio. Agricultural productivity measures the efficiency with which agricultural production system uses land, labour and capital. Agricultural productivity is associated with a number of physical, socio-economic, political, institutional and organizational factors.

One of the basic objectives of agricultural development should be a balanced regional growth. It is worthy to mention that a balanced regional agricultural development is being retarded due to wide regional disparity in agricultural resources. Scholars of different disciplines like geography, economics and agricultural sciences have contributed a lot in the analysis of agricultural productivity. Significant contribution in contributed a lot in the analysis of agricultural productivity. Significant contribution in this field was made by Buck (l937), Kendall (1939), Zobel (1964), Shafi (1967) and Bhalla (1978).

Most of the scholars have tried to estimate only agricultural productivity, but in the present paper an attempt has been made to analyse the agricultural productivity and to justify the significance of different agricultural factors on its productivity as the basic of planning framework for agricultural development.

Study Area

Purba Medinipur district came into existence after bifurcation of erstwhile Medinipur on and from January 1, 2002. This district is situated on the southern side of the state of West Bengal. The total area of the district is

4151.64 square kilometres. It exists between 21°38’ N to 22°31’ N and 87°27’ E to 88°12’ E. The District is surrounded by Ghatal sub-division of Paschim Medinipur district in the north, Bay of Bengal in the south, Paschim Medinipur district in the west and Hoogly-Rupnarayan river in the east (Rupnarayan river separates this district from Howrah). Tamluk, Haldia, Contai and Egra are its 4 subdivisions. The district comprises of 25 blocks and 5 municipalities, namely Panskura, Tamluk, Egra, Contai and Haldia. The population of the district is 5095875 (as per 2011 census) of which the literacy rate is 87.02 per cent & work participation rate is 37.49 per cent.

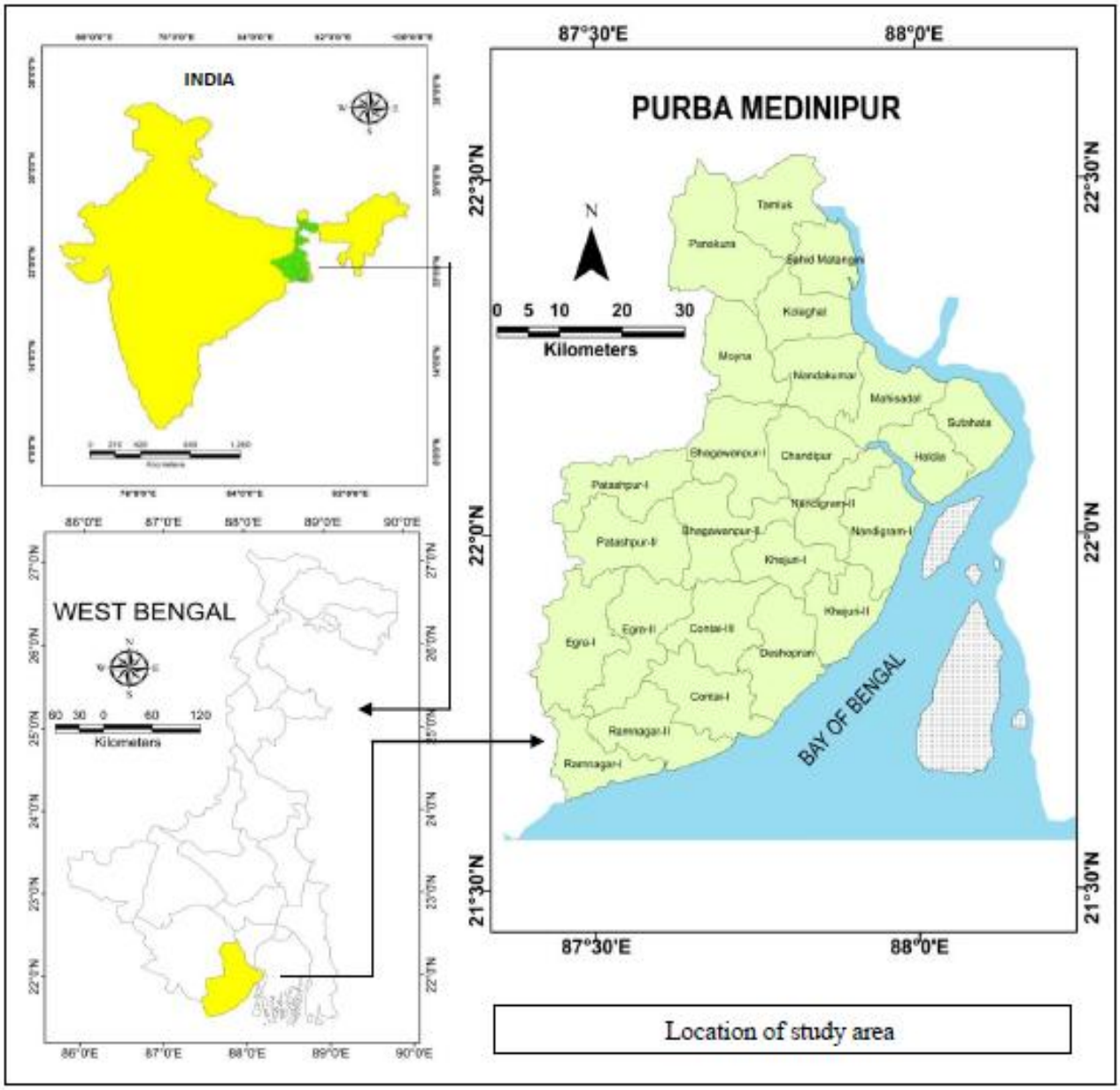

Fig.-1: Location & Administrative Divisions of Purba Medinipur District

Objectives

The major objectives of this study are as follows.

1. To estimate the productivity indices of agricultural crops.
2. To investigate the existing regional inequalities in crop productivity and agricultural development.
3. Finally to make suggestions for balanced regional agricultural development which are the basic prerequisites for socio economic development.

DATA BASE & METHODOLOGY

For the present study secondary data have been used to analyse the situation. The major sources of data are Directorate of Agriculture, Govt. of W.B. relevant issue, 2013-14; District Statistical Hand book-2014 of Purba Medinipur District, B.A.E.S., Govt. of W.B. and Primary Census Hand Book-2011 (Village Directory). The tabulated data have been represented by cartographic methods (maps & graphs).

Productivity of each crop has been estimated based on three aspects, i.e., (i) market price of each crop, (ii) area devoted to produce particular crop and (iii) total production. Productivity of crops in monetary term is estimated firstly by multiplying the market price with total production in block, and finally the result is divided by area devoted for the production of a particular crop. The productivity of crops like, rice, khesari, gram and maskalai (food grains), Mustard & potato (commercial crops) has been estimated to ascertain the average productivity of crops. Index of agricultural development has been estimated based on the standard score in each variable and the composite mean score by:

$$Z = \frac{X_{i-}\bar{x}}{\sigma}$$

Where, Z denote z-score of variable, X_i denote original value of the variable of ith variable.

$$C.S. = \frac{\Sigma Z_{ij}}{N}$$

Where, C.S. denotes Z score of an indicator in block j.

Correlation Matrix to show the inter relationship between the variables of Agricultural Development, by employing Karl Pearson's Correlation Coefficient and student's 't' test has been used to find out the level of significance.

CROP PRODUCTIVITY

Here an attempt has been made to estimate the regional variations in agricultural crop productivity at block level. To find out the ground reality all the crops grown in the district have been grouped into two categories, i.e, food grains and commercial crops. Finally the productivity in monetary term of all the crops grown in the district has been estimated to find out the overall crop productivity which is presented in (Table-l & Table-2).

Levels of Food Grains Productivity

In the present analysis the levels of food grains productivity has been calculated as the average crop yield index of rice, khesari, gram and maskalai. Crop yield index has been calculated in monetary term viz. Rs./hectare. The regional imbalances in crop productivity is depicted in the following (Table-l & Table-2) at block level in the district.

High food grains productivity

The blocks with crop productivity index of more than Rs.36728.26/hectare are categorized under high level of food grains productivity. Seven blocks of this category are Tamluk, Nandakumar, Chandipur, Mahisadal, Nandigram-I, Nandigram-II & Patashpur-I. The highest average productivity of food grains attained by the block Tamluk (Rs. 44186.24/hectare), followed by Nandakumar (Rs. 43922.83/hectare).

Medium food grains productivity

The average productivity of food grains (Rs./hectare) of this category ranges between Rs. 13306.42 - 36728.26/hectare. (Table-2) depicts that blocks fall in this category are Sahid Matangini, Panskura-I, Kolaghat, Moyna, Sutahata, Haldia, Patashpur-II, Egra-II, Khejuri-I, Khejuri-II, Bhagawanpur-II, Ramnagar-I, Ramnagar-II & Contai-III.

Low food grains productivity Remaining four blocks of this district fall under this category with average productivity of food grains less than Rs.13306.42/hectare. The blocks included in this category are Bhagawanpur-I, Egra-I, Contai-I & Deshapran.

Table-1: Crop Productivity Index of Purba Medinipur District, (2014)

Name of the Blocks	Crop Productivity Index (Rs./Hectare)		
	Food Grain Crops	Commercial Crops	Overall Crops
Tamluk	44186.24	94350.00	69268.12
Sahid Matangini	16548.91	174139.41	95344.16
Panskura-I	16517.45	205105.24	110811.35
Kolaghat	17801.48	120452.90	69127.19
Moyna	18350.56	176469.64	97410.10
Nandakumar	43922.83	131103.33	87513.08
Chandipur	40369.08	139963.70	90166.39
Mahisadal	39573.74	134923.42	87248.58
Nandigram-I	37688.53	76071.16	56879.84
Nandigram-II	37774.06	96584.48	67179.27
Sutahata	35962.99	121148.57	78555.78
Haldia	32031.89	0.000000	16015.95
Patashpur-I	43260.53	161105.79	102183.16
Patashpur-I	13658.34	157762.81	85710.57
Bhagawanpur-I	11993.80	91529.29	51761.55
Egra-I	12777.83	26809.32	19793.58
Egra-II	17791.15	155955.00	86873.08
Khejuri-I	21618.68	122489.43	72054.06
Khejuri-II	22607.03	143372.24	82989.64
Bhagawanpur-II	27642.54	101039.20	64340.87
Ramnagar-I	17218.88	0.000000	8609.44
Ramnagar-II	14462.69	0.000000	7231.35
Contai-I	9442.29	161177.87	85310.08
Deshapran	9317.63	130292.86	69805.24
Contai-III	22914.32	120460.39	71687.36

Source: Computed by Author(s), based on District Statistical Hand Book, 2014.

Levels of Commercial Crop Productivity

In the present analysis levels of commercial crop (Potato & jute) productivity have been calculated as the average crop yield index of rice, khesari. gram & maskalai. (Table-l & Table-2) depict the regional imbalances in the commercial crop productivity in the study area.

High commercial crop productivity

The blocks with average commercial crop productivity of more than Rs.168852.89/hectare fall under this category. The block Panskura-I (Rs.205105.24/hectare) attained the highest position in this respect followed by the block Moyna & Sahid Matangini.

Medium commercial crop productivity

In this category the average commercial crop productivity ranges between Rs.58531.59 - 168852.89/hectare. Eighteen blocks fall under this category. Among them the highest position is occupied by Contai-I (Rs. 161177.87/hectare) another blocks are Tamluk, Kolaghat, Nandakumar, Chandipur, Mahisadal, Nandigram-I, Nandigram-II, Sutahata, Patashpur-I, Patashpur-II, Bhagawanpur-I, Egra-II, Khejuri-I Khejuri-II, Bhagawanpur-II, Contai-I, Deshapran & Contai-III.

Low commercial crop productivity

The blocks with average productivity of commercial crops of less than Rs.58531.59/hectare fall under this category. The blocks in this category are Haldia, Egra-I, Ramnagar-I & Ramnagar-II. Among them Egra-I accounted for the lowest average commercial crop productivity.

Table-2: Regional Imbalances in agricultural Crop Productivity, Purba Medinipur, 2014

Levels of Productivity	Food grain Crop Productivity Index	Name of the Blocks	No. of Blocks
High	Above 36728.26	Tamluk, Nandakumar, Chandipur, Mahisadal, Nandigram-I, Nandigram-II &Patashpur-I	7
Medium	13306.42-36728.26	Sahid Matangini, Panskura-I, Kolaghat, Moyna, Sutahata, Haldia, Patashpur-II, Egra-II, Khejuri-I, Khejuri-II, Bhagawanpur-II, Ramnagar-I, Ramnagar-II& Contai-III	14
Low	Below 13306.42	Bhagawanpur-I, Egra-I, Contai-I & Deshapran	4

Levels of Productivity	Commercial Crop Productivity Index	Name of the Blocks	No. of Blocks
High	Above 168852.89	Sahid Matangini, Panskura-I & Moyna	3
Medium	58531.59-168852.89	Tamluk, Kolaghat, Nandakumar, Chandipur, Mahisadal, Nandigram-I, Nandigram-II, Sutahata, Patashpur-I, Patashpur-II, Bhagawanpur-I, Egra-II, Khejuri-I, Khejuri-II, Bhagawanpur-II, Contai-I, Deshapran & Contai-III	18
Low	Below 58531.59	Haldia, Egra-I, Ramnagar-I & Ramnagar-II	4

Levels of Productivity	Overall Crop Productivity Index	Name of the Blocks	No. of Blocks
High	Above 102790.57	Panskura-I	1
Medium	35910.01-102790.57	Tamluk, Sahid Matangini, Kolaghat, Moyna,Nandakumar, Chandipur, Mahisadal, Nandigram-I, Nandigram-II, Sutahata, Patashpur-I, Patashpur-II, Bhagawanpur-I, Egra-II, Khejuri-I, Khejuri-II, Bhagawanpur-II, Contai-I, Deshapran & Contai-III	20
Low	Below 35910.01	Haldia, Egra-I, Ramnagar-I & Ramnagar-II	4

Source: Compiled by Author(s)

Levels of Overall Crop Productivity

The overall crop productivity has been calculated as the average crop productivity index of food grains (i.e. rice, khesari. gram & maskalai) and commercial crops (i.e. potato & mustard). The regional imbalance in overall crop productivity that exists in the study area is calculating by using indexing method of statistical technique like mean and standard deviation. The blocks of the district have been categorized under three levels high, medium and low levels of overall crop productivity.

High overall crop productivity

The blocks with overall crop productivity index of more than Rs.102790.57/hectare are categorized under the level of high productivity. The highest productivity is recorded only by Panskura-I block.

Medium overall crop productivity

The medium levels of overall crop productivity ranges between Rs.35910.01 to 102790.57/hectare. Twenty blocks of the district fall under this category. These are Tamluk, Sahid Matangini, Kolaghat, Moyna, Nandakumar, Chandipur, Mahisadal, Nandigram-I, Nandigram-II, Sutahata, Patashpur-I, Patashpur-II, Bhagawanpur-I, Egra-II, Khejuri-I, Khejuri-II, Bhagawanpur-II, Contai-I, Deshapran & Contai-III.

Low overall crop productivity

The blocks with average corp productivity index of below Rs.35910.01/hectare fall under this category. Four blocks Haldia, Egra-I, Ramnagar-I & Ramnagar-II are included under low level of crop productivity.

AGRICULTURAL DEVELOPMENT

Development is a multidimensional phenomenon. Each of these dimensions is measured in different units. Due to the difficulties in analysing development of each dimension, researchers generally prefer to aggregate them what is called campsite index, to depict the overall status of a region. To work out the levels of agricultural development following variables (Table-3) have been considered.

Table-3: Variables of Agricultural Development

Sl. No.	Symbol	Variables
1	Y	Overall Agricultural Crop Productivity
2	X_1	Cropping Intensity
3	X_2	Irrigation Intensity
4	X_3	No. of Deep Tube wells per 1000 hect. of Net Cropped Area
5	X_4	No. of Shallow Tube wells per 1000 hect. of Net Cropped Area
6	X_5	Fertiliser (N+P+K) Consumption in tonnes per 1000 hect. of Gross Cropped Area
7	X_6	No. of Fertilizer Distribution Centres per 1000 hect. of Net Cropped Area
8	X_7	No. of Agricultural Credit Societies per 1000 hect. of Net Cropped Area
9	X_8	No. of Agricultural farm and research centres per 1000 hect. of Net Cropped Area

In the present analysis an attempt has been made to find out the existing regional imbalances and inequalities in agricultural development in the study area by employing standard and composite scores. Regional imbalances in agricultural development are due to the physico -cultural factors. For easy understanding all the blocks have been divided into three levels of agricultural development (Table-5 & Figure-2).

High agricultural development

The blocks with mean composite z-score more than + 0.20 are categorized in the high level of agricultural development. Nine blocks namely Tamluk, Panskura-I, Kolaghat Patashpur-I, Patashpur-II, Egra-I, Egra-II, Bhagawanpur-II & Contai-I are categorized in the higher level of development. These blocks are mostly lying in northern & south-western side of this district.

Medium agricultural development

The blocks with mean composite z-score between + 0.20 to - 0.20 are categorized under the medium level of agricultural development. The blocks in this level of development are Sahid Matangini, Moyna, Sutahata, Bhagawanpur-I, Khejuri-I & Contai-III.

Low agricultural development

The blocks namely Nandakumar, Chandipur, Mahisadal, Nandigram-I, Nandigram-II, Haldia, Khejuri-II, Ramnagar-I, Ramnagar-II & Deshapran with mean composite z-score of less than - 0.20 fall in the low level of agricultural development in the district.

Table-4: Index of Agricultural Development, Purba Medinipur District, 2014

Name of the Blocks	Z-Score of Agricultural Development									
	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Composite Mean
Tamluk	-0.003	-1.030	0.790	0.049	0.880	1.560	-0.605	1.129	3.060	0.648
Sahid Matangini	0.923	-0.510	0.700	-1.296	-1.152	-0.010	-0.057	-0.225	0.763	-0.096
Panskura-I	1.473	-0.610	0.360	1.016	0.880	1.060	0.449	-1.720	-0.486	0.269
Kolaghat	-0.008	-0.460	1.190	2.036	-1.004	0.360	0.949	-0.546	1.011	0.392
Moyna	0.997	-0.510	2.100	0.270	0.202	-1.080	-0.698	-0.457	-0.299	0.058
Nandakumar	0.645	-0.590	0.250	0.198	-0.233	-1.400	-1.099	-1.012	0.248	-0.332
Chandipur	0.740	-0.750	-0.240	0.722	-1.152	-0.700	-1.111	0.054	-0.510	-0.328
Mahisadal	0.636	0.320	0.310	-1.296	0.474	-1.580	-0.462	-0.626	-0.221	-0.272
Nandigram-I	-0.443	1.310	-1.630	-1.296	-1.152	1.120	-0.081	-1.252	0.079	-0.372
Nandigram-II	-0.077	0.540	-1.000	-1.296	-0.448	0.180	-0.890	-0.628	-1.160	-0.531
Sutahata	0.327	-0.500	0.050	-1.296	-1.152	-0.830	-0.164	1.298	1.651	-0.068
Haldia	-1.895	-1.810	-1.790	-0.399	-1.152	0.550	-1.834	-1.061	-1.040	-1.159
Patashpur-I	1.167	2.000	1.130	1.830	1.155	0.990	0.532	0.296	-1.047	0.895
Patashpur-II	0.581	2.430	0.840	-0.061	1.551	1.180	2.633	0.136	-1.109	0.909
Bhagawanpur-I	-0.625	0.700	0.840	0.314	-1.152	0.240	-0.389	2.046	-0.903	0.119
Egra-I	-1.761	0.580	1.090	1.316	2.831	0.360	1.297	-1.237	0.273	0.528
Egra-II	0.622	1.930	0.560	0.411	0.615	-0.330	0.266	0.087	1.192	0.595
Khejuri-I	0.096	-0.450	-0.780	-0.544	-0.214	-1.140	1.650	1.230	0.358	0.023
Khejuri-II	0.484	-0.560	-0.540	-0.356	0.654	-1.460	-0.137	-0.860	-0.318	-0.344
Bhagawanpur-II	-0.178	-0.390	0.490	0.977	0.303	0.990	-0.491	2.051	-1.220	0.281
Ramnagar-I	-2.158	-0.910	-0.250	-0.735	-0.334	0.300	-0.319	0.494	0.418	-0.388
Ramnagar-II	-2.207	0.190	-0.900	-0.735	-0.541	-1.140	1.593	-0.259	-0.852	-0.539
Contai-I	0.567	-0.460	-1.170	0.916	0.802	1.240	-1.110	1.160	0.884	0.314
Deshapran	0.016	-0.420	-1.630	-1.296	-0.322	1.180	0.421	-0.352	0.053	-0.261
Contai-III	0.083	-0.040	-0.750	0.552	-0.339	1.060	-0.358	0.292	-0.510	-0.001

Source: Computed by author(s), data from District Statistical Hand Book, 2014.

Table-5: Agricultural Development, Purba Medinipur District, 2014

Levels of Agricultural Development	Index of Agricultural Development	Name of the Blocks	Total No. of Blocks
High	Above + 0.20	Tamluk, Panskura-I, Kolaghat Patashpur-I, Patashpur-II, Egra-I, Egra-II, Bhagawanpur-II & Contai-I.	9
Medium	+ 0.20 to - 0.20	Sahid Matangini, Moyna, Sutahata, Bhagawanpur-I, Khejuri-I & Contai-III	6
Low	Below - 0.20	Nandakumar, Chandipur, Mahisadal, Nandigram-I, Nandigram-II, Haldia, Khejuri-II, Ramnagar-I, Ramnagar-II & Deshapran	10

Source: Compiled by Author(s).

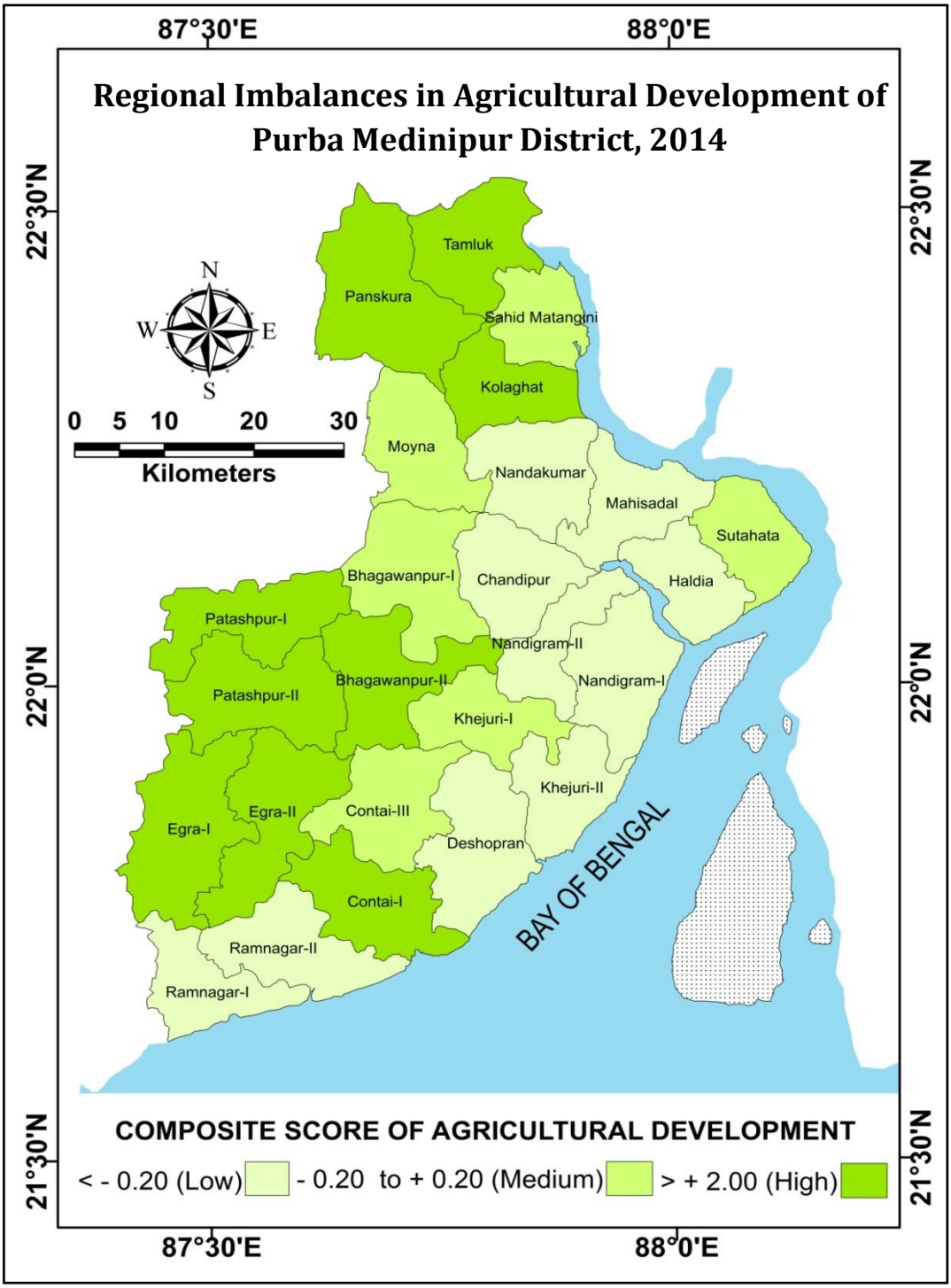

Fig-2: Regional Imbalances in agricultural Development of Purba Medinipur District, 2014

Correlation between variables of agricultural development

The correlation matrix (Table-6) reveals the association between the dependent variable i.e., average of overall agricultural crop productivity (Y) and each independent variable. Agricultural crop productivity (Y) is positively correlated (r = 0.349) with irrigation intensity (X_2) which insignificant at 1 per cent level. It explains the crop productivity is mostly dependent on irrigation intensity. Though very poorly, the crop productivity (Y) is negatively correlated with fertilizer consumption (X_5), No. of Fertilizer Distribution Centres (X_6) & agricultural credit societies (X_7). In this way both positive and negative correlations are observed among the variables of agricultural development. It is exhibited from the same table (Table-6) negative correlations between variables are very low. The variable correlated positively with X_1 and X_4, X_1 and X_6, X_2 and X_3 with X_3 and X_4 is associated at 1 per cent level of significance.

Table-6: Interrelationship between Variables of Agricultural Development, Purba Medinipur District, 2014

Variable	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Y	1.000								
X_1	0.182	1.000							
X_2	0.349	0.241	1.000						
X_3	0.184	0.110	0.502	1.000					
X_4	0.121	0.369	0.384	0.416	1.000				
X_5	-0.051	0.157	-0.100	0.290	0.202	1.000			
X_6	-0.056	0.532	0.223	0.100	0.386	0.046	1.000		
X_7	-0.011	0.007	0.125	0.076	-0.120	0.144	-0.030	1.000	
X_8	0.097	-0.251	0.150	-0.061	0.023	0.036	-0.055	0.178	1.000

Source: Compiled by Author(s).

CONCLUSION

The study clearly reveals the wide regional imbalances in agricultural crop productivity existing in the district. Imbalances in productivity is not due to single factor rather due to the combinations of different physic- cultural factors. Northern part and south-western parts of the district are highly developed. It is revealed that crop productivity is highly influenced by irrigation intensity. It may be suggested that for the high productivity of crops irrigation system should be improved and efficient. Comprehensive agriculture planning is essential for the balanced regional development.

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