NGJI, An International Peer Reviewed Journal
NGSI-BHU, ISSN: 0027-9374/2019/1710
Vol. 65, No. 3, September., 2019

Status of Agricultural Development in Malda District: A Geographical Analysis

Hasibur Rahaman[1], Shamsul Haque Siddiqui[2], S.P. Asthana[3] and Fazlur Rahman[4]
[1] Assistant Professor, Department of Geography, A.M.U, Aligarh
[2] Professor and former Chairperson, Department of Geography, A.M.U, Aligarh
[3]Associate Professor, D.A.V. PG College, Kanpur
[4]Assistant Professor, Department of Geography, A.M.U, Aligarh
(Corresponding Email : hmrahaman0551@gmail.com)

Abstract

In India, the status of agricultural development is still an important concern before policy makers, academia, research think-tank and planners not only because of its decreasing contribution to national GDP rather widespread development disparity and its impact in everyday life. Even after the Green Revolution and economic reforms, institutional, technological and infrastructural differences in agriculture have not been diminished at macro, meso and micro level which were expected during the planning era. Here, an attempt has been made to show the spatial pattern of agricultural development and disparity lies in it at block level in the Malda district of West Bengal. The data for present study has been obtained from Agriculture Census, Input Survey and other secondary sources. To measure agriculture development, the UNDP method has been used. The composite standardised score, interpolation, extrapolation, quartile and QGIS tools and techniques have been used for data operation. In the study, agricultural development has been measured through standardised composite score of thirty-two input variables and two output variables. The results of the study show horizontal and vertical transformation in agricultural development in the district from 1995-96 to 2015-16. The development transformation is mainly caused by increased inputs which positively impact on productivity and crop diversification index. The study also reveals extended disparity among blocks from 1995-96 to 2015-16. The study suggests the needs of immediate integrated policy intervention to minimise disparity and uplift less developed blocks in agricultural development in Malda district.

Keywords : Agricultural Development, Green Revolution, Development Disparity, Agricultural Transformation

Introduction

The purpose of development is to continuously improve the condition of something like standard of living. On the other hand, the purpose of agricultural development is to improve the agricultural system to get best possible output and minimized regional disparities. To meet food demand of increasing population, upheld livelihood options and support agro-based industries, the development of the agricultural sector is essential for the time being. In changing institutional, infrastructural and technological know-how, the agricultural system too demands certain modification to get plentiful production of crops. For this, the subsistence nature of agriculture has to be changed through bringing more and more well-equipped infrastructural facilities. In India, the attempt has been made to do so from the first five-year plan to recent one. One of the problems remain in planning investment in agriculture is regional disparities at micro and macro levels because the policy intervention focuses on sectoral and regional development rather than systematic and integrated development of agriculture as a whole. If this gap is to be minimised, then planning and policy design must be framed in keeping view of micro to macro regional problems rather than regional, sectoral basis. And to achieve these feet, it is necessary to look into existing agricultural situations from different micro regions through accessible and reliable data. The main objective of this study is to analyse the status, transformation and disparity in agricultural development in Malda district. An attempt has also been made to show the spatial pattern and variations in agriculture development at the block level in 1995-96 and 2015-16.

Study Area

In present study, Malda district of West Bengal has been selected as a study area. The district statistical handbook reveals that more than 90 per cent of the rural population directly depends on agriculture for their food and livelihood options. On the other hand, the Agriculture Census states an abundance of marginal and small farmers (comprise 95.6% cover 58.07% land) in the district that makes the district's agriculture subsistence cum slow commercial. Apart from these, decreasing groundwater table, variability in monsoon rainfall, climate change, natural calamities, price instability and slowdown of public investment in agriculture have been the major constraints. These persistence problems have slowed down agricultural contribution in district economy. To make resilient agricultural conditions, the existing agricultural situation has to be understood on a scientific basis. Therefore, the present study assumes a special significance in this context. The Malda district is spread over an area of 3733 sq.km and having population of 3988845 persons (Census, 2011). The district covers 4.7 percent of states' total area and is the home of 4.1 per centstates' population. It is located between 24°40'20" and 25°32'8" N latitudes and 87°45'50" to 88°28'10" E longitudes. It is bounded by Murshidabad district in south and in north by Uttar Dinajpur district. On the east, the district is surrounded by Bangladesh, on the west by the state of Bihar, on the northeast by Dakshin Dinajpur district and, on the southwest by Jharkhand state. Physiographically, the district is divided into three zones. i.e., Tal, Barind and Diara. The Tal region is characterised as a low-lying area subject to inundation in every rainy season. The soil texture varies from loam to clay loam. The six blocks namely Harishchandrapur -I and II, Ratua - I and II, and Chanchal - I and II come under Tal region. The Barind region is comparatively high land with small water sources. The soil is heavy old alluvium ranging from clay to clay loam. The four blocks, i.e., Gazole, Bamongola, Habibpur and Old Malda fall in the Barind region. The remaining five blocks includein the Diara region which has flat land on western side and has soil texture as sandy loam, clay loam, loam and silt loam.

Database and Methodology

The present study is based on mainly secondary sources of data which were extracted from the Agriculture Census of India. The data of 2015-16 from Agriculture Census and 2016-17 from Input Survey have been extrapolated. For extrapolation, data of the Agricultural Census of 2005-06 and 2010-11 are interpolated first, and then an average of the last three years is taken as the data of 2015-16. The same technique has been used for 2006-07 and 2011-12 input survey data to get 2016-2017 data.

$$\text{Interpolation} = \text{Base year data} + \frac{(\text{Recent year data} - \text{Base year data})}{\text{Number years (here Five)}} \quad (1)$$

Here for Agriculture Census data, the base is 2005-06 and the recent year is 2010-11 while for input survey data, the base year is 2006-07 and the recent year is 2011-12. The interpolated data has been standardised through dimension index as noted below in equation (2) and (3). In case of positive (2) and negative (3) variables of agricultural development, the dimension index differs in functions.

$$\text{Dimension Index} = \frac{(\text{Actual value} - \text{Minimum Value})}{(\text{Maximum value} - \text{Minimum Value})} \quad (2)$$

$$\text{Dimension Index} = \frac{(\text{Maximum value} - \text{Actual Value})}{(\text{Maximum value} - \text{Minimum Value})} \quad (3)$$

If data is in percentage, then the minimum value is zero (0) and the maximum is hundred (100). And, if data is in otherwise form, for that the minimum and maximum value should be from table value. After standardisation through (2) and (3) dimension index, the composite index has been calculated. As we know, agricultural development is measured on a composite scale of interrelated variables.

Composite Input Index (CII) = $1/32\ (X_1 + X_2 + X_3 \ldots X32)$ (4)

Composite Outputs Index (COI) = $1/2$ (YYI + CDI) (5)

Apart from thirty-two input variables, there are two output variables (productivity and crop diversification) also taken into consideration in view of overall agricultural development pursuit in the study area. To measure productivity, Yang's (1965) yield index (YYI) has been used.

Table 1: Method of Calculation of Yang's Yield Index (YYI) (6)

Name of the crops	The area under crop in the block (area in hectare)	Yield in Quintal/Hectare Average yield in district	Average yield in the block	Crop yield in the block as the percentage to the district	Percentage multiply by area (in hectares)
1	2	3	4	5	6
				(Col. 3/Col.4*100)	(Col.5*Col.2)
Cereals	21541	5122	2800	182.93	3940464.36
Pulses	6	1124	1298	86.59	519.57
Spices	2	1423	990	143.74	287.47
Fruits	5	3965	2413	164.32	821.59
Vegetables	3255	4562	2791	163.45	532042.64
Oilseeds	3050	851	963	88.37	269527.52
Fibres	5	5632	3892	144.71	723.54
Total	27864				4744386.68
Crop Yield Index for Bamongola Block Marginal Class, 2015-16					4744386.68/27864
					170.27

Source: Data calculated by authors based on Yang'sW.B technique (1965)

To measure the crop diversification index (CDI), Gibbs-Martin's technique has been used because this technique measures diversification up to 0.1 per cent aerial extent of crops of a region (district/block).

$$\text{Gibbs-Martin CDI} = 1 - \frac{\Sigma X^2}{(\Sigma X^2)} \quad (7)$$

Here, X is the percentage of area occupied by an individual crop at a point of time. The index value ranges from 0 to 1. The higher is the index value; higher would be the diversity and vice versa.

To measure overall (inputs-outputs) agricultural development, the composite index has been calculated with the help of equation (4) and (5).

Composite Index (input-outputs) = 1/2 [CII (4) + COI (5)] (8)

To categorize the ranges (index) of agriculture development quartile technique has been used.

$$\text{Upper Quartile (Q3)} = (N + 1) * \frac{3}{4} \quad (9)$$

$$\text{Lower Quartile (Q1)} = (N + 1) * \frac{1}{4} \quad (10)$$

Here 'N' means number of standardised units against the blocks. Therefore, the first breaking point of composite inputs data series of 1995-96 is 0.372 as lower quartile and 0.526 as upper quartile, and the same become 0.485 and 0.597 in 2015-16 correspondingly (see Table 5).

Selection of Variables and Indicators

Based on extensive literature survey, a set of thirty-two variables have been selected (see Table 2 and 3). The various literatures are cited on agricultural development ranging from different temporal and spatial extends. The selected variables have further categorized into seven indicators.

1. The first seven variables (X_1 to X_7) are related to different aspects of land such as percentage of marginal land size holders, average landholding, self-operated area, leased area, net sown area and location of land in and outside of village. So, here 'land' is an indicator.
2. Variables number X_8 to X_{13} can be subsumed under 'irrigation' indicator. The net irrigated area, sources of irrigations such as tank and other, electric and diesel operated well and tube well, total crops receive irrigation and not received so during one agricultural year are selected as major variables under irrigation.
3. The nature and types of 'seeds' is an important indicator of agricultural development which includes two variables like households use certified seeds (X_{14}) and HYV seed (X_{15}).
4. Variables number X_{16} to X20are entitled as 'credit' which is another important development indicator of agriculture. The institutional credit facilities and households availed credit from different banking institutions (PACS, PLDB, CBB and RRB) have been listed here.
5. Agricultural machinery gives impetus to mechanized farming which is very efficient to modern cultivationsystems. The variable number X_{21} to X_{23} relates to hand operated, animal operated and power operated machineries.
6. The variables X_{24} to X_{27} include fertilizer, pesticides, NPK mixture and other essential fertilizers for bumper agricultural productivity.
7. The last input indicator is 'socioeconomic' which includes marginal (X_{28}) and main workers (X_{29}) in the cultivation process. Apart from these, literacy, age and average family are also in-

Table 2: Variables of Agricultural Development 1995-96

Blocks/ Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Dist.
X1	69.43	76.63	81.46	74.98	66.77	67.90	84.47	72.67	90.53	84.82	71.29	85.27	74.61	73.51	72.83	75.63
X2	1.01	0.79	0.73	0.89	1.00	0.98	0.72	0.83	0.56	0.74	0.97	0.70	0.86	1.01	0.87	0.86
X3	79.03	81.76	78.50	67.77	70.36	68.49	78.66	86.28	79.71	80.05	85.78	84.52	50.72	85.27	76.18	75.65
X4	0.79	0.38	0.38	3.14	1.70	1.44	0.47	0.49	0.25	0.00	0.98	0.97	4.13	0.28	0.00	1.20
X5	99.93	98.57	97.98	89.37	98.93	98.65	97.48	96.48	97.44	97.95	92.40	95.27	98.19	90.58	94.07	96.44
X6	53.62	43.33	44.06	27.73	63.45	59.93	63.16	72.53	43.53	38.75	44.32	40.73	43.73	49.32	66.29	52.09
X7	46.38	56.67	55.94	72.27	36.55	40.07	36.84	27.47	56.47	61.25	55.68	59.27	56.27	50.68	33.71	47.91
X8	48.79	73.89	79.99	42.75	36.44	27.30	76.46	89.79	23.25	31.68	52.29	29.70	41.69	51.92	69.13	49.54
X9	53.93	7.70	5.52	19.13	43.42	60.31	1.63	1.53	3.57	41.77	4.50	12.93	31.82	3.55	22.78	19.81
X10	0.03	0.10	0.08	0.28	0.01	0.52	0.09	0.07	0.47	0.65	0.02	0.19	0.43	0.01	1.43	0.23
X11	1.03	0.52	0.45	0.50	0.46	2.64	1.40	1.80	0.87	0.25	0.71	1.18	4.32	0.38	0.87	1.13
X12	44.66	49.56	86.48	49.45	38.14	34.05	80.48	92.63	34.60	35.44	51.99	31.86	51.40	54.95	60.46	53.81
X13	55.34	50.44	13.52	50.55	61.86	65.95	19.52	7.37	65.40	64.56	48.01	68.14	48.60	45.05	39.54	46.19
X14	11.05	18.03	17.19	19.25	20.64	9.02	16.61	11.19	25.97	29.27	15.30	27.78	26.18	16.19	31.27	19.66
X15	19.62	19.60	20.91	20.97	24.76	22.96	20.26	20.91	19.54	18.76	18.79	21.56	19.77	19.78	18.76	20.46
X16	0.61	0.60	0.81	0.82	1.44	1.14	0.71	0.81	0.59	0.47	0.47	0.92	0.63	0.63	0.47	0.74
X17	0.17	0.17	0.22	0.23	0.39	0.31	0.19	0.22	0.16	0.13	0.13	0.25	0.17	0.17	0.13	0.20
X18	0.02	0.02	0.03	0.03	0.05	0.04	0.02	0.03	0.02	0.01	0.01	0.03	0.02	0.02	0.01	0.02
X19	0.14	0.14	0.19	0.20	0.34	0.27	0.17	0.19	0.14	0.11	0.11	0.22	0.15	0.15	0.11	0.18
X20	0.28	0.27	0.37	0.37	0.65	0.52	0.32	0.37	0.27	0.21	0.21	0.42	0.29	0.29	0.21	0.34
X21	40.36	47.39	52.13	44.62	95.84	61.11	41.87	61.00	19.13	21.09	34.34	50.37	32.34	53.66	33.98	45.95
X22	11.26	13.22	14.54	12.45	26.74	17.05	11.68	17.02	5.34	5.88	9.58	14.05	9.02	14.97	9.48	12.82
X23	1.19	1.40	1.54	1.32	2.83	1.81	1.24	1.80	0.57	0.62	1.01	1.49	0.96	1.59	1.00	1.36
X24	33.08	38.84	42.73	36.58	78.56	50.09	34.32	50.00	15.68	17.29	28.14	41.29	26.51	43.99	27.85	37.66
X25	15.34	18.01	19.82	16.96	36.43	23.23	15.92	23.19	7.27	8.02	13.05	19.15	12.29	20.40	12.92	17.47
X26	169.46	198.98	218.90	187.37	402.45	256.61	175.80	256.13	80.35	88.57	244.18	211.51	135.78	225.32	142.67	199.60
X27	123.34	161.00	198.00	136.37	241.00	161.00	183.00	186.42	180.00	191.00	200.00	218.00	116.00	146.00	188.00	175.28
X28	37.33	25.32	30.11	13.35	33.75	32.67	25.06	31.86	3.62	14.96	16.73	17.94	26.04	28.52	24.69	24.13
X29	62.67	74.68	69.89	86.65	66.25	67.33	74.94	68.14	96.38	85.04	83.27	82.06	73.96	71.48	75.31	75.87
X30	35.63	35.45	47.83	48.43	54.49	47.32	41.65	47.85	34.87	27.40	27.67	44.05	37.01	37.16	27.42	41.78
X31	45.78	45.98	46.72	45.39	46.34	45.68	44.19	45.71	46.09	43.78	45.42	45.54	44.45	46.15	45.99	45.55
X32	5.33	5.33	5.56	5.48	6.34	6.26	6.72	6.90	6.83	6.11	6.70	6.79	5.99	5.96	6.19	6.17
CSS Index	0.316	0.316	0.358	0.321	0.483	0.450	0.314	0.387	0.232	0.221	0.281	0.351	0.315	0.350	0.309	0.334

Source: Calculated from Agriculture Census by authors

(Note: X1 to X32 variables see Methodology and Blocks 1 to 15 see Table 4 or 5)

Table 3: Variables of Agricultural Development 2015-16

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Dist.
X1	81.25	85.78	82.24	79.53	82.03	77.48	85.38	84.03	90.65	85.68	87.47	83.65	83.54	84.94	83.99	83.40
X2	0.80	0.73	0.77	0.84	0.78	0.91	0.73	0.75	0.55	0.68	0.69	0.72	0.72	0.74	0.75	0.75
X3	70.43	69.11	35.47	83.99	75.54	51.47	61.57	42.03	97.96	85.86	68.67	81.18	48.82	87.66	45.09	66.75
X4	1.83	0.22	0.02	0.16	0.09	4.73	4.55	1.35	0.01	5.47	3.63	0.05	5.77	0.30	0.00	1.67
X5	96.23	96.97	97.07	74.48	98.47	95.45	99.68	98.18	97.88	99.61	97.98	93.26	97.28	94.59	99.46	95.26
X6	67.66	72.12	71.66	84.38	97.89	74.07	58.02	74.87	92.57	53.79	56.59	59.83	70.82	63.90	94.95	74.78
X7	32.34	27.88	28.34	15.62	2.11	25.93	41.98	25.13	7.43	46.21	43.41	40.17	29.18	36.10	5.05	25.22
X8	54.28	86.16	92.73	30.70	53.13	42.80	96.61	94.78	40.05	38.41	88.64	58.54	43.74	76.19	76.77	63.09
X9	59.43	1.38	55.94	86.31	60.42	45.35	0.90	0.54	15.12	8.43	1.85	5.33	28.46	6.54	6.72	25.48
X10	0.55	0.80	6.50	17.73	0.05	0.56	4.39	0.07	1.21	0.72	0.69	0.44	18.09	2.72	3.50	3.04
X11	6.38	0.52	9.56	7.37	1.99	9.50	15.00	1.80	18.86	19.08	5.84	9.41	14.15	6.56	18.26	11.01
X12	52.06	61.45	81.31	50.16	42.22	39.37	92.39	95.69	44.86	39.46	71.35	60.59	42.93	83.04	79.25	61.77
X13	47.94	38.55	18.69	49.84	57.78	60.63	7.61	4.31	55.14	60.54	28.65	39.41	57.07	16.96	20.75	38.23
X14	53.94	61.01	75.62	75.56	58.36	57.63	53.20	65.12	76.21	52.36	60.60	69.99	71.52	76.18	74.27	65.44
X15	53.82	54.30	58.51	58.10	77.25	72.27	48.75	55.06	55.68	49.88	37.79	54.14	61.24	62.32	49.26	56.56
X16	1.51	1.35	1.52	1.50	2.25	2.06	1.13	1.38	1.40	1.18	0.70	1.34	0.68	1.67	1.15	1.39
X17	0.18	0.18	0.20	0.20	0.30	0.27	0.15	0.18	0.19	0.16	0.09	0.18	0.09	0.22	0.15	0.18
X18	0.07	0.07	0.08	0.08	0.12	0.11	0.06	0.07	0.07	0.06	0.04	0.07	0.04	0.09	0.06	0.07
X19	1.00	1.01	1.14	1.12	1.69	1.54	0.85	1.03	1.05	0.88	0.53	1.01	0.51	1.25	0.86	1.03
X20	0.28	0.29	0.32	0.32	0.48	0.44	0.24	0.29	0.30	0.25	0.15	0.28	0.14	0.35	0.24	0.29
X21	30.98	35.68	42.91	25.71	51.33	48.57	34.83	37.38	16.44	16.74	18.06	28.49	10.66	38.38	28.72	30.99
X22	13.90	16.01	19.26	11.54	23.03	21.79	15.63	16.77	7.38	7.51	8.11	12.79	4.79	17.22	12.89	13.91
X23	13.96	16.08	19.33	11.58	23.13	21.88	15.70	16.84	7.41	7.54	8.14	12.84	4.80	17.29	12.94	13.97
X24	60.52	69.70	83.81	50.21	100.26	94.86	68.04	73.01	72.12	62.70	35.28	55.65	70.83	74.96	56.09	68.54
X25	60.27	64.86	71.92	72.11	80.14	77.45	64.03	66.51	86.06	79.36	70.65	81.84	70.42	67.49	58.05	71.41
X26	292.27	336.60	404.76	242.49	484.19	458.12	328.58	352.58	155.12	157.93	270.38	268.78	211.00	362.03	270.88	306.38
X27	219.37	252.65	303.81	182.01	291.00	249.00	276.00	286.00	249.00	246.00	256.00	264.00	218.00	239.00	247.00	251.92
X28	31.34	20.55	23.40	7.73	35.20	23.09	20.94	26.05	4.48	7.99	11.92	9.27	19.46	22.24	17.64	18.75
X29	68.66	79.45	76.60	92.27	64.80	76.91	79.06	73.95	95.52	92.01	88.08	90.73	80.54	77.76	82.36	81.25
X30	58.45	59.28	66.56	65.84	58.95	60.34	49.69	60.60	61.68	51.65	50.74	59.01	49.79	73.14	50.57	60.42
X31	48.45	48.60	49.21	48.50	48.92	48.54	47.94	48.64	48.88	47.61	48.44	48.51	48.15	48.91	48.87	51.41
X32	5.81	4.62	5.05	4.30	4.89	4.93	4.72	4.62	4.52	4.46	4.65	4.76	4.60	4.95	4.81	4.78
CSS Index	0.388	0.435	0.480	0.408	0.533	0.499	0.439	0.462	0.362	0.361	0.385	0.412	0.386	0.452	0.405	0.427

Source: Calculated from Agriculture Census 2016-17 by authors

(Note: X1 to X32 variables see Methodology and Blocks 1 to 15 see Table 4 or 5) cluded in socioeconomic indicator (X_{30} to X_{32}).

There are two popular dimensions to measure agricultural development, viz., input dimensions and output dimensions (Shafi, 1981). Apart from aforesaid input variables, there are two output variables (see Table 4) also incorporated in final composite index of agriculture (see Table 5). This work has measured development based on seven inputs (drawn from thirty-two variables) and two outputs indicators for 1995-96 and 2015-16.

Results and Discussions

This is an investigational study which has analysed and measured development in its combined agricultural aspects at block level for 1995-96 and 2015-16. There are two popular dimensions to measure agricultural development, viz., input dimensions and output dimensions (Shafi, 1981). The development assessment is a quantitative inquiry therefore, the best possible data have been extracted from institutional, technological, infrastructural and socioeconomic under input dimension. The Yang's yield index (productivity) and Gibbs-Martin's crop diversification index have been taken as output dimensions. In this section, two types of analyses have been done. One set relates to the spatial dimension of agricultural development and the second set relates to comparisons in agricultural development. The spatial dimensions of agricultural development have been displayed in Figure 1 and 2. The categorisation of indices breaking points is based on quartile techniques (equation 8 and 9).

In 1995-96, there were seven blocks lyingabove the district mean score (index value), i.e., 0.450. Although, three blocks score above

Table 4: Output Variables of Agriculture Development

SL No.	Block	YYI		CDI		CSS Outputs	
		1995-96	2015-16	1995-96	2015-16	1995-96	2015-16
1	Bamangola	146.05	172.06	0.377	0.512	0.316	0.388
2	Chanchal-I	152.70	202.92	0.474	0.632	0.316	0.435
3	Chanchal-II	150.93	195.35	0.426	0.740	0.358	0.480
4	Englishbazar	146.45	188.51	0.531	0.761	0.321	0.408
5	Gazole	144.28	183.81	0.392	0.587	0.483	0.533
6	Habibpur	146.69	192.75	0.272	0.431	0.450	0.499
7	Harishchandrapur-I	153.93	200.93	0.310	0.498	0.314	0.439
8	Harishchandrapur-II	160.65	209.90	0.364	0.500	0.387	0.462
9	Kaliachak-I	134.09	167.10	0.594	0.829	0.232	0.362
10	Kaliachak-II	136.57	169.21	0.592	0.757	0.221	0.361
11	Kaliachak-III	148.53	194.74	0.600	0.687	0.281	0.385
12	Manikchak	155.31	200.61	0.565	0.812	0.351	0.412
13	Old Malda	150.45	200.49	0.270	0.214	0.315	0.386
14	Ratua-I	151.40	200.50	0.576	0.785	0.350	0.452
15	Ratua-II	159.39	195.21	0.230	0.694	0.309	0.405
	District	148.99	188.66	0.442	0.706	0.334	0.427

Source: Calculated by Authors based on equation (6), (7) and (5)

Table 5: Composite (Inputs-Outputs) Index of Agricultural Development in Malda District

SL No.	Block	1995-95	2015-16
1	Bamangola	0.370	0.485
2	Chanchal-I	0.498	0.597
3	Chanchal-II	0.470	0.619
4	Englishbazar	0.481	0.551
5	Gazole	0.447	0.516
6	Habibpur	0.372	0.488
7	Harishchandrapur-I	0.398	0.532
8	Harishchandrapur-II	0.534	0.597
9	Kaliachak-I	0.362	0.431
10	Kaliachak-II	0.378	0.413
11	Kaliachak-III	0.526	0.546
12	Manikchak	0.601	0.645
13	Old Malda	0.339	0.388
14	Ratua-I	0.572	0.653
15	Ratua-II	0.393	0.562
	District	0.450	0.539

Source: Calculated by Authors based on equation (8)

0.526 but the overall disparity among blocks is persistence. The use of HYV seeds, consumption of fertilisers and insecticides, assured irrigation facilities, better socioeconomic condition have contributed higher output hence higher agricultural development. The three blocks mainly Manikchak (0.601), Ratua -I (0.572)and Harishchandrapur - II (0.534)represent higher development. The common feature of high developed blocks isthat the river Ganga pass through outand therefore, assured irrigation is the main cause of higher development.

There are eight blocks having index values between 0.372 to 0.526. In the mediumrange development category, Kaliachak -III (0.526) block reports highest index due to higher crop diversification induced by assured irrigation, consumption of fertiliser, HYV seeds and better socioeconomic conditions. The Chanchal-I block (0.498) also displays better development in said category due to productivity and diversification pushed by consumption of fertilisers and HYV seeds. Harishchandrapur-I (0.398), Ratua -II (0.393) and Kaliachak-II (0.378) and Kaliachak-III (0.526) blocks although have assured irrigation facilities but except Kaliachak-III, productivity and diversification have not showedbetter result. Because of better productivity and socioeconomic conditions, Gazole block scores 0.447 in 1995-96.

In 1995-96, low agricultural development is found in Old Malda (0.339) and Kaliachak-I block (0.291) mainly due to small size landholdings, lack of credit facilities and shortage of irrigation. The Bamongola (0.370) and Habibpur (0.372) were have facing acute shortage of irrigation in the district. However, productivity and diversification report better in Bamongolaand Kaliachak-I respectively but areas under self-operated farming, low use of HYV seeds, machineries and low credit facilities are responsible for the low development.

Because of the overall increase in composite score from 1995-96 to 2015-16, the common breaking points of indices are not possible to preserve for both the years. Therefore, breaking point in case of 2015-16 index value is calculated separately by use of quartile technique. In 2015-16, it is found that blocks lie above the upper quartile score have a familiar pattern of better input and hence better output. Similarly, lower quartiles led to the conclusion that lower inputs brought lower outputs. The medium class is enjoying a win-win situation in terms of inputs and outputs of agriculture in both the years. The overall development of agriculture is basically inputs influenced outputs and hence better agricultural development.

The disparity in agricultural development during 2015-16 did not decrease substantially rather become widen (Figure 2). Although, the number of blocks in high development category remains three but index value significantly differs from one another. There are three blocks

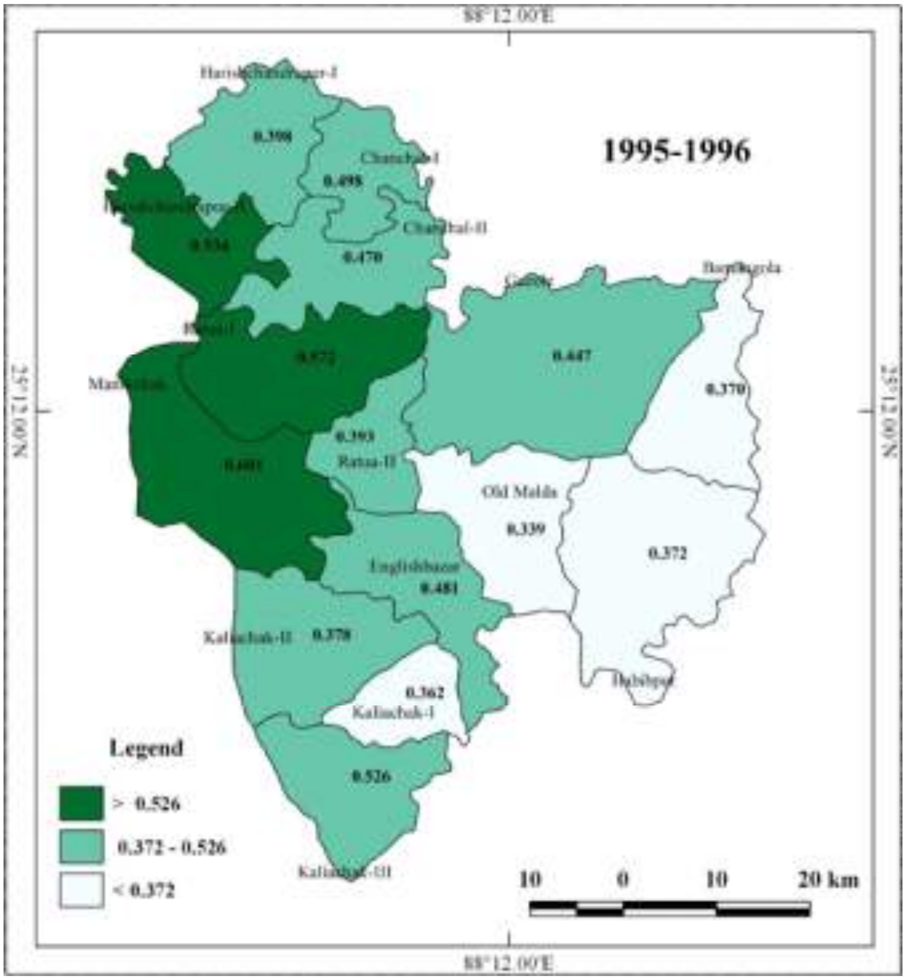

Figure 1: Agricultural development in Malda District

namely Chanchal-II (0.619), Ratua-I (0.653) and Manikchak (0.645) have reported high agricultural development due to above-mentioned causes. The medium index blocks depict better infrastructural availability in the form of land tenancy, irrigation, HYV seed and infrastructural consumption. The blocks like Harishchandrapur-II (0.597) and Chanchal-I (0.597)locate equal index value but productivity and diversification are different from one another mainly due to inputs differences. Kaliachak - III (0.546), Ratua-II (0.562) and English Bazar have reported better development due to productivity and diversification pushed by irrigation and fertilizers consumptions. English Bazar (0.551) block is noted better diversification due to market and socioeconomic conditions. Blocks like Gazole (0.516), Habibpur (0.488) and Harishchandrapur-I (0.532) display lower medium development due to low inputs consumption. Bamongola (0.485), Kaliachak-I (0.431), Kaliachak-II (0.413) and Old Malda (0.388) have experienced low irrigation infrastructure but due to high consumption of fertilizers productivity show off better output (Figure 2).

Change in Agricultural Development

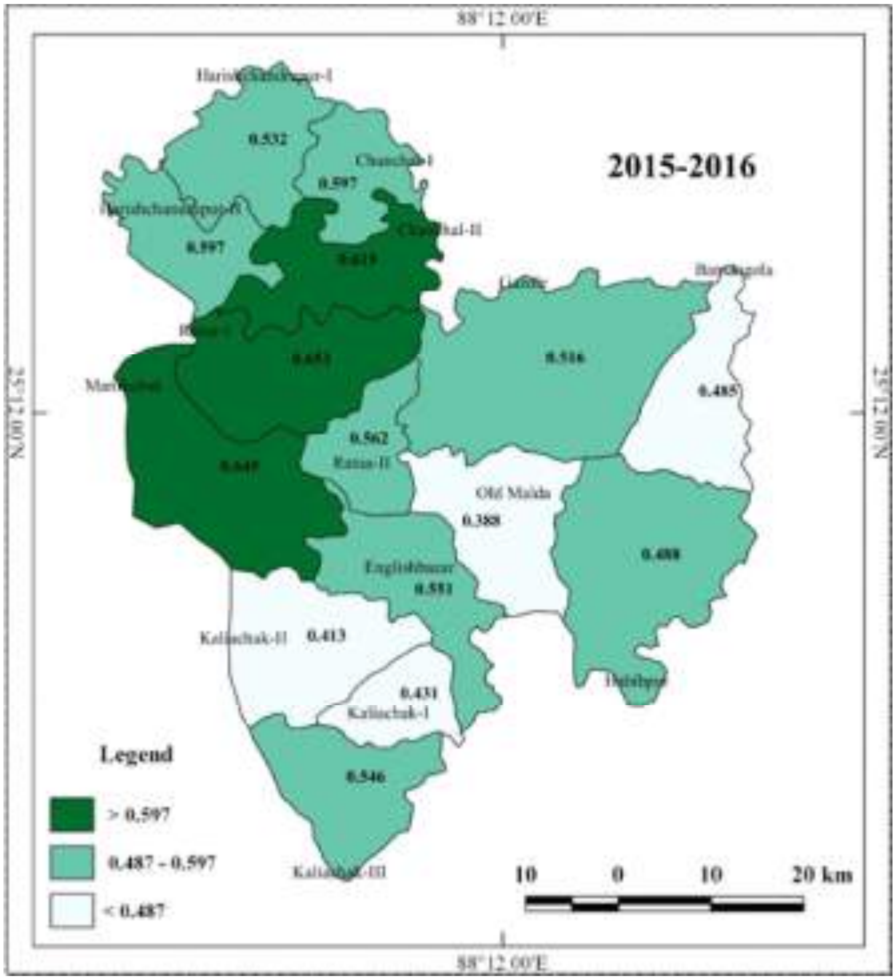

Figure 2: Agricultural Development in Malda District

The overall improvement in index value from 1995-96 to 2015-16 is not only suggests change rather transformation in spatial context too (see Figure 1 and 2). In 1995-96 three blocks have scored above third quartile while in 2015-16 it remains three with major transformation inHarishchandrapur-II block from high to medium category. The significant improvement in productivity and diversification is not comparatively same in case of dry blocks like Bamongola and Habibpur but Habibpurshows the positive transformation from low to medium category. The number of blocks in medium (0.341 to 0.503) range category during 1995-96 and 2015-16 (0.480 to 0.580) have remained the same but vis-à-vis transformation is seen as it is in the previous case. There are threeblocks reported low agricultural development in 1995-96 and 2015-16 but significant improvement in index value is located in Kaliachak-I and Bamongola block. The maximum improvement is found in Bamongola block (from 0.370 to 0.485) hence transformation in low development category is obvious.

Conclusion

The present study reveals an insight about spatial and temporal change in agricultural development from 1995-96 to 2015-16 in Malda district. The temporal change in institutional, infrastructural and technological aspects bring change in the quality of seed, fertilisers consumption and socioeconomic determinants which have improved productivity and diversity index. The transformation in spatial context does support this argument also. The attainment of institutional and infrastructural benefits at block level has raised two serious concerns; first, the distribution and delivery of welfare policies and programs had not been realised yet with their actual spirit and second, the discriminatory delivery role might have been played by local institutions. However, rural development policies especially, agricultural development programs are focused on a particular aspect of development. Therefore, a micro level analysis on agricultural development reports diversity mainly caused by disparity. In this context, a significant integrated development policy framework is required to minimise regional disparity in development measures. However, further research and analysis by land size categories is felt to bring out actual development differences among and between marginal, small, semi-medium, medium and large land size groups in the district.

References

Alam, S.M. and Mohammad, A. eds., 1976, *Planning atlas of Andhra Pradesh*. Pilot Map Production Plant, Survey of India.

Gangwar, L.S. and Sen, C., 1997, The Comparative Analysis of Technology Adoption and its Impact on Cropping Pattern and Productivity Nainital Vs. Uttar Pradesh. *Agricultural Situation in India*, 54, pp.501-504.

Joshi, Y.G. and Dube, J., 1979, Measurement of Regional Disparity in the Level of Agricultural Development in Madhya Pradesh, *The Deccan Geographer*, India, Vol. XVII (October-December), (3), pp.585-593.

Majid, H., 1996, Systematic: Agricultural Geography. Rawat Publication.

Malik, D.P. and Singh, I.J., 2002, Crop diversification-An economic analysis. *Indian journal of agricultural research*, 36(1), pp.61-64.

Mohammad, N., 1981, SPATIAL VARIATIONS AND DETERMINANTS. Perspectives in Agricultural Geography: *Regional dimensions in agriculture*, 1, p.415.

Mohanty, B.B., 2009, Regional disparity in agricultural development of Maharashtra. *Economic and political weekly*, pp.63-69.

Morgan, W.B. and Munton, R.J.C., 1971, *Agricultural geography*. Methuen young books.

Nath, V., 1969, The growth of Indian agriculture: a regional analysis. *Geographical review*, pp.348-372.

Norton, R.D., 2004, Agricultural development policy: concepts and experiences. *Food & Agriculture Org*.

Pacione, M., 2014, *Progress in Agricultural Geography* (Routledge Revivals). Routledge.

Tewari, R.T. and Singh, N., 1985. Development and Productivity in Indian Agriculture: A Cross-section Temporal Analysis. *Indian Journal of Regional Science*, 17(1), pp.65-75.

Ram, R., 1989, Agricultural development and planning in India. New Delhi, Criteria Publication.

Robinson, G.M., 2018. Globalization of agriculture. *Annual Review of Resource Economics*, 10, pp.133-160.

Sarkar, A., 2013, *Quantitative Geography: Techniques and Presentations*. Orient Black Swan.

Shafi, M., 1981, Increasing our Agricultural Production. *The geographer*, 28(1), pp.1-8.

Siddiqui, S.H. and Rahaman, H., 2019, Land Size Class Wise Change in Cropping Pattern in Malda District-A Block Level Analysis, *Journal of Geography, Environment and Earth Science International* 21(4): 1-19, 2019; Article no. JGEESI.49476, ISSN: 2454-7352

Shrivastava, S.L., 1983, Regional disparities in agricultural development in Madhya Pradesh. *Indian Journal of Regional Science*, 15(2), pp.55-60.

Swaminathan, M.S., 2000, Natural resource management-for an ever-green revolution. *the Hindu-Survey of Indian Agriculture*, pp.9-16.

Yang, W., 1965, *Methods of farm management investigations for improving farm productivity* (No. 04; RMD, S401. U6 Y3.).

●