

## A SPATIO-TEMPORAL ANALYSIS OF CROP DIVERSIFICATION IN HUGLI DISTRICT, WEST BENGAL

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### ABSTRACT

Agriculture plays a significant role in rural economic development especially in case of a country like India where 50.2 % of population is directly or indirectly dependent on agriculture for their livelihood. Agricultural and allied sectors contribute nearly 17.8 and 17% of Gross Domestic Product (GDP) of India. Moreover, agriculture fetches substantial amount of valuables foreign exchange. Agriculture which mostly covers farming practices is one of the potential endowments for some regions. As Indian agriculture is mainly rain-fed in nature, so farming is a risky business. Farmers face risk coming from natural as well as economic factors. The natural factors are difficult to control, but an economic factor related to changes in price commonly occurs and such risks are inevitable. So diversification of products is an important way to reduce both natural and economic uncertainties. Present study is confined on Hugli District which is one of the agriculturally developed districts in West Bengal. Such an analysis focuses on the identification of crop diversification regions that provide a clear areal differentiation in case of crop grown and also give avenue to future planners to establish more economically sustained agricultural system.

**Key Words:** Rural economic development, crop diversification, areal differentiation

### INTRODUCTION

The concept of crop diversification is a scientific devise to study the existing spatial relationship of crops in association with each other in agricultural geography and land utilization. Crop diversification leads to a movement of low-value agriculture to high-value agriculture and this is an important way to enhance agricultural output. Cropping pattern implies the proportion of area under different crops at appoint of time. A change in cropping pattern or crop diversification implies a change in the proportion of area under different crops. The cropping pattern in an area depends mostly up on agro climatic, technical and institutional factors (Vaidyanathan, 1992).

Crop diversification simply means rising of different varieties of crops in the arable land. It is also found that the higher the technical inputs, lesser the degree of diversification. In present day developmental paradigm of agrarian economy specifically in case of developing country like India, this concept is applied to individual farmers and to different farms as well as to regions. In the third world country like India where man-land ratio is high enough, agricultural diversification especially in term of crop diversification is very much necessary (Let, 2011). At the same time, Indian agricultural is gamble in monsoon i.e., to get rid from helpless dependency on seasonal monsoonal rainfall, irrigation facilities –one of the most efficient infrastructure technological aids are earnestly required so that agricultural economy is established in the strong relative platforms (Let & Bhattacharya,2010).

So, Governmental programmers also promoted the widespread diversification in the field of agricultural production. But due to several constrains like diversified socio-cultural traditions as well as economic profiles, inadequate knowledge about crop diversification promote rice monoculture at different parts of West Bengal which gives a declining status of crop diversification in State as well as district level. Even agriculturally developed districts like Barddhaman, Hugli, etc. do not enjoy the significant effects of this diversification system due to their traditional monoculture system. The study of crop diversification is very much important due to following reasons (Hussain, 2009):

- (i) In the monsoonal country (*e.g.*, India, Bangladesh), where whole agriculture system mainly depends of monsoon-rain; farmers often prefer to plough different crops in different seasons because of variability of rainfall and inadequacy of source of irrigation.
- (ii) In the tradition bound subsistent farming systems, the farmers grow several crops to meet the family requirements. In such areas, one may find a high degree of crop diversification.
- (iii) Diversification has usually been done by the farmers to enhance nitrogen in the soil and to replenish the soil fertility. Crop diversification increases the sustainability of arable soil.
- (iv) The diversification of crops also generates more employment as the farmers and agricultural workers remain busy in the sowing, weeding, harvesting and marketing of different crops throughout the year.

Diversification of crops also enables the farmers to provide a reasonable quantity of the costly inputs to their crops as different crops need different quantities of inputs (*e.g.*, chemical fertilizers, insecticides, pesticides and irrigation).

### STUDY AREA

The district Hugli is lying in between 22°39'32" North and 23°07' 20" North, 87°30' 20" East and 88° 30' 15" East longitude. The district is bordered on the north by the districts of Bankura and Barddhaman, on the south

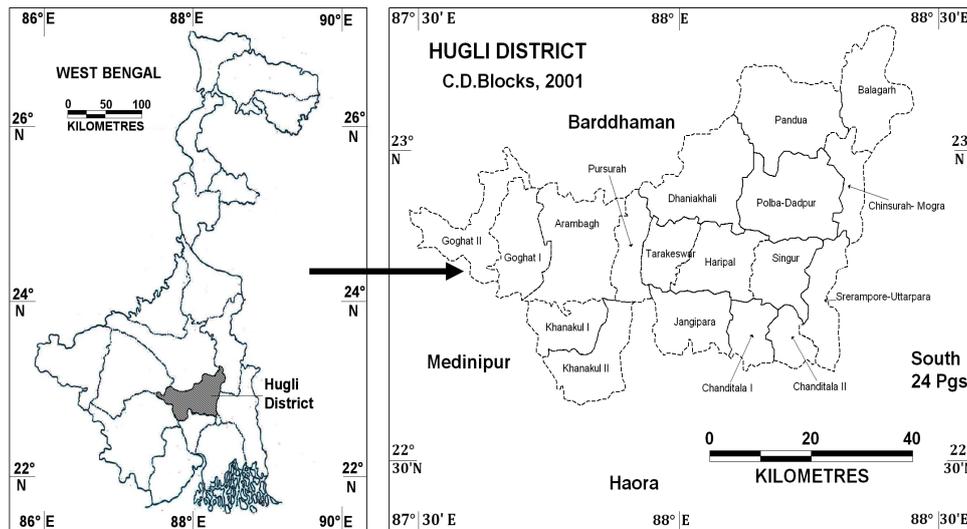
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by the district of Haora, on the east by the Bhagirathi (Hugli river) demarcating the district of Nadia towards north and North Twenty Four Parganas district east and the west and south-west by the district of Medinipur (Fig. No. 1). This district has a total area of 3,573.30 Sq. Kms and it ranks 13th among all the districts of West Bengal. Hugli has 18 C.D. Blocks with the District Headquarter in Chinsurah.

**IMPORTANT PHYSICAL CHARACTERISTICS OF THE STUDY AREA**

- (i) The district is a part of the proper Delta and its topographical homogeneity is remarkable. The district is formed of recent alluvium. The land in the west of Darakeswar has a perceptible rise in elevation and some undulations. The land is rocky as a continuation of the Bankura terrain at a higher elevation. The district is sloping from the north-west to the south-east and drained by important rivers of the Dwarkeswar, the Mundeswari, the Damodar and the Bhagirathi. The slope varies a couple of inches to more than a foot per mile. The slope is more marked in the portion west of the river Dwarkeswar. There is a flat alluvial plain intersected by the rivers and streams between Bhagirathi and Dwarkeswar rivers. This plain occupies 7/8th of the district. A number of saucer-shaped depressions are observed here and there between the rivers. All these marshy depressions are more common in Chandernagar sub-division. The saucer like depressions acts as the receiver of the drainage water from the surrounding lands (Census, 2001).
- (ii) The Hugli more commonly known as the Bhagirathi forms the eastern boundary of the district. The western bank of the river is fairly high. It is a tidal river and the tides run up to Guptipara. Sometimes, they go beyond the district and go up to Nabadwip. The mean level of the water is very much affected by tides. It carries down an immense volume of flood water during the rains. The chars and the islands become mostly submerged in the rains and the breadth of the rivers expands to more than a mile. In the summer, the river shrinks in breadth and also the height of the water level falls considerably (Census, 2001).
- (iii) The soils found in the region are mainly alluvial. The type of older alluvium with hard rocks of laterite debris is found stretching in the western part of the region. Laterite washing from the high lands of the Bankura has made the district quite rich in laterite content (Census, 2001).



**FIGURE NO. 1**

**TABLE 1: SOME INFORMATION OF HUGLI DISTRICT**

Total Area	3149 Sq.Km.
Total Population	5041976 (2001)
Population Density	1601 per Sq. Km.
Percentages of Cultivators	14.95
Percentages of Agricultural Labourers	24.31
Net Sown Area	219.91 (2007-08)
Area irrigated by different sources	345.150 ('000 Hec)
Yield Rate of Rice	2800 Kg. per Hec.

Source: Census of Hugli District, 2001 and District Statistical Handbook, 2008

**OBJECTIVES**

The present study has mainly examined the Spatio-temporal variation of agricultural diversification in different blocks of Hugli District which shows the changes in the total cropped area of the districts. Moreover, it envisages the different levels of diversification at block-level (*i.e.*, High, moderate, low, *etc.*) in the District.

Mainly the spatial pattern of crop diversification would be the tools for future planning in case of crop production.

**DATABASE AND METHODS**

The entire work is mainly based on secondary data i.e., collected from District statistical Handbook of Hugli District (2008), District Gazetteer of Hugli District and many others literature and research papers. To undertake the scientific investigation for crop diversification, first method was formulated by Jasbir Singh in 1984. It suggests the formula:-

$$\text{Index of Crop Diversification} = (\text{Percentage of total cropped area under 'n' crop} \div \text{Number of 'n' crops})$$

Where 'n' denotes those crops which individually occupied at least 5 % or more of total cropped area in the Tahsil.

For the measurement of diversification of crops Bhatia (1965) also developed a formula based on the gross cropped area. The formula has been expressed as:

$$\text{Index of crop diversification} = (\text{Percent of sown area under x crops} \div \text{number of x crops})$$

There are some limitations to adopt this formula since, in this purpose, the quantitative techniques proposed by Gibbs and Martin to measure crop diversification provide a useful index for measuring the degree of diversification in the cropping pattern of an area (Singh & Dhillon, 1984). The formula developed for calculating the Crop Diversification Index (CDI) is as follows:

$$\text{Crop Diversification Index (CDI)} = 1 - \{ \sum X^2 / (\sum X)^2 \}$$

Where, X is the percentages of the total cropped area occupied by each crop or hectare under individual crop. If the total cultivated area in a region is devoted wholly to one crop (i.e., specialization) the index value will be zero (0) and if it is evenly distributed among all crops (i.e., maximum diversification) the index value approaches one (1).

This direct and calculation- precise method has taken into consideration both the evenness factor (relative strength of crops) and number of factors (number of crops) perfectly to form the basis of proper measurement of diversity. On the other hand, the figures can be adjusted into hundreds, thousands, millions etc. which will not alter the results. Therefore, keeping all these advantages in mind, this method of crop diversification has been adopted in this purpose.

**ANALYSIS OF DATA**

Total area of Hugli District is 3149 Sq.Km. Out of this total land, only 219.91 thousand hectares (2199.1 Sq.km. i.e., 69.83%) is under agricultural uses in 2007-08. The tendency of total cultivated area is rather fluctuating during the period of 2003 to 2008 (Fig. No. 2), where as irrigated area under different sources of irrigation is also fluctuating during same time span (Fig. 3).

**TABLE: 2 Areas Under principal crops and major sources of irrigation**

Year	Total Cropped Area in '000 Hectares	Irrigated Area in '000 Hectares.
2003-04	225.17	342.571
2004-05	219.73	338.189
2005-06	218.82	335.107
2006-07	220.52	324.83
2007-08	219.91	345.15

Source: District Statistical Handbook, Hugli District (2008)

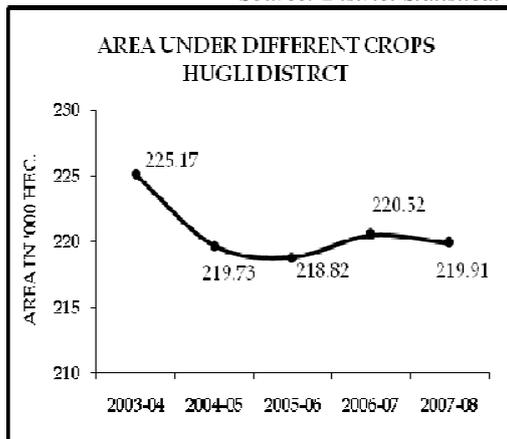


FIGURE NO. 2

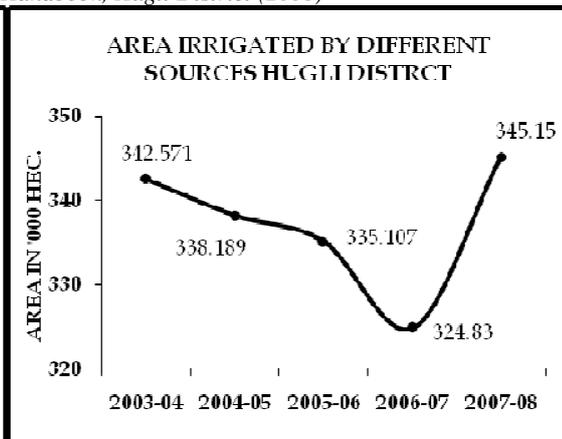


FIGURE NO. 3

**Table: 3 (a) & (b) Crop Diversification Categories, Hugli district, 2008**

<i>SL.NO.</i>	<i>Name of Block</i>	<i>Crop Diversification Index (CDI)</i>
1	Dhaniakhali	0.48
2	Pandua	0.38
3	Balagarh	0.48
4	Chinsurah-Mogra	0.24 (Minimum)
5	Polba-Dadpur	0.36
6	Tarakeswar	0.71 (Maximum)
7	Haripal	0.56
8	Singur	0.56
9	Jangipara	0.48
10	Chanditala-I	0.33
11	Chanditala-II	0.25
12	Srerampur-Uttarpara	0.28
13	Goghat-I	0.46
14	Goghat-II	0.52
15	Arambagh	0.46
16	Khanakul-I	0.61
17	Khanakul-II	0.65
18	Pursurah	0.71 (Maximum)

**TABLE: 3 (B)**

<i>Diversification Categories</i>	<i>Range of Crop Diversification Index</i>	<i>Block Sl. No.</i>	<i>Number of Blocks</i>
VERY LOW	<0.30	4,11,12	3
LOW	0.31-0.40	2,5,10	3
MODERATE	0.41-0.50	1,3,7,8,9	5
HIGH	0.51-0.60	7,8,14,	3
VERY HIGH	>0.60	6,16,17,18	4

*Source: District Statistical Handbook, Hugli District, 2008 and Calculated by author*

#### **RESULT AND DISCUSSIONS**

- (i) It is quite clear from the analysis (table no. 3-A & B) that crop diversification is not so much promising rather it is moderate in character. Within the whole district, crop diversification is very high (CDI>0.60) only in four blocks namely Tarakeswar, Khanakul I, Khanakul II and Pursurah. The region has many depressions which receive water from the surrounding lands during the rainy season and discharge the water through small channels. As a result, agriculturally this region is made of fertile alluvial soil with an ample supply of irrigated water (more than 80-90% cropped area is irrigated) which is more favourable for diversification of crops in different seasons (Fig. No. 4).
- (ii) High level crop diversification (CDI=0.51-0.60) is found within three blocks i.e., Haripal, Singur and Goghat II. These blocks are situated along the right bank of alluvial tract of Hugli River which is also favorable for irrigation facilities throughout the year (50-60% of cropped area is irrigated).
- (iii) In rest of the blocks, crop diversification index ranges below 0.50, whereas in Chinsurah-Mogra, Chanditala II and Srerampur-Uttarpara, CDI is very low i.e. below 0.30. Though these blocks are placed along the fertile tract of Hugli river but due to high level of urbanization and concentration of commercial activities the cropped area have been reduced and diversification has also been limited.

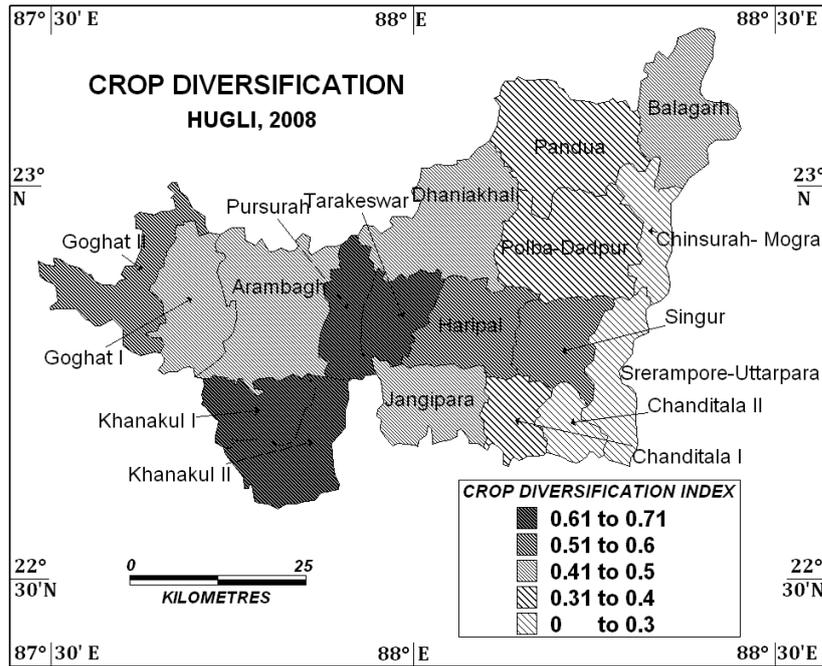


FIGURE NO.4

**CONCLUSION**

It is clear from the above analysis that blocks having greater number of urban centers along the Hugli River (e.g., Chinsurah-Mogra, Srerampur-Uttarpara, Chanditala I and II) belongs to low level of diversification. Whereas blocks like Pandua, Polba-Dadpur also has low level of diversification in comparison to rest of the blocks mainly due to rice monoculture and jute monoculture. Diversifications of crops from food grains to varieties of high value products like vegetables, oil seeds, jute etc. should be cultivated. Increase in crop diversification leads rural economic developments and gives an alternative source of income in urban to suburban areas. The most feasible way of improving the diversification is to reduce the sown area of rice cultivation through altering it towards other crop production. Orchard framing mainly in the urban areas may be the most valuable alternatives to enhance the diversification rate. If the diversification is appropriate then this district will be a multi-stored granary for different crops in near future.

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