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Land Size Class Wise Growth of Crop Diversification Index: A Case Study From Murshidabad District of West Bengal

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Abstract

Diversification towards high-value and more competitive commodities is considered to be an important strategy to tackle many problems as it ensures better income opportunities and employment generation and offers better nutrition security and sustainability of natural resources. Broadly, the concept of diversification carries different meanings to different scholars at different levels. It simply refers to the cultivation of multiple crops in a particular region at a given time. This study is conducted to analyse the spatiotemporal changes in crop diversification index across different land size class categories at the block level in Murshidabad district during 1995-96 to 2015-16. The required data for 1995-96 and 2015-16 have been collected from Agriculture Census of India. To calculate the diversification index, Gibbs-Martin's technique is applied. The result reveals an increasing trend of crop diversification in the district. The study suggests the proper capacity-building programs for the farmers so that the diversification process remains continuous and fruitful.

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Introduction

Agriculture, despite its falling share in GDP, continues to be one of the most crucial sectors of the national economy in developing countries like India. A vast majority of the nation's population is still very much dependent on agriculture for their livelihood. But the country is facing many hindrances, such as the shrinking size of landholdings, declining investment in the agricultural sector, slow technological advances in cereal crops, degradation of natural resources, etc.

(Joshi et al., 2004). Therefore, the development of this sector is the primary concern among policymakers, researchers and academicians (Rahaman, 2021). One of the dimensions defining the agricultural development of a region between two periods of time is agricultural diversification. Diversification towards high-value and more competitive commodities is considered to be an important strategy to tackle those abovementioned challenges (Pingali and Rosegrant, 1995; Vyas, 1996; Ryan and Spencer, 2001; Rao et al., 2006; Birthal et al., 2020; Rahaman and Singh, 2020).

Broadly, the concept of diversification carries different meanings to different scholars at different levels. For instance, Joshi et al. (2004) define diversification as “a movement from low-value crops to high-value crops for the betterment of the agricultural system”. It simply refers to the cultivation of multiple crops in a particular region at a given time. The diversification of crops towards high-value commodities ensures better income opportunities and employment generation and offers better nutrition security and sustainability of natural resources (Chand, 1996; Satyasai and Viswanathan, 1996; Bamji, 2000; Kasem and Thapa, 2011; Nunes et al., 2018; Piedra-Bonilla et al., 2020; Rahaman and Ansari, 2022). Apart from the innovation of institutional, infrastructural, and technological facilities, different policies at macro and micro level planning pace up the diversified cropping pattern in a region.

Diversification is a continuous process that changes over time and space. A proper understanding of diversification patterns and their limitations will help initiate appropriate policies and schemes that would benefit large numbers of marginal and small landholders. Thus, conducting such studies using aggregate and disaggregated data for different regions of the country is essential. The present study is, therefore, carried out across land size categories in the Murshidabad district of West Bengal. It may be noted that no such study has existed in the district across different land size class categories.

Study Area

Murshidabad district, the northernmost district of the presidency division, is located in the middle portion of West Bengal, lying between 23°43'30" and 24°50'20" North latitudes and 87°49'17" and 88°46'00" East longitudes (Figure 1). According to the 2011 census, 71,03,807 people live in the district spreading over an area of 5324 sq. km. It contributes 7.78 per cent of the total population of West Bengal and shares approximately 6 per cent of the state. The district is divided into two physiographic divisions: the western part reveals rugged terrain, locally known as Rarh, and a flat and rolling plain on the eastern side, known as Bagri. The 2015-16th Agriculture Census shows that the district has a total of 433507 hectares of net sown area. The same census reveals that 82.03 and 14.77 per cent of the district’s total farmers belong to marginal (less than 1 ha) and small (1-2 ha) land classes, respectively. Similarly, the semi-medium farmers (2-4 ha) account for 3.10 per cent, the medium farmers (4-10 ha) 0.09 per cent and the large farmers (more than 10 ha) are only 0.01 per cent of the total farmers.

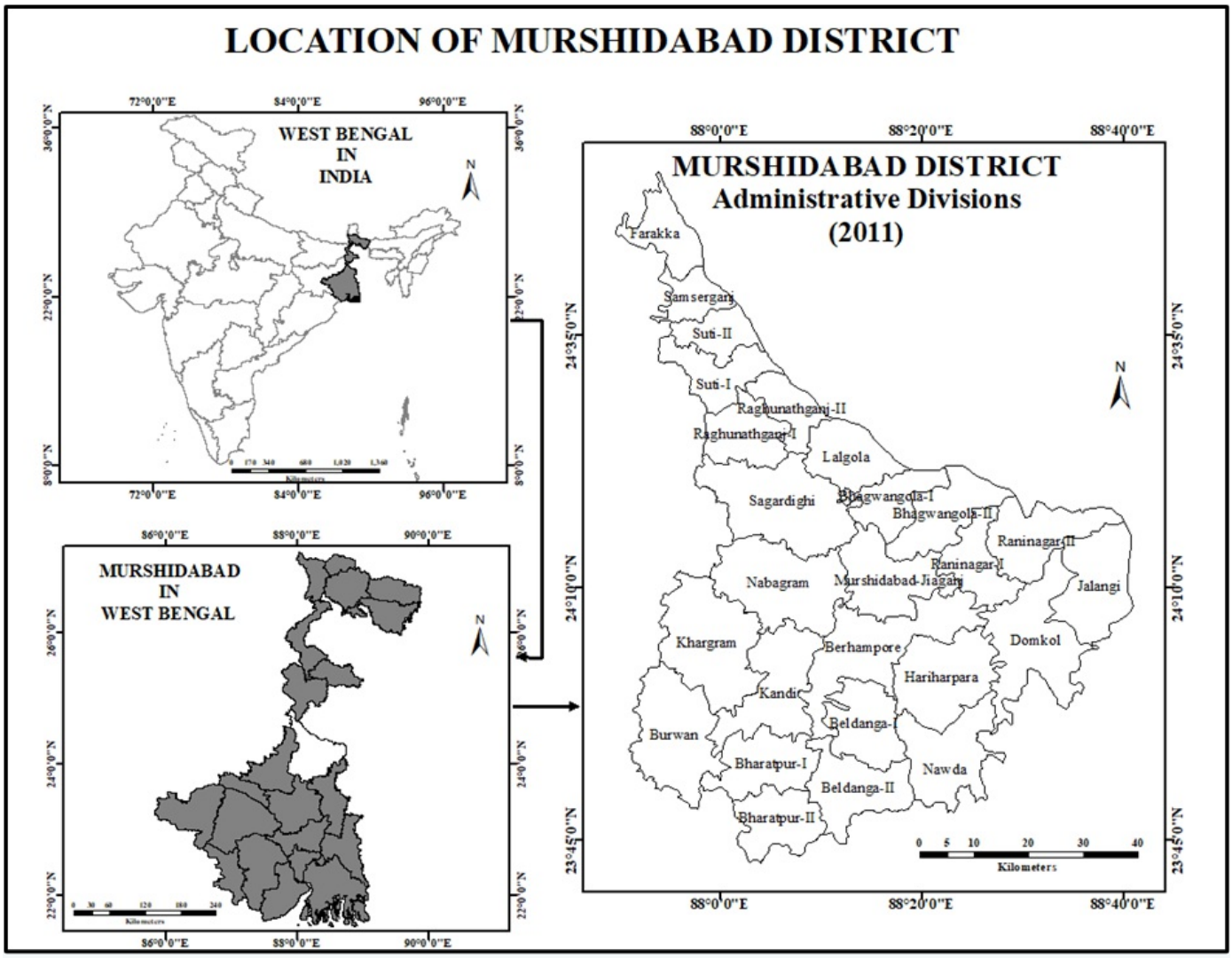

Figure 1. Locational map of the study area

Source: Base map sourced from Census of India, 2011

Objective

The prime objective of this study is to analyse the spatiotemporal changes in crop diversification index across different land size class categories at the block level in Murshidabad district during 1995-96 to 2015-16.

Data Source and Methodology

This research work is entirely based on secondary data sources, and the required data have been collected from the Agriculture Census of India.

Several methods measure the intensity of crop diversification, such as the Gibbs-Martin Index, Herfindahl Index, Transformed Herfindahl Index, Simpson Diversification Index, Entropy Index, Modified Entropy Index, Composite Entropy Index, Ogive Index, and others. Gibbs and Martin's (1962) technique is employed to assess the crop diversification index

in the present study because it considers the percentage of the areal extent of all the crops out of the total cropped area. The index is computed as follows:

$$\text{Crop Diversification Index} = 1 - \frac{\Sigma X^2}{(\Sigma X)^2}$$

Here, X is the percentage of the total cropped area occupied by an individual crop at a point of time. The index value of this technique ranges from 0 to 1. The crop diversification seems to be higher when the index value approaches 1, while the value reaching near 0 reflects a specialization of crop cultivation.

Result and Discussion

Figure 2 reveals an increasing trend of crop diversification across land size categories in the district from 1995-96 to 2015-16. There has been an increase in the diversification index value of 0.099 in the past twenty years, which reflects the diversification of crops in the district. The index value for the overall district was 0.598 in 1995-96 and has increased to 0.697 in 2015-16. Across the land categories, the large land class (0.287) reports the highest index gain, followed by small (0.124), marginal (0.097), semi-medium (0.073), and medium (0.055) land size classes.

Suti-II (0.757) records the maximum diversification index in marginal land class in 1995-96, followed by Raninagar-II (0.741) and Samserganj (0.724). Interestingly, Raninagar stands at the top of the table in 2015-16 with an index value of 0.844. such higher index values are the results of introducing horticulture and floriculture crops to the cropping system (Kumar et al., 2012). On the other hand, Bharatpur-II (0.369) and Khargram (0.486) are the blocks having the least index value in 1995-96 and 2015-16, respectively. All the blocks under this land holdings posit a positive change in the diversification index except for Hariharpara (0.108), Beldanga-I (0.062), and Raghunathganj-I (0.034), where reverse change has been noticed due to the dominance of major cereal crops in the existing cropping pattern. Kandi (0.264), Bharatpur-II (0.252), Murshidabad-Jiaganj (0.213), and Bharatpur-I (0.200) are the blocks that gained a significant amount of index value increase in the land class mentioned above.

Table 1 reveals that as many as sixteen blocks recorded an index value more than the district's average index (0.558) under the small land category in 1995-96, in which, Raninagar-II (0.735) indicates the maximum diversification index. Bharatpur-II again stands at the bottom in the same year with an index value of 0.284. In 2015-16, the maximum and minimum index values under the small holdings are noted by Raninagar-II (0.881) and Sagardighi (0.460), respectively. The Kandi block displays the maximum diversification increases in the past two decades with a value of 0.408. There are only three blocks under this land class which register an adverse change in index value in the district. These are Nawda (0.113), Farakka (0.058), and Suti-II (0.046). Such lowering of diversification is because the majority of the net sown area in those blocks is devoted to only a few major cereal and fibre crops.

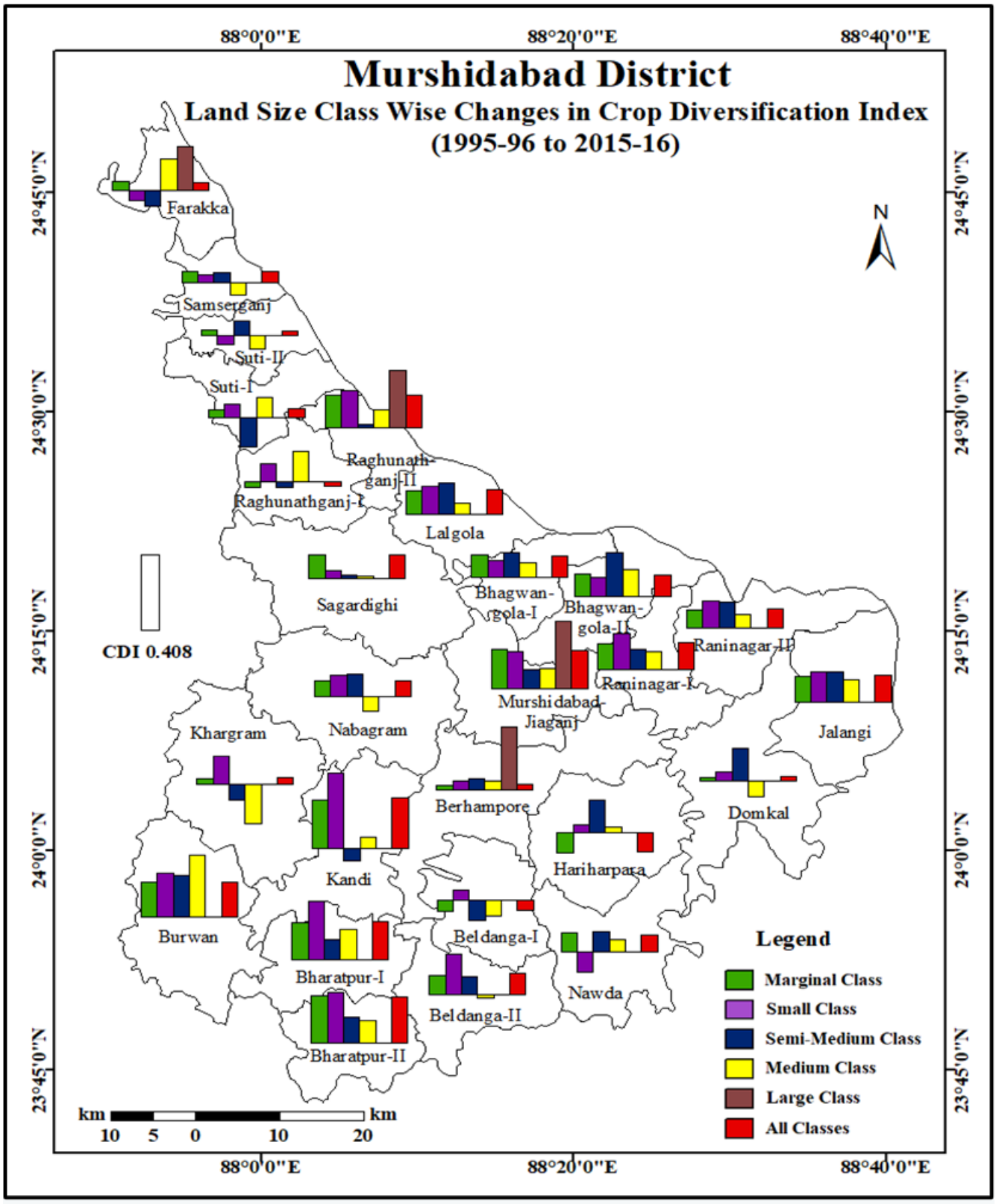

Figure 2. Land size class wise changes in crop diversification index, 1995-96 to 2015-16

Source: Based on Table 1

Table 1. Crop Diversification Index by Land Size Category in Murshidabad District, 1995-96 and 2015-16

Blocks	1995-96						2015-16					
	Marginal	Small	Semi-Medium	Medium	Large	All Classes	Marginal	Small	Semi-Medium	Medium	Large	All Classes
Berhampore	0.615	0.602	0.522	0.653	0.224	0.611	0.639	0.654	0.583	0.706	0.567	0.642
Burwan	0.383	0.302	0.307	0.347	N. A	0.379	0.568	0.536	0.535	0.683	0.471	0.565
Beldanga-I	0.694	0.535	0.440	0.633	N. A	0.686	0.632	0.590	0.327	0.546	N. A	0.628
Beldanga-II	0.621	0.581	0.534	0.585	0.433	0.613	0.724	0.802	0.627	0.562	N. A	0.729
Bhagwangola-I	0.708	0.684	0.688	0.701	N. A	0.703	0.832	0.777	0.826	0.778	0.443	0.821
Bhagwangola-II	0.701	0.702	0.478	0.502	N. A	0.702	0.823	0.808	0.717	0.647	N. A	0.820
Bharatpur-I	0.440	0.321	0.228	0.192	N. A	0.432	0.640	0.636	0.336	0.355	N. A	0.638
Bharatpur-II	0.369	0.284	0.259	0.285	N. A	0.366	0.621	0.558	0.396	0.402	N. A	0.615
Domkal	0.718	0.707	0.520	0.744	0.206	0.715	0.733	0.756	0.695	0.658	N. A	0.739
Farakka	0.592	0.589	0.640	0.231	0.112	0.590	0.643	0.531	0.555	0.400	0.348	0.634
Hariharpara	0.723	0.575	0.381	0.588	N. A	0.719	0.615	0.618	0.563	0.623	N. A	0.616
Jalangi	0.696	0.682	0.710	0.312	N. A	0.693	0.834	0.845	0.874	0.435	N. A	0.839
Kandi	0.376	0.308	0.375	0.447	N. A	0.371	0.640	0.716	0.305	0.506	N. A	0.644
Khargram	0.455	0.428	0.439	0.450	N. A	0.449	0.486	0.586	0.356	0.241	N. A	0.488
Lalgola	0.637	0.623	0.567	0.515	N. A	0.634	0.766	0.778	0.735	0.576	N. A	0.767
Murshidabad-Jiaganj	0.624	0.633	0.647	0.643	N. A	0.629	0.837	0.833	0.751	0.749	0.363	0.836
Nabagram	0.449	0.404	0.407	0.358	N. A	0.442	0.533	0.521	0.528	0.277	N. A	0.530
Nawda	0.635	0.719	0.503	0.620	N. A	0.641	0.736	0.606	0.611	0.686	0.422	0.731
Raghunathganj-I	0.586	0.549	0.437	0.525	N. A	0.582	0.551	0.644	0.404	0.689	N. A	0.556
Raghunathganj-II	0.650	0.574	0.582	0.618	0.210	0.644	0.829	0.781	0.602	0.716	0.523	0.822
Raninagar-I	0.679	0.653	0.692	0.663	N. A	0.677	0.818	0.846	0.801	0.758	N. A	0.823
Raninagar-II	0.741	0.735	0.646	0.797	N. A	0.739	0.844	0.881	0.789	0.872	N. A	0.847
Sagardighi	0.511	0.419	0.416	0.407	N. A	0.504	0.641	0.460	0.430	0.421	N. A	0.633
Samserganj	0.724	0.679	0.676	0.569	N. A	0.718	0.781	0.723	0.732	0.497	N. A	0.778
Suti-I	0.570	0.535	0.461	0.571	0.107	0.563	0.613	0.612	0.302	0.682	N. A	0.612
Suti-II	0.757	0.694	0.754	0.733	N. A	0.751	0.788	0.648	0.835	0.658	N. A	0.779
Total	0.602	0.558	0.512	0.526	0.162	0.598	0.699	0.682	0.585	0.582	0.448	0.697

Source: Calculated by Researcher (Data extracted from Agriculture Census, Government of India, 1995-96 and 2015-16)

N.A – Not Available

Under the semi-medium land class, a total of thirteen blocks report diversification index value above the district's average (0.512) in 1995-96, where, Suti-II (0.754) along with Jalangi (0.710), Raninagar-I (0.692), and Bhagwangola-I (0.688) indicate the maximum diversification. In the same year, Bharatpur-I (0.228) appears to be the least diversified block due to the dominance of paddy and jute crops in the total gross cropped area. Jalangi (0.874) emerges as the most diversified block, while Suti-I (0.302) displays the least index value under the same land category in 2015-16. All but six blocks, namely Beldanga-I, Farakka, Kandi, Khargram, Raghunathganj-I, and Suti-I, record an increase in diversification index

under this land holdings in the district.

Figure 2 depicts that Burwan (0.336) reports the maximum increase in the diversification index under the medium land size category, followed by Farakka (0.169), Raghunathganj-I (0.164), and Bharatpur (0.163). Seven blocks have experienced an adverse increase in diversification index in the past twenty years under this land holdings. In 1995-96, Raninagar-II (0.797) was the highest diversified block in the district, followed by Domkal (0.744), Suti-II (0.733), and Bhagwangola-I (0.701). In contrast to this, Bharatpur-I (0.192), Farakka (0.231), Bharatpur-II (0.285), and Jalangi (0.312) are the least diversified blocks sequentially. Once again, in 2015-16, Raninagar-II appeared as the most diversified block in the district, with an index value of 0.872. However, Khargram (0.241) fell at the bottom regarding the diversification index in 2015-16.

The farmers of large land holdings are more intent on monocropping rather than the diversified cropping pattern. As a result, this land size category reports the lowest diversification index (0.162 in 1995-96 and 0.448 in 2015-16) among different land classes. It is essential to mention that only eight blocks had large land holdings in 1995-96 and seven blocks in 2015-16. Among these blocks, Beldanga-II (0.433) and Berhampore (0.567) represent the maximum diversification index in 1995-96 and 2015-16, respectively.

Figure 2 reveals that sixteen blocks remained above the district average in the diversification index during 1995-96, while in 2015-16, the number of blocks was reduced to thirteen. Suti-II (0.751) sits on the top of the list of most diversified blocks in 1995-96, followed by Raninagar-II (0.739) and Hariharpara (0.719). These higher index values are due to the shifting of the cropping pattern from cereal to fruits, vegetables, pulses, and other cash crops. Bharatpur-II (0.366) turned out to be the least diversified block during 1995-96 in the district. The maximum diversification during 2015-16 is displayed by Raninagar-II (0.847). On the contrary, Khargram (0.466) attains the bottom position in the same year. The majority of the blocks have shifted towards a more diversified cropping system in the past twenty years, as evidenced by Figure 2. The most prosperous blocks in this regard are Kandi (0.273), Bharatpur-II (0.249), Murshidabad-Jiaganj (0.207), and Bharatpur-I (0.206). Overall, only three blocks report an adverse increase in the diversification index, among which the highest decrease is located by Hariharpara, with an index value of 0.103, followed by Beldanga-I (0.058) and Raghunathganj-I (0.026).

Conclusion

The study reveals an increasing trend of crop diversification in the district from 1995-96 to 2015-16, both at the land size class category level and block level. Some blocks like Kandi, Bharatpur-I & II, Murshidabad-Jiaganj, Burwan, Raghunathganj-II, Raninagar-I, etc., have seen a significant improvement in diversification index over the course of twenty years span. Across land size categories, the marginal and small land holdings report dominance improvement in the district. Although the large land class gains the maximum increase in index value, it is almost negligible as the share of large farmers accounts far below one per cent of the total farmers in the district. After realizing the continuous growth of diversification in the district, the study suggests the proper capacity-building programs for the farmers so that the

diversification process remains continuous and fruitful.

References

- Bamji, M. S. (2000). Diversification of agriculture for human nutrition.*Current Science*, 78(7), 771-773.
- Birthal, P. S., Hazrana, J., & Negi, D. S. (2020). Diversification in Indian agriculture towards high value crops: Multilevel determinants and policy implications. *Land Use Policy*, 91, 104427.
- Chand, R. (1996). Diversification through High Value Crops in Western Himalayan Region: Evidence from Himachal Pradesh. *Indian Journal of Agricultural Economics*, 51(4), 652-663.
- Joshi, P. K., Gulati, A., Birthal, P. S., & Tewari, L. (2004). Agriculture diversification in South Asia: patterns, determinants and policy implications. *Economic and political weekly*, 2457-2467.
- Kasem, S., & Thapa, G. B. (2011). Crop diversification in Thailand: Status, determinants, and effects on income and use of inputs. *Land Use Policy*, 28(3), 618-628.
- Kumar, A., Kumar, P., & Sharma, A. N. (2012). Crop diversification in Eastern India: Status and determinants.*Indian Journal of Agricultural Economics*, 67(902-2016-66732), 600-615.
- Nunes, M. R., van Es, H. M., Schindelbeck, R., Ristow, A. J., & Ryan, M. (2018). No-till and cropping system diversification improve soil health and crop yield. *Geoderma*, 328, 30-43.
- Piedra-Bonilla, E. B., da Cunha, D. A., & Braga, M. J. (2020). Climate variability and crop diversification in Brazil: An ordered probit analysis. *Journal of Cleaner Production*, 256, 120252.
- Pingali, P. L., & Rosegrant, M. W. (1995). Agricultural commercialization and diversification: processes and policies. *Food policy*, 20(3), 171-185.
- Rahaman, H. (2021). *Agricultural Development: Inputs-Outputs Dimension*. In Diversified Cropping Pattern and Agricultural Development (pp. 71-106). Springer, Cham.
- Rahaman, H., & Ansari, S. (2022). Status of Crop Diversification by Land Size Classes: A Case Study from State of West Bengal, India. *Journal of Asian and African Studies*, 00219096221106092.
- Rahaman, H., & Singh, S. (2020). De-stunting growth of crop diversification Index: A case study from Malda District, India. *Ecology, Environment and Conservation*, 26, 179-184.
- Rao, P. P., Birthal, P. S., & Joshi, P. K. (2006). Diversification towards high value agriculture: role of urbanisation and infrastructure. *Economic and Political Weekly*, 2747-2753.
- Ryan, J. G., & Spencer, D. C. (2001). *Future challenges and opportunities for agricultural R&D in the semi-arid tropics* International Crops Research Institute for the Semi-Arid Tropics.
- Satyasai, K. J. S., & Viswanathan, K. U. (1996). Diversification in Indian Agriculture and Food Security*Indian Journal of Agricultural Economics*, 51(4), 674-679.
- Vyas, V. S. (1996). Diversification in agriculture: Concept, rationale and approaches.*Indian Journal of Agricultural Economics*, 51(4), 636.