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Exploring the dimensions and economic factors influencing crop diversification across different agro-climatic regions of Chhattisgarh

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Abstract

Given its diverse agro-climatic zones, Chhattisgarh has untapped potential for crop diversification, which could lead to more sustainable agricultural practices, enhanced economic resilience, and a reduction in environmental stresses. This study was done with a purpose of examining the status and pattern of crop diversification along different agro-climatic zones of Chhattisgarh state and to decipher the economic factors influencing crop diversification in the state. The study was conducted in the state of Chhattisgarh using secondary data over the period of 22 years (2001-02 to 2022-23). The Simpson's Diversification Index (SID) has been estimated and it reveals varying patterns across the Rabi and Kharif seasons along three agro-climatic zones. The SDI for Rabi in Chhattisgarh Plains has been found to be 0.7337 and for Kharif 0.1410 with an overall of 0.4710. In Bastar Plateau the SDI ranged from 0.8348 in Rabi, 0.2695 in Kharif and an aggregate of 0.3030. In Northern Hills Rabi exhibited an SDI of 0.7387 and in Kharif 0.4297 and at aggregate level 0.5261.In Chhattisgarh state, in Rabi season the SDI was found to be 0.7651 and 0.2450 in Kharif and an overall of 0.4820.Crop diversification was influenced by several economic factors. The multiple linear regression analysis suggested that Rabi diversification benefits from higher per capita GSDP and pulse procurement prices, while Kharif diversification is negatively affected by MSP for rice and irrigation expansion. Fertilizer consumption significantly reduces diversification in both seasons, while market density, road length, and landholding size show mixed or insignificant effects. The insights of the study suggests that targeted policy interventions, such as revising MSP policies, promoting diverse cropping patterns, promoting incentives and crop insurances, assured procurement of pulses and oilseeds, identification and development of market and roads can encourage better diversification in the state.

Keywords: Crop diversification, Chhattisgarh plain, Bastar plateau, northern hills, Simpson's Diversification Index (SDI)

Introduction

India is a global agricultural powerhouse. As per Indian economic survey 2020-21, agriculture employed more than 50 per cent of the Indian workforce and contributed 20.2 per cent to the country's GDP. More than 70 percent of India's population lives in rural areas, where agriculture is the primary occupation. India has made tremendous progress in the agricultural sector over the last 50 years. In order to feed the growing vast population, self-reliance in food grains has been the major agenda of policies. The changing scenario of agriculture has forced the farming community and policy makers in agriculture to search for a more remunerative and viable production portfolio. The diversification of agriculture towards non-food grain and high value commodities has been the right answer for it, because these commodities have potential of income augmentation, employment generation, poverty alleviation and export promotion (Jha1996; Chand 1996 and Joshi *et al*. 2004) [6, 4, 7]. Crop diversification, a vital aspect of agricultural development, entails the shift from traditional cropping patterns to a variety of crops that are more sustainable, profitable, and resilient to climatic and market uncertainties. In the Indian context, especially in agrarian states like Chhattisgarh, crop diversification plays a crucial role in ensuring food security, enhancing farmer incomes, and maintaining ecological balance. Chhattisgarh, known for its significant contribution to India's rice bowl, has predominantly followed a monoculture approach centered around paddy cultivation. However, this dependency poses several challenges, including soil degradation, water scarcity, and economic vulnerabilities arising from market fluctuations. Agriculture employs over 80 per cent of the population in the State, while arable land under cultivation is 43 per cent of the total land area. The cropping pattern was found to be dominated by Niger, soybean, and groundnut under oilseeds, and paddy, kodo-kutki, maize, and wheat under cereals, chickpea and lathyrus an under pulses. Given its diverse agro-climatic zones, Chhattisgarh has untapped potential for crop diversification, which could lead to more sustainable agricultural practices, enhanced economic resilience, and a reduction in environmental stresses. Thisstudy was done with a purpose of examining the status and pattern of crop diversification along different agro-climatic zones of Chhattisgarh state and to decipher the economic factors influencing crop diversification in the state. The study was based on time series data over the period of 22 years (2001-02 to 2022-23).

Methodology

The present study was conducted in Chhattisgarh state of India. The state is divided into three agro-climatic zones *viz;* Chhattisgarh plains, Bastar plateau, and Northern Hills were considered for detailed investigation. The present study was mainly based on secondary data for evaluating and analyzing the specific objectives of the study. Data used for the study was collected from various published sources from the Directorate of Economics and Statistics (DES), Raipur Chhattisgarh, Directorate of Agriculture Chhattisgarh and from other unpublished resources for the period from 2001-02 to 2022-23. The study is confined to a period of 22 years, from 2001-02 to 2022-23 and for analytical convenience, this period is divided into two sub-groups, *viz*; 2001-02 to 2011-12 (first subperiod) and 2012-13 to 2022-23 (second sub-period).

Considering the objectives of the study, SDI is used to calculate the status and pattern of crop diversification. The Simpson Diversification Index have been developed for agro-climatic zone wise and also whole Chhattisgarh state for Rabi and Kharif season and for overall crops taken together. The SDI was calculated for 22 years (2001-02 to 2022-23) and for analytical convenience it has been divided to two sub-periods *viz*; 2001-02 to 2011-12 (first subperiod) and 2012-13 to 2022-23 (second sub-period).

Simpson Diversity Index (SDI)

$$SDI = 1 - \sum_{\{i=1\}}^{\{N\}} p_i^2$$

Where,

Pi = Proportion of area under i^{th} crop

N = Total number of crops cultivated

The value of SDI ranges from zero (0) to one (1). SDI takes a value close to zero (0) when crop diversification is minimal, but a value close to one (1) under high diversification situations. Levels of diversification according to Simpson Diversification Index:

1. Low- index value less than 0.25
2. Moderate- 0.25 and more than 0.25
3. High- 0.5 but less than 0.75
4. Very high- index value more than 0.75

Multiple linear regression analysis was carried out using the time series data for the period from 2001-02 to 2022-23 to identify the important economic factors affecting crop diversification. The functional form used was:

$Y = a + b_1X_1 + b_2X_2 + \ldots\ldots\ldots + bnXn + U$

Where,

Y= Simpson Diversification Index (%)

X_1= Per capita Gross State Domestic Product

X_2= Percentage of area under High Yielding Varieties of Cereals

X_3= Percentage of gross irrigated area to gross cultivated area

X_4= MSP of paddy

X_5= Procurement price of pulses

X_6= Average land holding

X_7= Market density (number of markets per 1,000 ha of gross cropped area)

X_8= Fertilizer consumption (Kg/ha)

$X_{9=}$ Road length (square km per 1,000 ha of gross cropped area

X_{10}= Percentage of small and marginal landholders in total holdings

U= Error term.

Results and Discussion

Status and pattern of crop diversification in Kharif and Rabi season in Chhattisgarh Plains

The study on the crop diversification trend in Chhattisgarh Plains from 2001-02 to 2022-23 revealed that, varying patterns across the Rabi and Kharif seasons. The performance of periodic as well as Annual Simpsons Diversification Index (SDI) in Chhattisgarh plains during Rabi and Kharif seasons, as well as overall from 2001 to 2022 is being represented in Table (1). The Rabi season exhibited a relatively higher and more dynamic diversification trend, with a Simpson Diversification Index (SDI) of 0.703 in the first sub-period and 0.745 in the second sub-period and an overall of 0.733. In contrast, the Kharif season consistently demonstrated low crop diversification, with SDI values of 0.143, 0.139 and 0.141 in sub-period 1, sub-period 2 and overall respectively. At the aggregate level, the overall crop diversification index showed moderate diversification, with fluctuations over time. It is quite apparent from (fig.1) that, the rate of diversification effect in kharif, rabi and whole during the period of 2001-02 to 2022-23.

Table 1: Status and pattern of crop diversification in Kharif and Rabi season in Chhattisgarh Plains

Year	Rabi (SDI)	Kharif (SDI)	Total (SDI)
2001-02	0.6633	0.1120	0.4493
2002-03	0.6909	0.1176	0.4252
2003-04	0.6695	0.1200	0.4787
2004-05	0.6772	0.1730	0.5051
2005-06	0.6819	0.1733	0.5124
2006-07	0.7104	0.1742	0.5148
2007-08	0.7054	0.1294	0.4973
2008-09	0.7125	0.1299	0.4816
2009-10	0.7163	0.1341	0.4669
2010-11	0.7214	0.1497	0.4878
2011-12	0.7250	0.1481	0.4868
2012-13	0.7358	0.1678	0.5045
2013-14	0.7311	0.1704	0.5007
2014-15	0.7341	0.1637	0.4981
2015-16	0.7303	0.1761	0.4807
2016-17	0.7365	0.1557	0.4824
2017-18	0.6946	0.1491	0.4482
2018-19	0.6887	0.1345	0.4230
2019-20	0.6929	0.1072	0.4611
2020-21	0.7426	0.1014	0.4510
2021-22	0.7097	0.0998	0.3605
2022-23	0.6934	0.1022	0.3721
Sub period 1	0.7034	0.1428	0.4840
Sub period 2	0.7456	0.1392	0.4566
Total	0.7337	0.1410	0.4710

Source: Commissionerate of Land record, Revenue department of Chhattisgarh (1998- 2022).

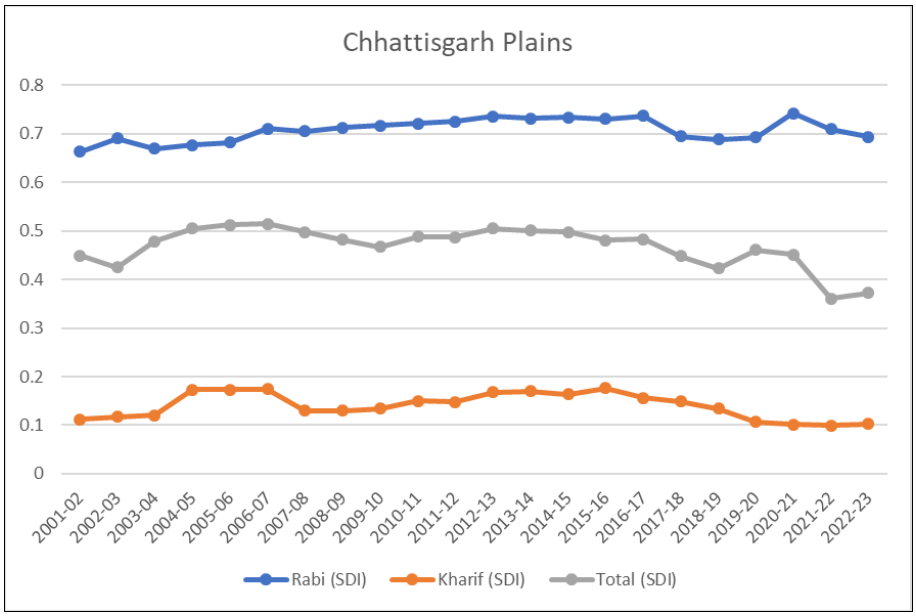

Fig 1: Crop diversification along years in Chhattisgarh Plains

Status and pattern of crop diversification in Kharif and Rabi season in Bastar Plateau

The performance of periodic as well as annual SDI in Bastar Plateau during Rabi and Kharif seasons and in overall from the year 2001 to 2022 was presented in the table (2). It was also analyzed for two sub-periods for convenience. Bastar plateau exhibited a high crop diversification pattern in Rabi season.The findings indicated a varying trend in crop diversification across different seasons in the Bastar Plateau from 2001 to 2022. In the Rabi season, the region initially exhibited a high crop diversification pattern, with the SDI increasing from 0.75 to 0.79 during the first subperiod. In second sub-period it exhibited a diversification Index of 0.78 and overall, 0.83. In the Kharif season, the SDI initially increased from 0.19 to 0.35 (2001-02 to 2004-05) but later exhibited mixed trends with periods of both decline and growth. The overall diversification remained low, with an index of 0.27. When considering both seasons together, the Bastar Plateau demonstrated a moderate diversification trend, with an overall diversification index of 0.30.

Table 2: Status and pattern of crop diversification in Kharif and Rabi season in Bastar Plateau

Year	Rabi (SDI)	Kharif (SDI)	Total (SDI)
2001-02	0.7476	0.1896	0.2354
2002-03	0.7442	0.1873	0.2216
2003-04	0.7840	0.1958	0.2389
2004-05	0.7664	0.3462	0.3761
2005-06	0.7843	0.3437	0.3751
2006-07	0.7877	0.3394	0.3745
2007-08	0.7902	0.1936	0.2390
2008-09	0.7929	0.1929	0.2368
2009-10	0.7942	0.1956	0.2382
2010-11	0.7737	0.2017	0.2433
2011-12	0.7783	0.2054	0.2402
2012-13	0.7744	0.3382	0.3644
2013-14	0.7615	0.3185	0.3464
2014-15	0.7458	0.3196	0.3477
2015-16	0.7388	0.3082	0.3349
2016-17	0.6958	0.3096	0.3335
2017-18	0.7401	0.2963	0.3185
2018-19	0.7139	0.2683	0.2888
2019-20	0.5660	0.2415	0.2670
2020-21	0.3860	0.2177	0.2523
2021-22	0.6168	0.2636	0.3182
2022-23	0.5991	0.3429	0.3862
Sub period 1	0.8301	0.2434	0.2814
Sub period 2	0.7812	0.2937	0.3229
Total	0.8348	0.2695	0.3030

Source: Commissionerate of Land record, Revenue department of Chhattisgarh (1998- 2022)

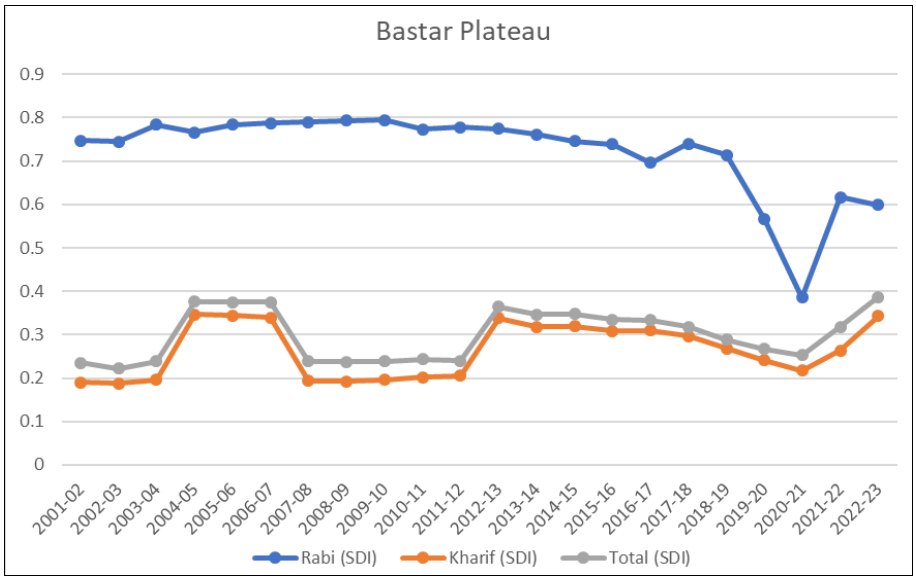

Fig 2: Crop diversification along years in Bastar Plateau

Status and pattern of crop diversification in Kharif and Rabi season in Northern Hills

The performance of periodic and annual SDI in Northern Hills during Rabi and Kharif seasons as well as overall from 2001 to 2022 is presented in the table (3). From the table it can be observed that, the Rabi season has executed a high crop diversification with SDI ranging from 0.73 in 2001-02 to 0.72 in the recent years of 2022-23. In the Kharif season, it exhibited a moderate level of diversification in Northern Hills as it can be observed from table. The diversification Index SDI stood at 0.42 in the first sub-period, where it was 0.44 in the second sub-period. Overall SDI was 0.43 over the study period in the Kharif season. Taking the overall diversification in Northern Hills, it executed a highly moderate level of crop diversification ranging from 0.52 in the first sub-period and 0.53 in the second sub-period with an overall diversification index of 0.53.

Table 3: Status and pattern of crop diversification in Kharif and Rabi season in Northern Hills

Year	Rabi (SDI)	Kharif (SDI)	Total (SDI)
2001-02	0.7274	0.4171	0.5242
2002-03	0.7293	0.4226	0.5258
2003-04	0.7302	0.4217	0.5273
2004-05	0.7323	0.4484	0.5465
2005-06	0.7319	0.4450	0.5435
2006-07	0.7318	0.4430	0.5412
2007-08	0.7288	0.4033	0.5104
2008-09	0.7247	0.3972	0.5063
2009-10	0.7273	0.3949	0.5049
2010-11	0.7397	0.4200	0.5258
2011-12	0.7310	0.4079	0.5155
2012-13	0.7299	0.4459	0.5433
2013-14	0.7300	0.4636	0.5622
2014-15	0.7343	0.4525	0.5490
2015-16	0.7297	0.4615	0.5536
2016-17	0.7278	0.4548	0.5507
2017-18	0.7286	0.4438	0.5323
2018-19	0.7258	0.4218	0.5131
2019-20	0.7200	0.4089	0.5002
2020-21	0.7075	0.4146	0.4974
2021-22	0.6982	0.4130	0.4911
2022-23	0.7185	0.4148	0.4834
Sub period 1	0.7400	0.4213	0.5251
Sub period 2	0.7364	0.4373	0.5265
Total	0.7387	0.4297	0.5261

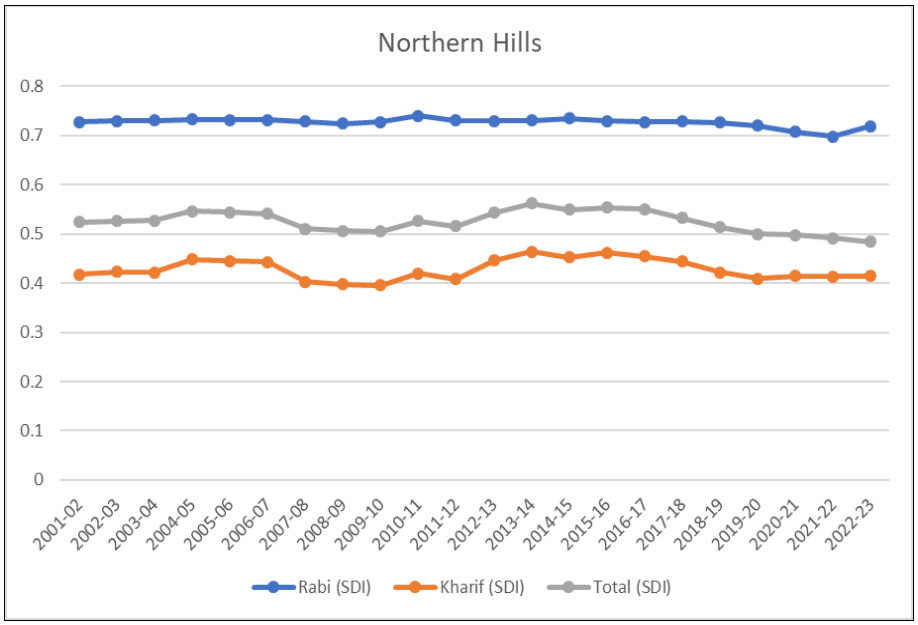

Fig 3: Crop diversification along years in Northern Hills

Status and pattern of crop diversification in Kharif and Rabi season in Chhattisgarh.

The Simpson's Diversification Index for respective seasons and overall was also calculated for two sub-periodsfor the state.The result of the study revealed that in Chhattisgarh state, Rabi season executed a high crop diversification pattern over the study period (2001-02 to 2022-23) with a SDI of 0.744 in first sub-period and 0.762 in the second sub-period with an overall of 0.765 in the respective season.Whereas in Kharif, Chhattisgarh showed a low diversification with SDI ranging 0.257 in the first sub-period and 0.233 in the second sub-period with an overall diversification index of 0.245. In overall, in Chhattisgarh, the diversification shown a pattern of moderate level of crop diversification with an SDI of 0.492 in first sub-period and declining gradually to 0.471 in second sub-period and resulting in an overall diversification index (SDI) of 0.482.

Table 4: Status and pattern of crop diversification in Kharif and Rabi season in Chhattisgarh State

Year	Rabi (SDI)	Kharif (SDI)	Total (SDI)
2001-02	0.7172	0.2633	0.4828
2002-03	0.7405	0.2620	0.4634
2003-04	0.7167	0.2617	0.4990
2004-05	0.7216	0.2593	0.4993
2005-06	0.7248	0.2584	0.5040
2006-07	0.7480	0.2568	0.5056
2007-08	0.7433	0.2555	0.5054
2008-09	0.7507	0.2522	0.4925
2009-10	0.7548	0.2521	0.4806
2010-11	0.7569	0.2528	0.4907
2011-12	0.7594	0.2481	0.4877
2012-13	0.7672	0.2499	0.4943
2013-14	0.7655	0.2545	0.4944
2014-15	0.7662	0.2485	0.4905
2015-16	0.7643	0.2552	0.4769
2016-17	0.7683	0.2418	0.4776
2017-18	0.7343	0.2327	0.4477
2018-19	0.7494	0.2124	0.4408
2019-20	0.7304	0.2026	0.4589
2020-21	0.7507	0.1983	0.4647
2021-22	0.7518	0.1846	0.4443
2022-23	0.7436	0.2763	0.4810
Sub period 1	0.7441	0.2576	0.4924
Sub period 2	0.7622	0.2333	0.4708
Total	0.7651	0.2450	0.4820

Source: Commissionerate of Land record, Revenue department of Chhattisgarh (1998- 2022)

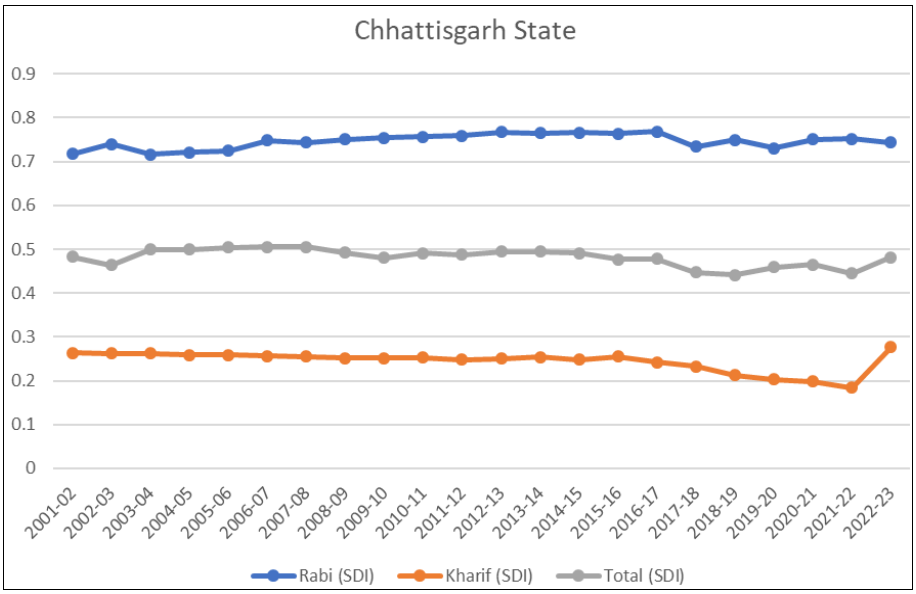

Fig 4: Crop diversification along years in Chhattisgarh state

Economic factors influencing crop diversification in Chhattisgarh

The estimated regression function for the determinants of crop diversification was presented in the table (5) The regression analysis revealed that the per capita GSDP has exerted a positive and significant effect on crop diversification in Rabi. A negative insignificant influence on Kharif season and total crops. The regression coefficient for proportion of area under High Yielding Varieties of cereals was negative in the three cases and the effects were insignificant.

The proportion of gross irrigated area to gross cultivated area exerted a negative impact on crop diversification in both Rabi and Kharif season and in overall crops. The negative effect was significant in Kharif season.

The Minimum Support Price (MSP) of rice had a significant negative impact on crop diversification in the Kharif season, indicating that government policies may inadvertently discourage diversification. In contrast, the procurement prices of pulses had a positive and significant effect on crop diversification in Rabi season, suggesting that targeted policies can promote diversification. It can be observed that, the effect of average landholding is mixed. It showed insignificant negative effect on diversification of crops in both Rabi and Kharif and an insignificant positive effect on total crops taken together.

Market density also exerted a mixed effects on diversification. It had an insignificant positive influence on crop diversification in Rabi and an insignificant negative influence on diversification in Kharif and overall crop taken together. It is observed that fertilizer consumption exerted a dampening effect on diversification. It was negatively significant in both Rabi and Kharif season. In overall crop taken the negative effect was insignificant.

Road length had a positive effect on diversification. It can be observed that the effect was insignificant and positive in Rabi, Kharif and overall crops taken together.

Proportion of small and marginal landholders to the total holdings exerted a mixed effect on diversification of crops in the state. It can be observed that it had an insignificant positive influence on crop diversification in both Rabi and Kharif. A negative and insignificant effect can be observed of the same in overall crops.

By considering these factors, policymakers and practitioners can develop more effective strategies to promote crop diversification and improve agricultural sustainability in Chhattisgarh.

Table 5: Estimated regression function for the determinants of crop diversification.

Factors/Season	Rabi	Kharif	Total
Constant	0.6278	0.9176	0.9029
GSDP (X1)	0.4297**	-0.5707	-0.3221
Area under HYV of cereals (X2)	-0.0543	-0.2314	-0.1343
Percentage of gross irrigated area (X3)	-0.2307	-0.2170**	-0.1271
MSP rice (X4)	-0.0541	-0.4262**	-0.2681
Procurement prices of pulses (X5)	0.0732*	0.0291	0.0535
Average land holding (X6)	-0.0683	-0.4170	0.0721
Market density (X7)	0.2831	-0.6452	-0.2683
Fertilizer consumption (X8)	-0.0185*	-0.0168*	-0.1577
Road length (X9)	0.0473	0.0311	0.0523
% of small and marginal landholders (X10)	0.0581	0.1500	-0.2101
R2	0.8148	0.7501	0.8567
F value	4.8409*	3.3017**	6.5766*

** denotes significant at 5 percent

* denotes significant at 1 percent

Conclusion

Indian agriculture has undergone significant diversification with impressive improvements in the crop sector and from the share of livestock and fisheries sectors. Through diversification, India enjoys a comparative advantage due to its diverse agro-eco regions in meeting the challenge posed by a multiplying population. Most part of the eastern India is bestowed with plenty of rainfall and good quality of natural resources basic to agriculture, but poor resource management of these resources and unscientific land use planning has led to a situation where people of this "resource rich region are resource poor".

Chhattisgarh, known for its significant contribution to India's rice bowl, has predominantly followed a monoculture approach centered around paddy cultivation. Given its diverse agro-climatic zones, Chhattisgarh has untapped potential for crop diversification, which could lead to more sustainable agricultural practices, enhanced economic resilience, and a reduction in environmental stresses. This study on the status and pattern of crop diversification in Chhattisgarh and across its various agro-climatic zones from 2001-02 to 2022-23 revealed varying patterns across the Rabi and Kharif seasons. The Rabi season exhibited a relatively higher and more dynamic diversification trend, with a gradual increase in the Simpson's Diversification Index (SDI) across all agro-climatic zones whereas the Kharif season consistently demonstrated low crop diversification, with SDI values remaining low throughout the study period. At the aggregate level, the overall crop diversification index showed moderate diversification, with fluctuations over time. This study highlights the dominancy of paddy monoculture in the state and it's untapped potency for an efficient diversification within the crop sector.

The analysis of the economic factors influencing crop diversification in the state reveals that economic and policy factors influence crop diversification differently across seasons. Rabi diversification benefits from higher per capita Gross State Domestic Product (GSDP) and pulse procurement prices, while Kharif diversification is negatively affected by MSP for rice and irrigation expansion. Fertilizer consumption significantly reduces diversification in both seasons, while market density, road length, and landholding size show mixed or insignificant effects. These insights suggest that targeted policy interventions, such as revising MSP policies, promoting diverse cropping patterns, and optimizing irrigation and fertilizer use, can encourage better diversification in the state. Harnessing the potential of diversification pre-supposes gradual restructuring of policies, credit and fiscal setup into the diversification encouraging ones, thereby promoting a sustainable agricultural development in the state.

References

1. Anonymous. Directorate of Agriculture and Tables of Agricultural Statistics, 2020.
2. Acharya SP, Basavaraja H, Kunnal LB, Mahajanashetti SB, Bhat AR. Crop diversification in Karnataka: an economic analysis. Agric Econ Res Rev. 2011;24(2):351-357.
3. Adjimoti GO, Kwadzo GTM. Crop diversification and household food security status: evidence from rural Benin. Agric Food Secur. 2018;7(1):1-12.
4. Chand R. Diversification through high value crops in western Himalayan region: Evidence from Himachal Pradesh. Indian J Agric Econ. 1996;41(4):652-663.
5. Hazra CR. Crop diversification in India. In: Crop diversification in the Asia-Pacific Region. Food and Agriculture Organization of the United Nations, Regional Office for Asia and the Pacific, Bangkok, Thailand; 2001. p. 32-50.
6. Jha D. Rapporteur's Report on Diversification of Agriculture and Food Security in the Context of New Economic Policy. Indian J Agric Econ. 1996;52(1):52-54.
7. Joshi PK, Gulati A, Birthal PS, Tewari L. Agriculture diversification in South Asia: patterns, determinants and policy implications. Econ Polit Wkly. 2004;2457-2467.
8. Kaushal R, Choudhary VK, Pathak H. Trends analysis in area, production and productivity of major kharif crops in Chhattisgarh State of India. Pharm Innov J. 2023;12(7):1160-1166.
9. Kaushal R, Jain BC. Comparative study on crop diversification in tribal and non-tribal area of Chhattisgarh, India. Int J Environ Clim Change. 2023;13(9):1091-1095.
10. Naik K, Jadav SS, Awais M. Pattern of crop diversification and its implications on sustainable agriculture in India. Dyn Indian Agric Post-Independence Era. 2023;9(1):1-14.
11. Sharma HR. Agricultural development and crop diversification in Himachal Pradesh: understanding the patterns, processes, determinants and lessons. Indian J Agric Econ. 2005;60(1):72-93.
12. Singh A, Kumar S, Agrahari RK, Pandey A, Kumar H, Kumar A. Study on crop diversification through area status of crops in Kharif season of Chhattisgarh. Int J Environ Clim Change. 2024;14(4):795-814.
13. Tiwari A, Choudhary VK, Shrey R. Nature and extent of crop diversification in Kharif season in northern hills of Chhattisgarh. Int J Adv Biochem Res. 2024;8(5):398-402.