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Regional Pattern, Shift and Extent of Crop Diversification with Special Reference to Malwa Region of Madhya Pradesh

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Abstract

Crop diversification is the use of multiple cropping systems, i.e., the addition of more crops to the existing cropping system along with the use of different crop species. In this study, the Gibbs-Martin index, log scale technique, and linear regressions are used to explain the regional pattern of crop diversification and the shift in the degree and extent of crop diversification. The Crop diversification was discovered in the Malwa region, with a positive shift in crop diversification over the last 15 years, according to the study. The study also found increases and decreases in the pattern of crop acreages for different crops.

***Key words*:** Crop Diversification

Introduction

The problems impacting the Indian agricultural economy are its focus on conventional food grains and a way out of the non-viable, non-competitive condition of our agriculture. In response to this, the team of experts nominated by the World Bank has recommended a set of steps that involve diversifying our agriculture away from traditional food grain development and traditional crops. Since then, a great deal of focus has been put on diversifying our farming sector towards developing high-value crops (HVCs) instead of conventional food products. Crop diversification research in different parts of India, however, varies significantly in terms of developing some established and consistent relationships between water use and diversification scale.At the same time, research diverges significantly on the idea that farm size plays an important role in assessing the degree of diversification. Instead, there has been a substantial geographical variance in the degree of diversification. Hence, based on data obtained via the micro-survey conducted for the study, this chapter primarily aims to explore: a) the regional pattern of crop diversification in the Malwa region; b) whether and under what circumstances crop trends have become more diversified or not; and c) what are the factors at the micro-level affecting the decision of the farmers on diversification.

In particular, we plan to analyze, regional pattern of crop diversification and also analyze cropping pattern, diversification decisions get affected by other variables like the availability of investment capital in the form of formal or informal credit.

Indian agriculture has undergone a major shift with commercial crops (such as paddy, wheat) etc. plantation crops, and the production of horticultural crops in India. However, Indian agriculture historically burdens certain related problems. The dominance of marginal and small land farmers in terms of number and region of production, rural distress, seasonal and pseudo-jobs, non-mechanized agriculture, weak rural infrastructure, monsoon reliance, etc. often pose a major challenge to the growth of Indian farming along with increasing revenue, stabilizing seasonal income flow and conservation. In recent years, Indian agriculture has experienced a dramatic transformation from conventional to high-value cultivation. The economy has also undergone a change in diet from conventional cereals to a more balanced and healthy diet of items like fruits and vegetables, milk,

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pork, meat and poultry, and this is attributed to rapid economic development. In Indian agriculture, thus, agricultural diversification against high-value crops was introduced. Agricultural diversification has become a critical component for achieving enhanced yield efficiency, higher farm profits, work development, natural resource preservation and poverty alleviation. South-East Asia, Middle East and North Africa's history suggest that politicians and planners depend on agricultural diversification to encourage agricultural production (Petit and Barghouti, 1992). Several scholars have concluded that agricultural diversification may be used as a method for increasing farm incomes, creating job prospects, alleviating hunger and conserving natural capital. Given the shrinking agricultural land and institutional resources that are due to urbanization and fast population growth rates, together with shifts in customer food preferences, farmers are straining to incorporate or absorb additional high-value crops in the crop system (Singh, 2011). Indian agricultural sector output in terms of income generation and diversification has taken an erratic direction and shown significant differences at the disaggregated level between various geographical locations in the country (Radhakrishna and Panda, 2006). Such geographical disparities remained a matter of concern throughout the nations. In order to propel the agricultural sector towards further growth and development, it is crucial to define state-level crop diversification for making unique strategies. Agricultural diversification has been researched in India mainly at the national level, and there are just a few studies at the state level. Although states are considered as the required administrative unit for provincial-level studies, diversification of agriculture typically differs widely across states due to various regional features in terms of capital endowment, infrastructure, and environment. A study on the nature and extent of crop diversification in Karnataka state in India done by Saraswati et al. (2011), revealed that crop diversification was deter-mined by a number of infrastructural and technological factors. Moreover Singh (2006), in his research "Crop Diversification in Bari-Doab Region of Punjab" has found that variations in relief and the pattern of crop Diversification are correlated positively

About Madhya Pradesh

Madhya Pradesh, the country's core and second-largest state in terms of area, has always been a backward and poor territory, and was previously known as one of the BIMARU states. The increase was still less than the national average. Madhya Pradesh has worked diligently over the past decade to shed its BIMARU name. Their achievements in the fields of health and education are noteworthy, as are their attempts to promote economic growth and alleviate poverty. (Kawadia, G., & Philips, S. S. (2014).However, it is too late; the state's economy has begun a phase of rapid expansion and become the nation's fastest-growing economy.Since 2011-12, the Madhya Pradesh economy has grown at a rate of more than 8% per year. In 2014-15, the economy grew at a double-digit rate of 10.19 percent at constant rates (NITI Aayog, 2016).The state economy's agricultural sector has emerged as a major contributor to productivity, and its share of GSDP at constant prices has become nearly 30 percent. This sector offers 69.8 percent of the state's population with jobs (Govt. of MP, 2016). This can be deduced by contrasting the state's agricultural pattern and total GSDP growth rates. Agriculture sector growth in 2007-08 was 1.49 percent, while GSDP growth at constant prices was 4.69. In 2011-12, the rate of growth in agriculture grew to 13.38 percent and GSDP also increased by 8.54 percent. In comparison, the agriculture sector raises 20.40% in 2013-14 and the state's GSDP also increased to 9.48%, and so on (NITI Aayog, 2016). For the fourth consecutive year in 2015-16 the state has also received the 'Krishi Karman' award for highest food grain production. Madhya Pradesh contributes a diverse range of crops to the state's agricultural wealth. Crops grown in the state include cereals such as wheat, rice, maize, and Jowar, pulses such as tur, gram, moong, and urad, and oilseeds such as Soybean, mustard, and groundnut. Soybean, cotton, and sugarcane are the main cash crops in Madhya Pradesh. Wheat is the main crop in MP, both in terms of production and region, with paddy coming in second. MP is the leading soybean-producing nation in India. At the national level, the state contributes more than 50 percent of overall soybean production. In addition, soybean ranks first among State-grown commercial crops followed by second-placed cotton and third-placed sugarcane. A large proportion of groundnut is also generated in MP which holds sixth place among all Indian

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states. From 2005-2006 to 2019-2020, production of major crops, including maize, rice and cotton, grew by 185.01, 114.17 and 343.82 percent respectively. The majority of the credit can be traced back to numerous state-run schemes that provide incentives for specific funds for crops such as paddy, wheat, and pulses. The increase in installed capacity in the power sector from 4000 megawatts to 14000 megawatts, as well as the increase in gross irrigated area from 4.3 million hectares in 2000-01 to 10.3 million hectares in 2014-15, has also contributed to the growth of various crops in Madhya Pradesh.

Crop Diversification in the Malwa Region

The Malwa region contributes significantly to broad Kharif and Rabi crops.The growth rate of various Kharif and Rabi crops in the Malwa agroclimatic region and Madhya Pradesh state was calculated using the compound growth feature. The area produces the most soybeans, cereals like maize, pulse crops, pigeon peas, and other crops during the Kharif Season.Wheat is widely grown in rabi crops such as chickpeas.

The trend of crop diversification in the Malwa region is analysed with mathematical precision and also tested for its association with changing climatic conditions. The Malwa region's eight districts are being studied in terms of usage trends, technology availability, awareness of modern harvesting technologies, improved seed efficiency, fertilizers, bank loan availability, credit, and market dynamics regulating.It is not that any farmer has access to this technology and knowledge, but as peer groups adopt newer approaches, the effects of learning spread widely. Peer-performance pressure in the Malwa area is an essential factor for new crop adoptions, which has caused crop diversification.

In this study, the crops that are dominant in terms of the proportion of harvesting areas are identified. Crops that are not being harvested now but were previously harvested, as well as crops that were harvested less frequently but are not gaining traction now.

Methodology

To examine the Crop Diversification in the Malwa region we have used Gibbs & Martin Crop Diversification Index. In this study, Gibbs & Martin Index is used to measure crop diversification.

The state is primarily classified into 7 agro-climatic zones, in which more than 150 crops are being harvested in multiple seasons on diverse lands. The number of crops is an important determinant in other Crop Diversification Index metrics when calculating the Cop Diversification Index.In the computer software package Microsoft Office Excel 2016, it was tedious to change the formula every time the number of crops changed. In the Gibbs and Martin Index, keeping a record of the number of crops was not required because, in the calculation, if the acreage of a particular crop is zero, it will automatically be struck out of the calculation without impacting the final index result.

Linear regressions can be used to evaluate trends and make estimates or forecasts. Here we use the linear regression of CDI on time to find the extent of crop diversification. To analyse the shift in the degree of crop diversification in the Malwa region, the "log scale technique" has been used.

Crop Diversification Index

The output of the test is produced in the tables and graphs. Details of the crop diversification index of the Malwa region year-wise from 2005 to 2020 are given below: - A graphic representation of the same is given as well.

Gibbs and Martin's crop Diversification index

$$\mathbf{CropDiversificationindex} = 1 - \frac{\sum X^2}{(\sum X)^2}$$

Hypothesis:

- **Null Hypothesis: There is no crop Diversification in Malwa Region**
- **Alternative Hypothesis: There is crop Diversification in Malwa Region.**

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Table 1: CDI of Malwa region from the year 2005 to 2020

Crop Diversification Index of Malwa Region from the year 2005 to 2020	
Financial Year	**Gibbs & Martin Index**
2005-2006	0.5247840851
2006-2007	0.6348629727
2007-2008	0.5893894067
2008-2009	0.6982505392
2009-2010	0.6888861137
2010-2011	0.639800749
2011-2012	0.6819866364
2012-2013	0.6829066867
2013-2014	0.6621651703
2014-2015	0.6714270288
2015-2016	0.6758037892
2016-2017	0.6729999494
2017-2018	0.6729999494
2018-2019	0.6873527208
2019-2020	0.694785709

Source: Calculated by Scholar

Figure 1: CDI of Malwa Region from the year 2005 to 2020

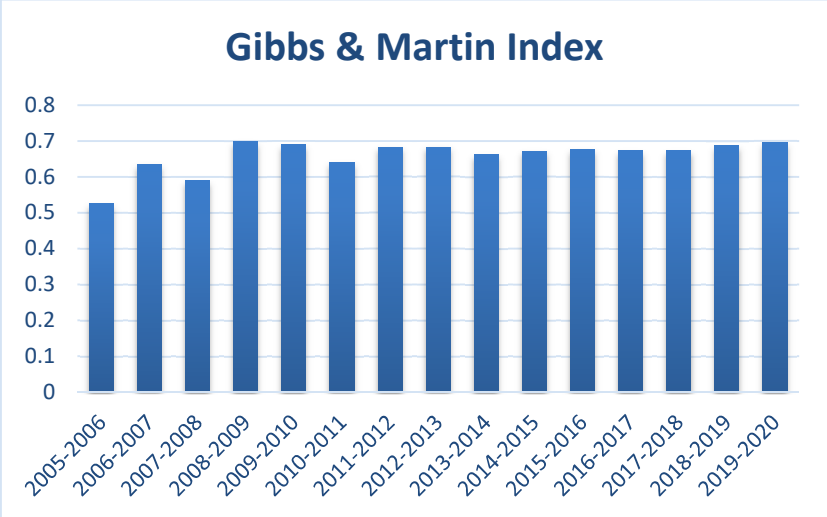

Table 1 and Figure 1 clearly show the crop diversification of the years from 2005–2006 to 2019–2020. The diversification results are more than 0.50 for all fifteen years, and they have also increased since 2005. Therefore, the null hypothesis is rejected and the alternative hypothesis is confirmed, suggesting that agricultural diversification in the Malwa region is rising. From 2005–2006 to 2019–20, it went from 0.52 to 0.69. Crop diversification has always been greater than 0.5, which means it has always been in an increasing form.

It is observed that all the GMI values are greater than 0.55, and by definition the GMI value always lies between 0 and 1. A value closer to 1 signifies more diversification, and vice versa. Since all the GMI values from the year 2005 to 2020 of cropping patterns in all eight districts of the Malwa Region are greater than 0.55, the null hypothesis is rejected and the alternate hypothesis is accepted that there is significant crop diversification in the Malwa region and that it has been persistently rising since the financial year 2005-06.

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The Pattern of Acreage of crops

Table 2 : Farming of selected crops from the year 2005 to 2020

Crops(Declining)	Crops(Augmenting)
Paddy	Soybean
Jowar	Wheat
Maize	Barley
Bajra	Gram
Sunflower	Tur
Urad	Moong
Rap seed	Pea

Table 2 shows the pattern of the crops like paddy, jowar, maize, bajra, sunflower, urad, and rapeseed, which have all declined in the last 15 years. The crops with increasing trends are soybean, wheat, barley, gram, tur, moong, and pea. It clearly shows that the production of these crops is increasing year by year.

Pattern of Crop Diversification

Madhya Pradesh is a landlocked state in the middle of the Indian subcontinent. It is diverse in its natural design. From mountains to rivers, river basins to girds and plates, and dense forests, Madhya Pradesh is naturally rich and fertile. Because of the state's terrain, a large portion of the state cannot be irrigated. The Narmada River is the state's lifeline. Madhya Pradesh's main agro-climatic beginnings are the Kymore Plateau and Satpura Hills, the Vindhyan Plateau and Hills, the Narmada Valley, the Central Narmada Valley, etc. Megadam projects and check dam projects have created numerous opportunities for Madhya Pradesh residents to invest in agriculture. The dam projects have altered the climatic and idol conditions of the Malwa region, as well as increased the land's irrigation potential.

With increasing opportunities, farmlands are being utilised more efficiently, and diverse cropping is becoming the natural selection of the farmers of the Malwa Region. The log scale technique was used with the Microsoft Office Excel 2016 package to maximise observational correctness.By observing the above Table No. 3, it is deducible that crops are being diversified from Paddy, Jowar, Bajra, Sunflower, Maize, Cotton, Urad, and Rapeseed towards crops like Tur, Soybean, Wheat, Barley, Gram, Moong, Pea, and Lentils.

Further, explain the increase and decrease in harvest acreage of different crops in the Malwa region to understand the shift in crop diversification.

Table 3: Total Harvest Acreage in ("000"HA) of crops in Malwa region in the interval of the five-year term from the year 2005-2010, 2011-2015, 2016-2020 Years (Area in"000" Hectare)

CROP NAME	1st Five year Term 2005-2010	CP (%) change	2nd Five year Term 2011-2015	CP (%) change	3rd Five year Term 2016-2020	CP (%) change
Paddy	31.3	0.17	22.7	0.11	9.54	0.04
Jowar	585.8	3.19	346.4	1.67	113.79	0.50
Maize	1469.3	**7.99**	1260.3	**6.08**	1093.2	**4.80**
Bajra	30.8	0.17	26.7	0.13	19.87	0.09
Sunflower	0.7	0.00	0.2	0.00	0.023	0.00
Cotton	797.4	**4.34**	900.7	**4.35**	671.21	**2.94**
Urad	354.9	1.93	201.1	0.97	201	0.88
Arhar	99.8	0.54	84.7	0.41	104.51	0.46
Rapeseed	270.5	1.47	486.3	2.35	351.30	1.54

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Tur	99.8	0.54	84.7	0.41	104.51	0.46
Soybean	9725.4	**52.90**	10557.6	**50.95**	11087.1	**48.63**
Wheat	2690.1	**14.63**	3595.8	**17.35**	5189.3	**22.76**
Barley	3.6	0.02	6.1	0.03	11.74	0.05
Gram	2028.8	**11.04**	2951.7	**14.24**	3576.5	**15.69**
Moong	48	0.26	39.9	0.19	51.21	0.22
Pea	21.8	0.12	26.5	0.13	56.37	0.25
Lentils	37.7	0.21	53.4	0.26	81.81	0.36
Groundnut	71	0.39	61.2	0.30	56.4	0.25
Sesame	17.1	0.09	15.3	0.07	17.95	0.08

Source: Calculated by Scholar

Farming reduced (from 2005 to 2020 in 3 five year terms)

Table 3 shows that the farming of crops like paddy, jowar, maize, Bajra, sunflower, urad, and cotton is declining every five years from 2005-2010 to 2011-2015 to 2016-2020. The crops reduce their harvest acreages due to some major and important reasons like climate change, market demand, the risk involved, and the availability of labour at the time. As a result, crop harvest acreage is reduced from 2005 to 2020.Further, the specific reasons for reducing the farming of every crop have been explained in detail.

The crops, namely Paddy, Jowar, Bajra, Sunflower, Urad, Maize, and Cotton, have shown a decline in the past 15 years.

Reason for cropping pattern decline:

Paddy: (a) It is a labour-intensive crop; the cost of labour is high, the crop requires high irrigation, and risk is also involved. (b) The unfavourable monsoon and uncertainty of rain in the Malwa region (c) A drop in the price of some important rice.

Jowar:- Due to continued drought and farmers eyeing commercial crops, the cultivation of Jowar is shrinking year by year. Drought, labour intensiveness, low productivity, and high input costs are the primary causes of the fall in cultivation area.

Bajra:-Conditions like rising temperatures and the frequency of extreme climate events and heat waves in many parts of the Malwa region due to erratic weather and market factors are reasons behind this decrease.

Sunflower: Climate change, weather conditions, and soil conditions are responsible for the reduced area of sunflower acreages.

Droughts, freezes, or excessive rainfall during harvest or planting are all examples of urad-risks.Production risks may also result from damage due to insect pests and disease.

Maize: Poor rainfall and climate change are responsible for the reduction in the maize crop.

Cotton: The impact of climate change on cotton production Heavy floods and rain caused a loss. The price of cotton has decreased in recent years. Growers produced an excess of inventory.

Farming increased (from 2005 to 2020, three times in five-year terms)

Table 3 shows that farming of crops like soybean, wheat, barley, gram, turmeric, moong, and peas is increasing every five years, from 2005-2010 to 2011-2015 to 2016-2020. From 2005 to 2020, crop farming activities increased.Better market and profit conduct, as well as climate conduct, are the primary reasons for increasing crop harvest acreage.The increased crop harvest is primarily due to a higher minimum support price (MSP) set by the Madhya Pradesh government and improved irrigation facilities for the crops.The state government encouraged crop diversification and improved the agricultural support system for farmers. Further, some reasons have been discussed in detail.

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The crops, namely soybean, wheat, gram,, moong, tur, peas, and barley, have increased in the last 15 years.

Reason for cropping pattern changes:

Soybean is a high-value crop with excellent marketability and profitability. The harvest acreage of soybeans has increased, but the share of gross cropped area is declining in the Malwa region. The certain increase of soybean acreage was supported by several factors, including low production costs and a greater number of 50-50 corn-soybean rotations. Furthermore, soybeans were one of the first crop types that achieved commercial success as bioengineered crops. In most of the area of the Malwa region, the soybean crop is in very good condition, and production is expected to be higher. Better climate conduction will also benefit the crop.

Wheat: improved climate transmission for wheat production,Cold weather is required for a better yield of wheat, and better marketability and profitability are the main factors for increases in wheat harvest acreage. Better MSP and government policies are one of the reasons for the increase in wheat prices.

Moong raised the income of farmers and enhanced soil nutrients for the next crop. Good market conduct and the climate are also factors. Encouragement from the state government.

Turf marketability and profitability, the climate factor, and better irrigation are the responsible factors for improvement in the tur crop

Marketability and profitability conditions Improved variety seeds are more expensive per unit, but they provide higher productivity and return, so they should be used according to the growers' capacity. Bank credit and financial assistance should be available to individual farmers for increasing production. Proper allocation and level of increase in fertilizer, irrigation, and human labour are required for a higher return.

Barley: Barley crops can be grown with minimum water requirements and in diverse climatic conditions. It is considered a poor man's crop, but of late, its importance as an industrial crop and its use for human health are being realized. Because of its low input requirements, barley is more profitable for farmers.

Based on the tables and the detailed observations made above, a shift in diversification towards cash crops can be observed based on emerging irrigation opportunities, the availability of technology, and the cost viability of these cropping. Due to the government's initiatives of a minimum support price and better market facilities, the area of cropland and crop diversification has increased. The minimum support price has favoured crop diversification. It aids and benefits the crop, resulting in an increase in crop yield. Better seeds, good-quality fertilizer, and proper irrigation increase the area of their crop. Over all, government support is very important for crop diversification.

2. The shift in the degree of crop diversification in Malwa region

A shift in the degree of crop diversification can be understood as a change in the types of crops sown by the farmers of the area. It is interesting to explore what factors have contributed to this shift and what factors act as barriers. Despite knowing the significance of sowing a variety of crops, farmers are not able to do so because of multiple issues.

Diversification of the agriculture sector is an essential instrument for economic development. Increased focus has been paid to agricultural diversification as a method to meet product development targets, job generation, and the protection of natural capital. The plan allows for improvements in farm sector output practises to meet growth objectives. Changes in crop trends respond to certain causes. The country's aggregate crop patterns, expressed by the gross crop area distribution between different crops, are dependent on individual farmers' crop patterns or groups of farmers within each region, district, province, and nation. Farmers allocate their land to alternate crops in order to maximise their yield.The pattern of state cropping represents the reasoned decisions of an aggregate of farmers, subject to technological and structural restrictions,

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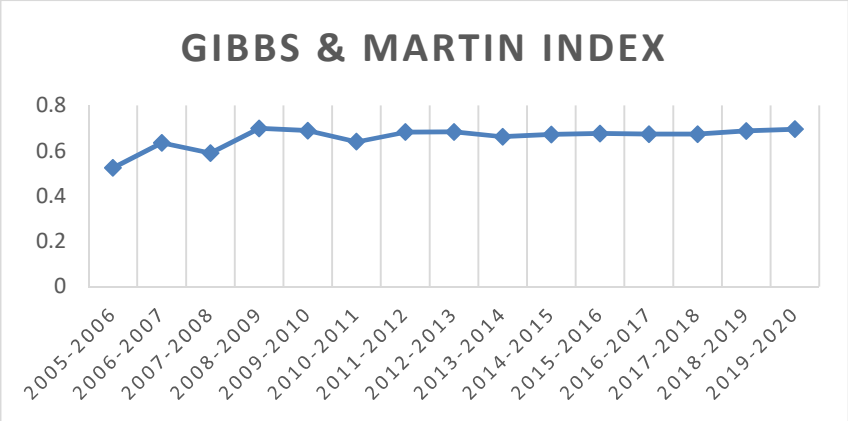
including those enforced by the existence of subsistence farming. Most subsistence farmers cultivate food grain crops to fulfil the demand for food grains from their communities. The adjustments they are able to make in crop patterns are influenced by this criterion, coupled with their incapacity to take the chances inherent in depending solely on a single crop return. Thus, farmers prefer to adhere to a steady cropping pattern under any given agro-climatic climate. But to the degree determined by market factors in changing acreage in response to breakthroughs in agricultural production technology, such as the use of high-yielding crop varieties along with fertilizers, pesticides, insecticides, and changes in irrigated areas, farmers do not change far from this role.

Since the beginning of the green movement, India has experienced significant crop diversification in terms of region-shifts under various crops.Crop diversification is beneficial for farm preservation. Monoculture impacts the quality of the soil and causes biotic and abiotic damage to plants. The introduction of the green movement in the late 1960s and early 1970s to resolve the country's food crisis has adversely affected the country's cropping trend. Several states had become mono-crop territories as a result of the introduction of receptive fertiliser and high-yielding rice and wheat varieties.The central and state governments launched several schemes to diversify crop trends to sustain food protection after achieving self-sufficiency in food grain production. The composition of the crops has also been modified by costs, weather, and the supply of labour.

3. Shift in the degree of crop diversification

We have taken 29 crops from 8 districts and calculated the crop diversification of the MalwaRegion to find out the difference in CDI for all the years from 2005–2006 to 2019–2020.

Figure 2: Flow of crop diversification from the year 2005-06 to 2019-20



The above figure clearly shows that there is an increase in the crop diversification of the Malwa region. With increasing opportunities, farmlands are being utilized more efficiently, and diverse cropping is becoming the natural selection of the farmers of the Malwa Region.
The index shows the value of crop diversification fluctuating every consecutive year, but it is always greater than 0.525. It also explains that crop diversification is on an increasing path, and the shift in crop diversification is also on an upward path. It was clearly observed that the shift in crop diversification. There is an upward shift in the degree of crop diversification in the Malwa region. The log scale technique was used to maximize observational correctness. Present data on a logarithmic scale that can be helpful when the data covers a large range of values, since the use of the logarithms of the values rather than the actual values reduces a wide range to a more manageable size with the help of the Microsoft Office Excel 2016 package.

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4. Extent of crop Diversification in malwa region

The extent of CDI on time is measured by the model:

$$CDI = \beta_0 + \beta_1 T + \mu$$

Table 4 Regression result of the function CDI = f (Time)

Sr. No.	Factors	Regression coefficient	t statistics	P value	R Square
1	Intercept	0.6063	29.6912	2.48E-13	0.3934
2	Time	0.0065	2.9038	0.0123	
*The value of the coefficient is significant at a 1% level of significance.					

Source: Calculated by Scholar

Table 4 shows the trend of the crop diversification index (CDI) over time. The total time is taken as 15 years, from 2005–06 to 2019–20. CDI is being calculated with the help of the Gibbs and Martin index formula. The CDI is considered the dependent variable, and time is considered the regressor. The R-square of the model is 0.3935 (coefficient of determination). In other words, 39 percent of the variation around the mean CDI (the predicted "Y" variable) is explained by the x-value (time). Hence, there is a moderate degree of independent value fit on the regression line. It means that over a period of one year, there is a 0.0065 increase in CDI. The P-value of the time coefficient is less than 0.05, which shows that there is a significant and positive impact of time upon crop diversification.

Conclusion:

Crop diversification is significant, but it is not only due to market motivation as much as it is due to socio-economic compulsion. Crop diversification in the Malwa region is more of a push than a pull phenomenon. External reasons are reflected in the diversification index rather than internal reasons. Farmers are more connected with the market and sensitive to demand and supply of yields, seeds, fertilizers, technology, and methodology. It is improving productivity and yield and narrowing the demand and supply gaps in the market. Crop diversification is a continuous effort made by agricultural research institutes. While farmers adopt farming practises on a peer-to-peer basis, these institutes have succeeded in breaking the impasse between the scientific and cultural approaches to farming. Crop diversification is one indicator of the same.

This chapter studies the crops that are dominant in terms of proportion of harvesting areas, which are not being harvested as they used to be, and the crops that used to be harvested in less proportion but are not gaining momentum. The study clearly shows that the crop diversification of all the years from 2005–2006 to 2019–2020 was positive. The diversification results are more than 0.50 for all fifteen years, and they have also increased since 2005.

The main crops grown in the Kharif season are soybeans, paddy, maize, bajara, tur, etc., and in the Rabi season, wheat, gram, mustard, cotton, jowar, and vegetables. Madhya Pradesh is the highest producer of pulses (gram, soy, and soybean), contributing 21.38 percent, 40.33 percent, and 59.92 percent, respectively, and is second in oilseed production.

Diversification of the agriculture sector is an essential instrument for economic development. Diversification therefore depends on farmers' opportunities to diversify and react to these opportunities. It is largely dependent upon innovative technologies, customer demand, government policy, trade agreements, and irrigation, highways, and other infrastructure growth. Similarly, crop diversification problems and threats arise from (i) demand and price uncertainties, (ii) uncertainties associated with current crop management activities, (iii) adverse shifts such as depletion of natural capital and the environment, and (iii) socio-economic needs such as job creation, self-sufficiency in some crops, and foreign exchange earnings from others. Due to the shift in crop diversification, the lifestyle of the farmers has improved from earlier. The production of crops has increased, and due to crop diversification, the cost of production has reduced from before. So, it is clearly observed that due

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to the shift in crop diversification, the farmers of the Malwa region have gotten better opportunities for market profit and have improved their lifestyle.

For the purpose of this study, 29 crops were taken from 8 districts in the Malwa region to calculate the crop diversification and find out the difference in CDI for all the years from 2005–2006 to 2019–2020. It clearly shows that there is an increase in the diversification of crops in the Malwa region. With increasing opportunities, farmlands are being utilised more efficiently, and diverse cropping is becoming the natural selection of the farmers of the Malwa Region. The shift in the degree of crop diversification has been noted here by GMI, and the shift is from 2000–01, when the value of GMI was 0.525, to 2014–15, when the value of GMI was 0.694. The change has been noticed by 0.169.

The extent of crop diversification has been observed to increase with time. The time coefficient has a P-value less than 0.05, indicating that time has a significant and positive impact on crop diversification. The value of the coefficient is significant at the 1% level of significance. Hence, there exists a positive trend in CDI in our study. The extent of crop diversification is on the rise.

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