JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Diversification of Agriculture in India: A Regional Perspective

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I
Introduction

India's future agricultural development will require much faster crop diversification in view of changes in consumption pattern. There is growing preferences for horticulture and dairy products. These areas hold a high promise as they have higher export potential.

According to RBI, "A contributing factor to below-potential performance of agriculture is the failure to sufficiently diversify the cropping pattern. The minimum support price (MSP) policy has distorted the relative prices between rice and wheat, on the one hand, and other food and non-food crops, on the other, giving rise to a distorted cropping pattern. It has contributed to a steep rise in the ratio of procurement to production over the years. The higher increases in MSPs of rice and wheat relative to prices of other agricultural commodities have contributed to an incentive structure that favours production of rice and wheat at the cost of other crops. The policy has contributed to a burgeoning stock- far in excess of food security requirements adding to carrying costs and locked- in bank credit, which could have been otherwise deployed for funding productive activities"(RBI 2001).

Emphasizing the need for diversification of Indian Agriculture, the Tenth Five Year Plan (2002-2007), observed, " Finally, the true potential of Indian Agriculture can be realized only when there is diversification of agricultural products, both geographically and over time. The food and nutritional requirements of the people for leading healthy lives demand a wider range of food products than are presently consumed on the average. For such diversification to gain momentum, the requisite science and technology inputs will have to be provided along with appropriate supportive price policies.

Most of the non-grain food products are, however, perishable in nature. In order to encourage the diversification through minimum wastage, considerable attention will be required to focus on post harvest technologies and marketing infrastructure. It would also require a reconsideration of the various rules and regulations that govern agricultural trade, which frequently act against the interests of the farmers and distort their incentive structure"(Planning Commission 2007).

After the independence in 1947, India's agricultural policy was to achieve self sufficiency in food grain production to tide over the imbalances in food supplies caused by the partition of the country in that year. However, over the years, horticulture has emerged as an indispensable part of agriculture, offering a wide range of choices to the farmers for crop diversification. It also provides ample opportunities for sustaining large number of agro-industries which generate substantial employment opportunities. The sector encompasses a wide range of crops namely fruit crops, vegetables crop, potato and tuber crops, ornamental crops, medicinal and aromatic crops, spices and plantation crops. New introductions like mushroom, bamboo and bee keeping further expanded the scope of horticulture.

The Government has identified horticultural crops as a means of diversification for making agriculture more profitable through efficient land use, optimum utilization of natural resources (soil, water and environment) and creating skilled employment for rural masses, especially women folk. Recent efforts have been rewarding in terms of increased production and productivity and availability of a much larger volume of horticulture produce. India Ghats emerged as the largest producer of coconut, arecanut, cashew nut, ginger, turmeric, black pepper and the second largest producer of fruits and vegetables. Among the new crops, kiwi, olive crops and oil palm have been successfully introduced for commercial cultivation in the country. Some improvement is seen in the adoption of technology for raising production.

Efforts are on to encourage private investment in hi-tech horticulture with micro-propagation, protected cultivation, drip irrigation, and integrated nutrient and pest management besides making use of latest post-harvest technology particularly in the case of perishable commodities. As a result, horticulture crop production has begun to move from rural confines to commercial ventures and has attracted young entrepreneurs, since it has proved to be intellectually satisfying and economically rewarding. A large variety of fruits are grown in India, of these, mango, banana, citrus, pineapple, papaya, guava, sapota, jackfruit, litchi and grapes are some of the tropical and sub tropical fruits and nuts. Apple, pear, peach, plum, apricot, almond and walnut constitute the temperate fruits and nuts. Aonia, ber, pomegranate, annona, fig and phalsa are some of the arid zone fruits. India produces over 46 million tones of fruits accounting for about 10 percent of the world production. The country ranks first in the production of mango, banana, sapota and acid lime and, in recent years recorded the highest productivity in grape. Mango is the

most important fruit covering about 39 percent of the area accounting for 23 percent of total fruit production in the country.

India's share in the world production of mango is about 54 percent. Citrus ranks second in area and accounts for about 10 per cent of country's fruit production. Limes, lemons, sweet orange and mandarin cover bulk of the area under this group od fruits. Banana ranks third in area covering about 13 percent of the total area. It ranks first in fruit production contributing nearly one-third of the total fruit production. Apple is the forth major fruit crop of the country with production of 1.42 million tones. The share of other fruits like guava and papaya is about 4 percent while that of grapes and pineapple is about 2 percent and litchi, about 1 percent. The arid zones of country are potential areas for fruits like aonia, ber, pomegranate, annona, etc. There has been a steady increase in the area and production of these fruits particularly aonia, ber and pomegranate in the country as a result of identification and development of suitable varities and production technologies. In addition to these, date palm and fig cultivation is also finding favour in some areas. Vegetables constituting the most important food next only to cereals and milk. Important vegetable crops grown in the country include potato, tomato, onion, brinjal, cabbage, cauliflower, okra and peas. India occupies first position in the production of cauliflower, second in onion and third in cabbage production in the world (MOA 2009).

II

Data and Methodology

Data

The present study is mainly based on secondary sources of data. Data on various categories of land use in Indian agriculture has been obtained from Directorate of Agriculture and Statistics, Government of India, Ministry of Agriculture, Government of India, Planning Commission, Government of India, Reserve Bank of India (RBI) and Centre for Monitoring Indian Economy (CMIE), Report on Agriculture (Various Issues), www.indiastat.com, www.agricoop.nic.in, Agricultural Statistics at a Glance-An Annual Publication of the Directorate of Statistics, Government of India, and Ministry of Agriculture. State wise and region wise data for area, production and yield of various crops have been compiled from official website of Government Reports and Journals. These data have been categorized for different regions of India for further analysis (Bhalla & Singh).

Methodology

Herfindal Index

The approach of Crop Diversification used in this study, which involves utilization of a variety of measures of crop diversification this indicate the extent of dispersion and concentration of activities in a given time and space by a single quantitative indicator. The extent of crop diversification at a given point of time may be examined by using Herfindahl Index. All these indices are computed on the basis of proportion of gross cropped area under

different crops cultivated in a particular geographical area. Hirschman Herfindahl Index (HHI) has also been constructed using the following equation.

$$HHI = \sum_{i=1}^{n} P_i^2 / 100$$

Where P_i = percentage share of ith crop in the agriculture sector.

III

Result and Discussion

Region wise Diversification of Area under Major Crops in India

Diversification means of area means competition among various grown crops for space in a given region. It may be explained as raising a variety of crops involving intensity of competition amongst field crops for arable land: the higher the competition, the higher the magnitude of crop diversification. It is a concept which is opposite to crop specialization or crop concentration. It is an indicator of multiplication of crops which obviously involves intensive competition among the growing crops (Singh 1976).

IV

Diversification of Area under Major Crops North Western Region in India

Region wise diversification of area under major crops in India is given in the following tables:

Table-1 Region wise percentage share of major crops to Total cropped area in India (2006-072017-18) (Area in 000' hectares)

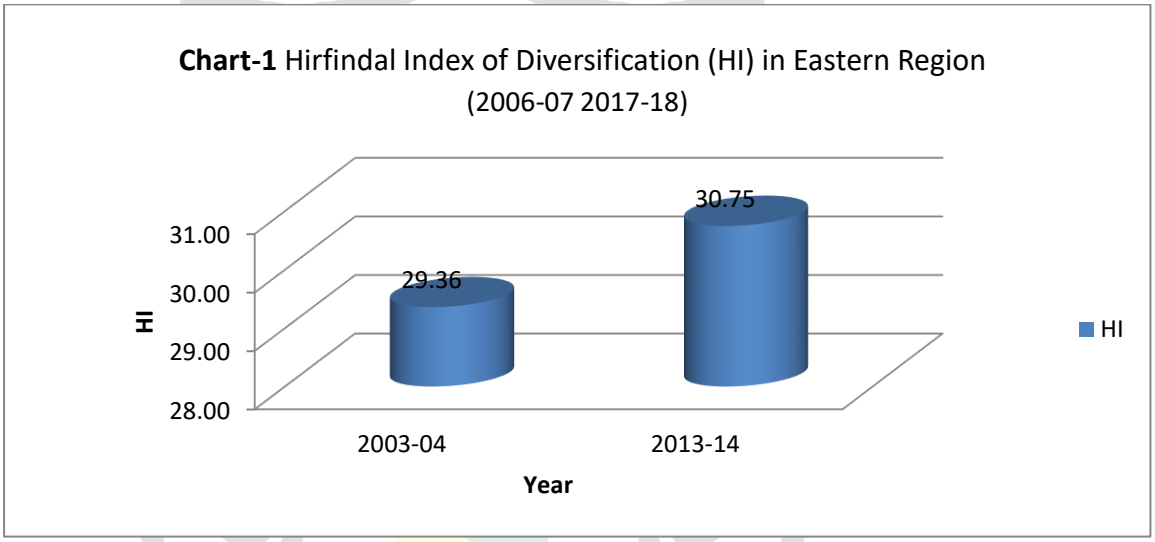
Crops	North Western Region			
	2006-07		2017-18	
	Area in 0000 ha	% share	Area in 0000 ha	% share
Rice	9698	27.55	10317	28.84
Wheat	15820	44.95	16455	45.99
Jowar	401	1.14	235	0.66
Bajra	1574	4.47	1358	3.80
Maize	1634	4.64	1490	4.16
Pulses	3120	8.86	2564	7.17
Fruit &Vegetables	1376	3.91	1555	4.35
Oilseeds	1575	4.47	1804	5.04
Total Cropped Area	35198	100.00	35778	100.00
HI	29.35		30.74	
CV	124.15		129.16	

Note: %age share calculated by the author.
HI = Herfindahl Index
CV = Coefficient of Variation

Source:Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

As far as the extent of diversification in area of major crops in North Western Region is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table-1 the value of HI has increased from 29.35 in 2006-07 to 30.74 in 2017-18. This is due to increased percentage share of Rice and decreased percentage share of oilseeds, pulses and in other crops. It implies that in North Western Region area under cultivation is mainly concentrated in few crops i.e. Rice and Wheat.

The values of coefficient of variation also show that the variation among different crops has increased. The value of coefficient of variation stood at 124.15 in 2006-07 and rose to 129.16 in 2017-18.



Source: Based on Table-1

Diversification of Area under Major Crops Eastern Region in India

Table-2 Region wise percentage shares of major crops to total cropped area in India (2006-07-2017-18) (Area in 000' hectares)

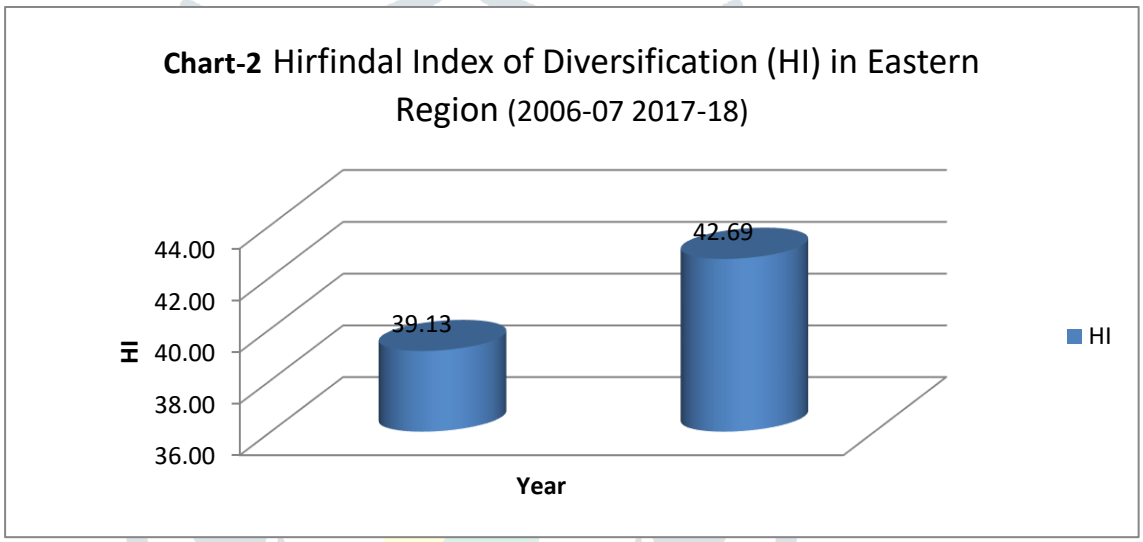
Crops	Eastern Region			
	2006-07		2017-18	
	Area in 0000 ha	% share	Area in 0000 ha	% share
Rice	16466	59.59	15254	62.87
Wheat	2592	9.38	2565	10.57
Jowar	14	0.05	5	0.02
Bajra	5	0.02	4	0.02
Maize	867	3.14	917	3.78
Pulses	2691	9.74	1393	5.74
Fruit &Vegetables	2975	10.77	2678	11.04
Oilseeds	2024	7.32	1448	5.97
Total Cropped Area	27634	100.00	24264	100.00
HI	39.13		42.69	
CV	156.03		166.13	

Note: %age share calculated by the author.

Source: Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

As far as the extent of diversification in area of major crops in Eastern Region is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table -2, the value of HI has increased from 39.13 in 2006-07 to 42.69 2017-18.This is due to increased percentage share of Rice and decreased percentage share of oilseeds and pulses. It implies that in Eastern Region area under cultivation is mainly concentrated in few crops i.e. Rice and Wheat.

The values of coefficient of variation also show that the variation among different crops has increased. The value of coefficient of variation stood at 156.03 in2006-07 and rose to 166.13 in 2017-18.



Source: Based on Table-2

Diversification of Area under Major Crops Central Region in India

Table-3 Region wise percentage shares of major crops to Total cropped area in India (2006-07-2017-18) (Area in 000' hectares)

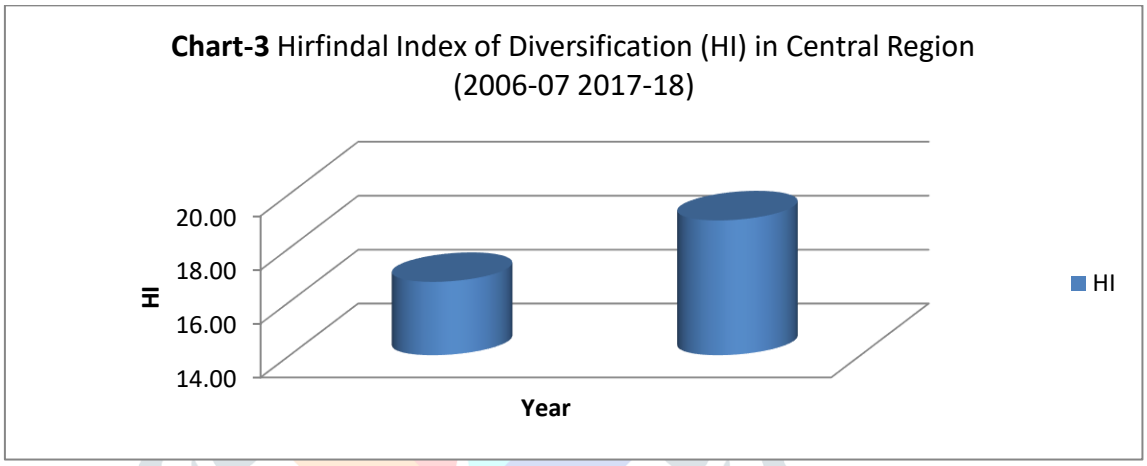
Crops	Central Region			
	2006-07		2017-18	
	Area in 0000 ha	% share	Area in 0000 ha	% share
Rice	4058	6.84	4278	6.88
Wheat	7717	13.01	10690	17.20
Jowar	6217	10.48	4287	6.90
Bajra	8756	14.76	5917	9.52
Maize	2919	4.92	3149	5.07
Pulses	12820	21.61	12040	19.37
Fruit &Vegetables	1982	3.34	2060	3.31
Oilseeds	14847	25.03	19721	31.74
Total Cropped Area	59316	100.00	62142	100.00
HI	16.73		19.01	
CV	62.18		77.14	

Note: %age share calculated by the author.

Source: Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

As far as the extent of diversification in area of major crops in Central Regionis concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table-3 the value of HI has increased from 16.73 in 2006-07 to 19.01 in 2017-18.This is due to increased percentage share of Rice, Wheat, Fruit &Vegetables and Oilseeds on the other side the decreased percentage share of pulses and other crops. It implies that in Central Regionarea under cultivation is mainly concentrated in few crops i.e. Rice, Wheat, Oilseeds and Fruit &Vegetables.

The values of coefficient of variation also show that the variation among different crops has increased. The value of coefficient of variation stood at 62.18 in 2006-07 and rose to 77.14 in 2017-18.



Source: Based on Table-3

Diversification of Area under Major Crops Southern Region in India

Table-4 Region wise percentage shares of major crops to total cropped area in India (2006-07-2017-18) (Area in 000' hectares)

Crops	Southern Region			
	2006-07		2017-18	
	Area in 0000 ha	% share	Area in 0000 ha	% share
Rice	5726	22.77	6591	27.25
Wheat	244	0.97	233	0.96
Jowar	2748	10.93	1759	7.27
Bajra	616	2.45	385	1.59
Maize	1487	5.91	2567	10.61
Pulses	4593	18.27	4423	18.29
Fruit &Vegetables	2480	9.86	2680	11.08
Oilseeds	7252	28.84	5548	22.94
Total Cropped Area	25146	100.00	24186	100.00
HI	19.42		18.95	
CV	79.57		76.80	

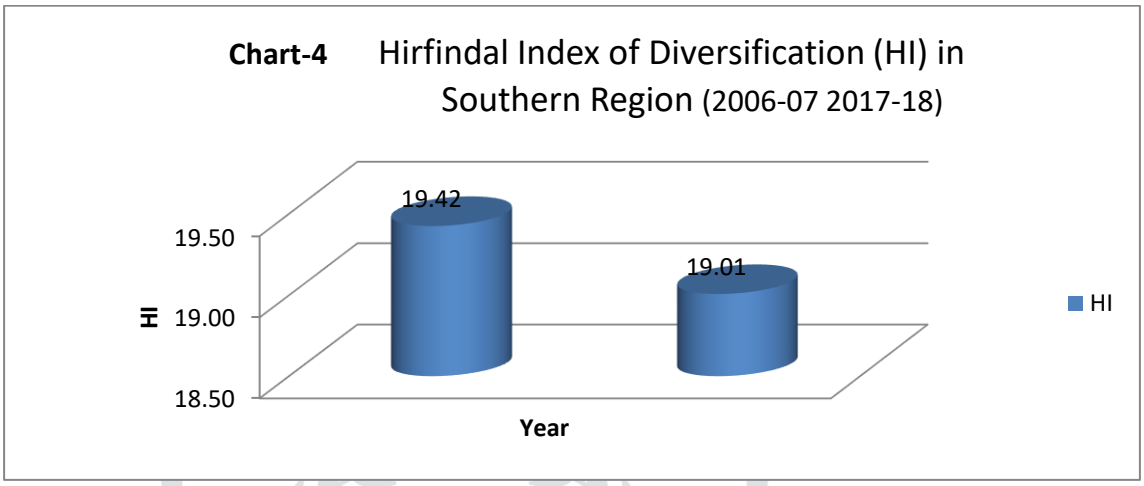
Note: %age share calculated by the author.

Source: Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

As far as the extent of diversification in area of major crops in Southern Region is concerned it seems to have increased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table-4 the value of HI has

decreased from 19.42 in 2006-07 to 18.95 in 2017-18. This is due to increased percentage share of Rice, Maize and Fruit &Vegetables on the other side the decreased percentage share of Wheat, Bajra and Oilseeds crops. It implies that in Central Region area under cultivation is mainly diversified between Rice, Maize and Fruit &Vegetables.

The values of coefficient of variation also show that the variation among different crops has decreased. The value of coefficient of variation stood at 79.57 in 2006-07 and rose to 76.80 in 2017-18.



Source: Based on Table-4

Region wise Diversification in Production of Major Crops in India

Region wise diversification in production of major crops in India is given in the following tables:

Diversification in Production of Major Crops, North Western Region in India

Table-5 Region wise percentage shares of major crops in total Production in India

(2006-07-2017-18) (Production in Million Tons)

Crops	North Western Region			
	2006-07		2017-18	
	Production	% share	Production	% share
Rice	23.02	21.84	29.9	20.90
Jowar	0.28	0.27	0.21	0.15
Bajra	1.98	1.88	2.44	1.71
Maize	3.14	2.98	2.96	2.07
Wheat	47.42	44.98	60.09	42.00
Pulses	2.53	2.40	1.84	1.29
Fruit &Vegetables	25.15	23.86	43.73	30.57
Oilseeds	1.89	1.79	1.9	1.33
Total Output	105.41	100.00	143.07	100.00
HI	30.91		31.46	
CV	129.75		131.65	

Note: %age share calculated by the author.

Source: Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

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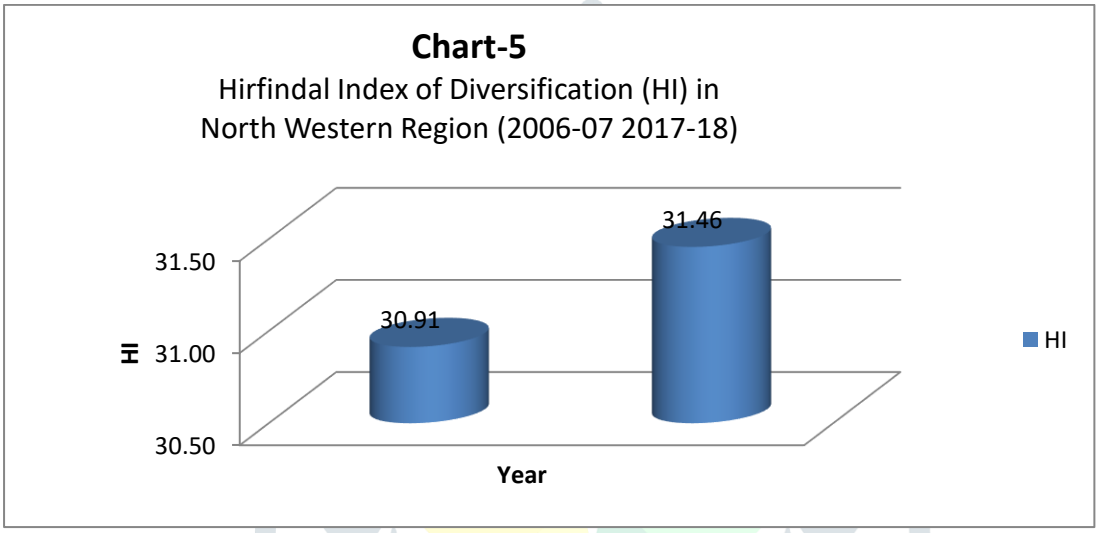
As far as the extent of diversification in production of major crops in North Western Region is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table-5 the value of HI has increased from 30.91 in 2006-07 to 31.46 in 2017-18. This is due to increased percentage share of Fruit &Vegetables and decreased percentage share of Rice, Wheat, oilseeds, and pulses and in other crops. It implies that in North Western Region Production major crops under cultivation is mainly concentrated in Fruit &Vegetables.

The values of coefficient of variation also show that the variation among different crops has increased. The value of coefficient of variation stood at 129.75 in 2006-07 and rose to 131.65 in 2017-18.



Source: Based on Table-5

Diversification in Production of Major Crops, Eastern Region in India

Table-6 Region wise percentage shares of major crops in total Production in India

(2006-07-2017-18) (Production in Million Tons)

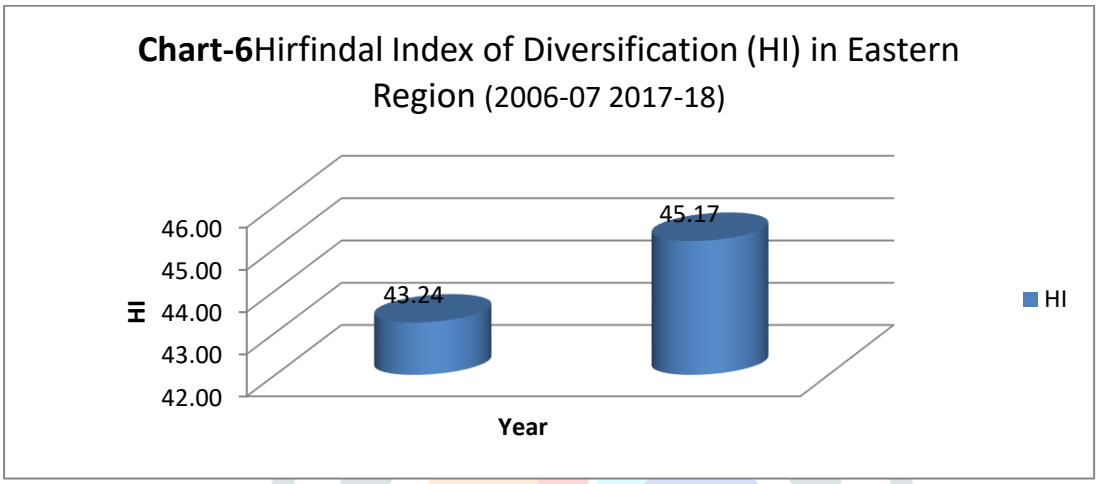
Crops	Eastern Region			
	2006-07		2017-18	
	Production	% share	Production	% share
Rice	27.29	34.50	33.18	30.08
Jowar	0.01	0.01	0	0.00
Bajra	0	0.00	0	0.00
Maize	1.61	2.04	2.54	2.30
Wheat	4.17	5.27	6.06	5.49
Pulses	0.89	1.12	1.19	1.08
Fruit &Vegetables	44.04	55.67	65.94	59.78
Oilseeds	1.1	1.39	1.39	1.26
Total Output	79.11	100.00	110.30	100.00
HI	43.24		45.17	
CV	167.65		172.83	

Note: %age share calculated by the author.

Source: Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

As far as the extent of diversification in production of major crops in Eastern Region is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table-6 the value of HI has increased from 43.24 in 2006-07 to 45.17 in 2017-18. This is due to increased percentage share of Wheat and Fruit &Vegetables and decreased percentage share of Rice, Oilseeds, and Pulses and in other crops. It implies that in Eastern Region Production of major crops under cultivation is mainly concentrated in Fruit &Vegetables.

The values of coefficient of variation also show that the variation among different crops has increased. The value of coefficient of variation stood at 167.65 in 2006-07 and rose to 172.83 in 2017-18.



Source: Based on Table-6

Diversification in Production of Major Crops, Central Region in India

Table-7 Region wise percentage shares of major crops in total Production in India

(2006-07-2017-18) (Production in Million Tonns)

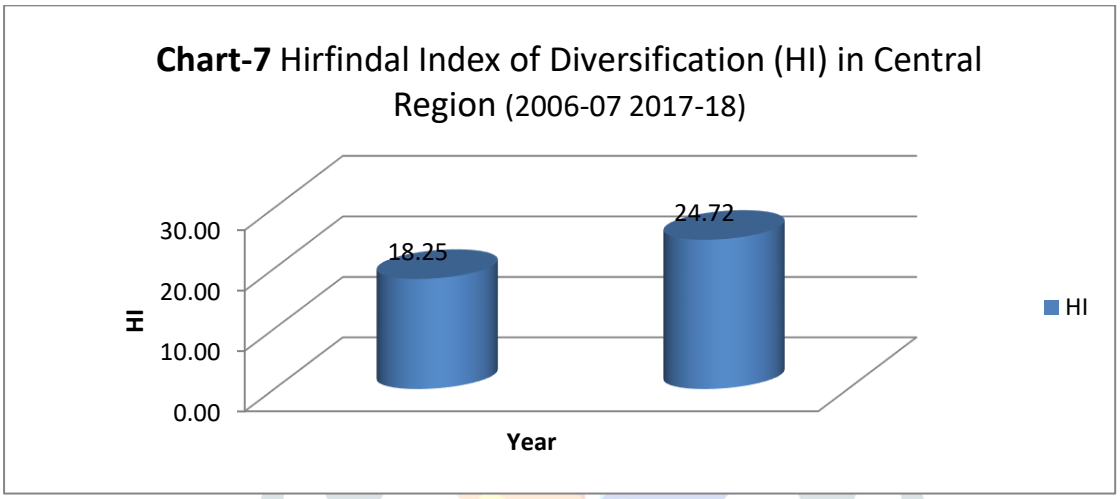
Crops	Central Region			
	2006-07		2017-18	
	Production	% share	Production	% share
Rice	4.57	5.69	7.35	4.90
Jowar	4.73	5.89	3.09	2.06
Bajra	5.45	6.79	6.23	4.15
Maize	3.67	4.57	6.78	4.52
Wheat	15.72	19.57	28.1	18.71
Pulses	6.91	8.60	11.42	7.61
Fruit &Vegetables	23.19	28.87	62.37	41.54
Oilseeds	16.07	20.01	24.81	16.52
Total Output	80.31	100.00	150.15	100.00
HI	18.25		24.72	
CV	72.53		105.72	

Note: %age share calculated by the author.

Source: Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

As far as the extent of diversification in production of major crops in Central Region is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table-7 the value of HI has increased from 18.25 in 2006-07 to 24.72 in 2017-18. This is due to increased percentage share of Fruit &Vegetables and decreased percentage share of Rice, Wheat Oilseeds, and Pulses and in other crops. It implies that in Central Region Production of major crops under cultivation is mainly concentrated in Fruit &Vegetables.

The values of coefficient of variation also show that the variation among different crops has increased. The value of coefficient of variation stood at 72.53 in 2006-07 and rose to 105.72 in 2017-18.



Source: Based on Table-7

Diversification in Production of Major Crops, Southern Region in India

Table-8 Region wise percentage shares of major crops in total Production in India

(2006-07-2017-18) (Production in Million Tonns)

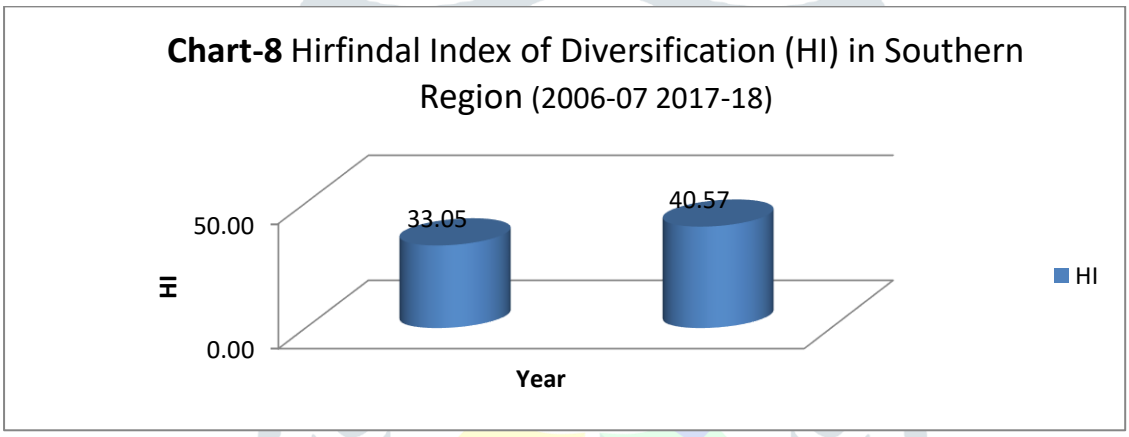
Crops	Southern Region			
	2006-07		2017-18	
	Production	% share	Production	% share
Rice	18.88	29.25	22.84	21.40
Jowar	2.21	3.42	2.09	1.96
Bajra	0.47	0.73	0.51	0.48
Maize	4.86	7.53	10.59	9.92
Wheat	0.18	0.28	0.23	0.22
Pulses	2.06	3.19	3.46	3.24
Fruit &Vegetables	31.05	48.10	62.87	58.92
Oilseeds	4.84	7.50	4.12	3.86
Total Output	64.55	100.00	106.71	100.00
HI	33.05		40.57	
CV	137.06		160.21	

Note: %age share calculated by the author.

Source: Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

As far as the extent of diversification in production of major crops in Southern Region is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table-8 the value of HI has increased from 33.05 in 2006-07 to 40.57 in 2017-18. This is due to increased percentage share of Pulses, Maize and Fruit &Vegetables and decreased percentage share of Rice, Wheat Oilseeds, and Pulses and in other crops. It implies that in Southern Region Production of major crops under cultivation is mainly concentrated in Fruit &Vegetables.

The values of coefficient of variation also show that the variation among different crops has increased. The value of coefficient of variation stood at 137.06 in 2006-07 and rose to 160.21 in 2017-18.



Source: Based on Table-8

Region wise Percentage Shares of All Regions of Major Crops in Total Production in India

Region wise diversification in production of major crops in India is given in the following tables:

Table-9 Region wise percentage shares of major crops in total Production in India (2006-07-2017-18) (Production in Million Tonnes)

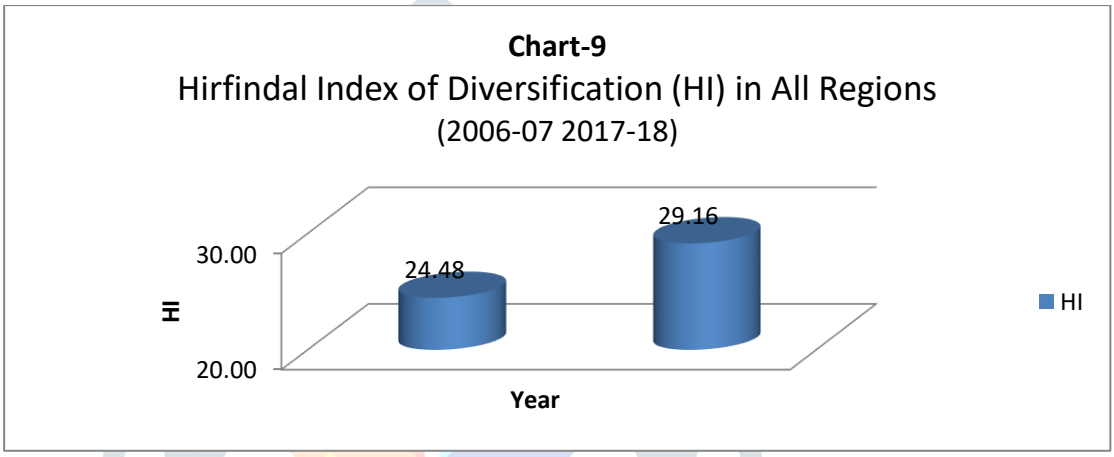
Crops	All Regions			
	2006-07		2017-18	
	Production	% share	Production	% share
Rice	83.13	23.74	106.54	19.42
Jowar	7.24	2.07	5.39	0.98
Bajra	7.93	2.26	9.18	1.67
Maize	14.17	4.05	24.35	4.44
Wheat	68.64	19.60	95.91	17.49
Pulses	13.13	3.75	19.27	3.51
Fruit & Vagetable	131.62	37.58	254.96	46.49
Oilseeds	24.35	6.95	32.88	5.99
Total Output	350.21	100.00	548.48	100.00
HI	24.48		29.16	
CV	104.67		123.41	

Note: %age share calculated by the author.

Source: Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2006-07 and 2017-18.

As far as the extent of diversification in production of major crops in All Regions is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. This becomes clear when the HI values for study period is considered. As shown in Table -9 the value of HI has increased from 24.48 in 2006-07 to 29.16 in 2017-18. This is due to increased percentage share of Maize and Fruit &Vegetables and decreased percentage share of Rice, Wheat Oilseeds, and Pulses and in other crops. It implies that in All Regions Production of major crops under cultivation is mainly concentrated in Fruit &Vegetables.

The values of coefficient of variation also show that the variation among different crops has increased. The value of coefficient of variation stood at 104.67 in 2006-07 and rose to 123.41 in 2017-18.



Source: Based on Table-9

Conclusion

Indian agriculture has undergone diversification, with notable increases in the sector's share of livestock and fisheries in total agricultural income. The diversification has mostly been in the crop sector. Most states are in favour of non-food grain crops. Though, the Diversification in these states has not primarily been for the purpose of generating income, but has also been used for risk mitigation. As far as the extent of diversification in area of major crops in all regions except Southern Region is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07. As far as the extent of diversification in production of major crops in all Regions is concerned it seems to have decreased in the year 2017-18 vis-a-vis the year 2006-07.

Utilizing the potential of diversification, however, necessitates a progressive transformation of infrastructure and quality standards, credit and fiscal setup, and market institutions into those that promote it. However, while accelerating the pace of diversification, certain precautions regarding long-term food security, probable changes in the global market, and the element of risk in transitioning from traditional to commercialised agriculture in the presence of sizable small and marginal farmers must also be kept in mind. As the political and economic effects of globalisation become more clear, the policies are changing.

However, there is general agreement that the difficulties that lie ahead are undoubtedly daunting and will call for more focus and effort.

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