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Recent Trends in Agricultural Diversification: A Comparative Analysis

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Abstract – Agricultural diversification is an essential strategy, which enhances agricultural income, minimizes risks due to crop failures & helps to earn foreign exchange. The most important input required for sustainable agricultural development is irrigation as it facilitates multiple cropping and increase crop productivity. The irrigation brings about overall changes in agriculture. Diversification in agriculture has tremendous impact on the agro-socio-economic impact and uplifting of resources-poor farming communities. It generates income and employment for rural youth. This study was mainly depends on primary data. It was collected from 200 farmers of Radhanagari and Jangamhatti command area and other relevant variables were collected through field work for the year 2013-14. The data have been interpreted in terms of cropping pattern and analyzed by using descriptive statistics and presented by using different kind of graphs. It was concluded that the whole picture of Radhanagari and Jangamhatti irrigation command area has been changed in terms of agricultural diversification after the construction of dam. In fact it help to bring out technological changes in agriculture thereby enhance economic prosperity of farmers and the region. This paper deals with the, cropping pattern, and magnitude of the extent of agricultural diversification that is taking place in both the talukas of Kolhapur district before and after the construction of dams and explore the farmers' cropping strategy and to identify the determinants of diversification in both talukas.

Key Words: Agriculture, Cropping pattern, Irrigation, Diversification

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1. INTODUCTION:

Agricultural diversification is an essential strategy, which enhances agricultural income, minimizes risks due to crop failures & helps to earn foreign exchange. It can be designed to help poverty alleviation, employment generation & environmental conservation. Moreover, the agricultural diversification increases both individual & social gain. Hence, sustainable agricultural diversification has become a most popular concept attracting the agrarian, scholar and economist.

The most important input required for sustainable agricultural development is irrigation as it facilitates multiple cropping and increase crop productivity. In fact, water is more valuable than land, because when water is applied to land it increases its productivity at least six fold and renders great extends of land productivity which otherwise would produce less quantities of output. The irrigation brings about overall changes in agriculture. It not only changes in cropping pattern, input use etc. but helps to replace traditional farming by modern farming with advanced technology. The regular supply of the water through irrigation encourages the use of modern inputs as well as capital in agriculture which ultimately results in increasing crop yields and income of the farmers through increased yield and land use intensity. Thus, through the expansion of irrigation, technological changes can be brought out easily in agriculture, thereby, facilitates to socio-economic betterment of the farming community.

Diversification in agriculture has tremendous impact on the agro-socio-economic impact and uplifting of resources-poor farming communities. It generates income and employment for rural youth. It implies the use of local resources in a larger mix of diverse cropping systems and livestock, aquaculture and other non-farm sectors in the rural areas. With the globalization of markets in the WTO era, diversification in agriculture is one means to increase the total production and productivity in terms of quality, quantity and monetary gains under diverse agro-climatic situations of the country. There are many opportunities of crop diversification both in the irrigated and non-irrigated vast areas in the rural India.

Today, whole world is concerned about problems like climate change, water crises, food insecurity, poverty, resource mobilization and environmental

loss etc. hence scientific approach towards agriculture is inevitable. Agriculture irrigation gives input to all round sustainable development. Therefore it is important to study the agricultural diversification; in recent years because of economic reforms, agriculture sector is slowly moving into industrial sector the main reason is that the industrial sector acquired agriculture land to produce capital goods. However it is proper time to assess the impact of irrigation on sustainable agricultural diversification.

2. THE STUDY AREA:

2.1 The Radhanagari Major Irrigation Project, Radhanagari Taluka:

The Radhanagari irrigation project is located in Radhanagari taluka of Kolhapur district on the river Bhogawati. The Radhanagari dam is constructed by the Chhatrapati Shahu Maharaj on 3rd February 1902. Chhatrapati Shahu's demise in 1922, so construction was delayed further and was finally completed in 1954 at a cost of Rupees 1384 Lakhs.

Radhanagari dam is 1,150 meter long and 42.7 meter high with a reservoir capacity of 236.79 million cubic meters. Its hydroelectric power house generates 6600 kilowatts of electricity and its command area is 59110 hectares. It presently irrigates 26560 hectares out of which 20900 hectares are under perennial irrigation (sugar cane) and 4100 hectares under seasonal irrigation. Radhanagri irrigation cum hydro electric project as the name implies is a multipurpose project providing water for irrigation & drinking purpose and for generating electric power from water.

2.2 The Jangamhatti Medium Irrigation Project, Chandgad Taluka:

The Jangamhatti project is situated at Jangamhatti village in Chandgad taluka of Kolhapur district in Maharashtra (India) on the river Honhall tributary of the river Tamraparni. This project was started on January 1981. The capacity of dam to store water is 21.40 square kilometers and water level is 34.21 million. This project has irrigation potential to the extent of 4503 hectares. At present, command area of the project is 4457 hectares. Moreover 14 villages have been covered under this project. The length of dam is 960 meter and its height is 31.40 meters, the total land occupied by project is 519.28 hectares. The project was completed and implemented on June 1995. Since then farmers in this have been availing the irrigation facilities.

3. REVIEW OF LITERATURE:

P.K.Joshi et.al. (2007), in their research paper entitled, "Agricultural Diversification in India", examined status nature, determinants and pattern of agricultural diversification in India during 1981-2000.

S.S.Kalamkar (2011), in his book entitled, "Agricultural Growth and Productivity in Maharashtra" examined the different trends and determinants in agriculture sector in Maharashtra. **Sarfraz K.Qureshi, Madeeha G.Qureshi and Others (2007)** in their research paper entitled, "Agricultural Diversification in Pakistan", examined status, and opportunities for agricultural diversification in Pakistan during 1981-2004.

4. OBJECTIVES OF THE STUDY:

The following are the main objectives of the present research work.

a) To study the cropping pattern of Radhanagari and Chandgad taluka.

b) To study the diversification of agriculture before and after the construction of dam.

5. DATA ANALYSIS AND INTERPRETATIONS:

The present research work is analytical study on crop diversification in agriculture in Radhanagari taluka.The study was undertaken in the command area of the Radhanagari irrigation project located in Radhanagari taluka, and Jangamhatti irrigation project located in the Chandgad taluka, both irrigation projects are located in Kolhapur district. Out of total villages situated in command areas of Radhanagari dam and Jangamhatti dam, 200 farmers from 10 villages were selected i.e. 100 farmers from 5 villages from the command areas of the Radhanagari dam and 100 farmers from 5 villages from command areas of Jangamhatti dam, in view to assess the impact of irrigation on agricultural development through technological changes. Primary data was collected from 200 farmers i.e. 100 farmers from Radhanagari taluka and 100 farmers from Chandgad taluka. The data have been interpreted in terms of cropping pattern, diversification and analyzed by using descriptive statistics and presented by using different kind of graphs.

Tools of data analysis:

Herfindahal Index Number:

In order to find out the degree of diversification in cropping pattern we adopted Herfindahal Index Number of diversification,

Herfindahal Index = H.I. = 1-H

The Herfindahal Index Number is computed by taking the sum of acreage / hectares in proportion of each crop in the total cropped area.

$$\text{H.I.} = \frac{\sum^{n}}{i = 1} \text{Pi}^2$$

when 'n' is total number of crops and 'Pi' respondents' average proportion of 'ith' crop in total cropped area, with increase in diversification, this index takes the value of one when there is a complete specialization and approaches to zero, when 'n' gets larger, which indicates that diversification is perfect. Hence, the Herfindahal index is bounded by zero and one. Since, the H.I. is a measure of concentration; it was transformed by subtracting it from one i.t. 1-H.I. The transformed value of H.I. avoids confusion to compare it with other indices.

6. CROPPING PATTERN OF RADHANAGARI AND CHANDGAD TALUKA:

Cropping pattern refers to the proportion of area under different crops at a point of time. A change in the cropping pattern means a change in the proportion of area under different crops. (M. V.Shinde, 2006) Cropping pattern is determined by natural factors like climate, soil conditions and rainfall etc.

Table 1.1

Diversification of Cropping Pattern in Chandgad and Radhanagari Taluka

Sr. No.	Crops	Name of the Taluka				Simple Growth Rate (SGR)		Percentage Change	
		Chandgad		Radhanagari					
		Before Dam	After Dam	Before Dam	After Dam	Chandgad	Radhanagari	Chandgad	Radhanagari
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A)	**Kharif Cereals Crops**								
1	Rice	152.95	123.9	162.06	132.36	-29.05	-29.70	-18.99	-18.33
2	Ragi	120.12	46.65	92.99	43.25	-73.47	-49.74	-61.16	-53.49
	Kharif Pulses Crops								
3	Gram	1.275	1.275	1.232	1.427	0.00	0.20	0.00	15.83
	Khariff Cash Crops								
4	Jowar	31.5	5.37	14	6.3	-26.13	-7.70	-82.95	-55.00
5	Sweet-Potato	90.22	70.19	56.12	62	-20.03	5.88	-22.20	10.48
6	Vari-rice	0.91	0	0.05	0.18	-0.91	0.13	-100.00	260.00
	Kharif Oil Seeds Crops								
7	Groundnut	62.95	44.95	30	27.65	-18.00	-2.35	-28.59	-7.83
	Khariff Fodder Crops								
8	Maize	56	9.13	27.05	14.95	-46.87	-12.10	-83.70	-44.73
9	Grass/Fodder	40.25	18.425	19.173	4.02	-21.83	-15.15	-54.22	-79.03
Herfindahal Index		**0.0266**	**0.017**	**0.0349**	**0.0207**	-	-	-	-
B)	**Rabbi Cereals Crops**								
1	Wheat	112	28	73.87	30.25	-84.00	-43.62	-75.00	-59.05
	Rabbi								
2	Gram	74.2	12.754	31.5	3.254	-61.45	-28.25	-82.81	-89.67
	Rabbi Cash Crops								
3	Sugarcane	90	346.1	57	265.38	256.10	208.38	284.56	365.58
4	Chilly	3.04	5.105	2.11	3.955	2.07	1.85	67.93	87.44
5	Banana	0	24.5	0	19	24.50	19.00	0.00	0.00
6	Cabbage	0	13.73	0	21.76	13.73	21.76	0.00	0.00
7	Cauliflower	0	13.527	0	17.05	13.53	17.05	0.00	0.00
8	Marigold	0	8.1	0	4.01	8.10	4.01	0.00	0.00
9	Nishigandha	0	7.835	0	5.15	7.84	5.15	0.00	0.00
	Rabbi Oil Seeds Crops								
10	Sunflower	133	60	117.5	53.5	-73.00	-64.00	-54.89	-54.47
	Rabbi Fodder Crops								
11	Jawar	60.5	49.5	59.05	59.05	-11.00	0.00	-18.18	0.00
12	Maize	75	72	54.5	50.5	-3.00	-4.00	-4.00	-7.34
13	Fodder/Grass	87.25	32.9	80.25	23.49	-54.35	-56.76	-62.29	-70.73
Herfindahal Index		**0.0283**	**0.0883**	**0.0303**	**0.0728**	-	-	-	-
C)	**Summer Cereals Crops**								
1	Rice	9.5	12	8.63	8.75	2.50	0.12	26.32	1.39
	Summer Pulses Crops								
2	0	0	0	0	0	0	0	0	0
	Summer Cash Crops								
3	Chilly	9.04	85.75	5.92	93.24	76.71	87.32	848.56	1475.00
4	Potato	46.23	34.48	10.15	12.39	-11.75	2.24	-25.4164	22.06897
5	Cashewnut	34.18	41.32	13.14	33.485	7.14	20.345	20.88941	154.8326
	Summer Oil Seeds Crops								
6	Groundnut	122.75	88.75	116.54	95.24	-34.00	-21.30	-27.70	-18.28
	Summer Fodder Crops								
7	Maize	74.97	46.97	39.5	25.5	-28.00	-14.00	-37.35	-35.44
8	Fodder/Grass	47.5	6.35	37	3.61	-41.15	-33.39	-86.63	-90.24
9	Bajara	10.945	7.765	2.81	5.19	-3.18	2.38	-29.0544	84.69751
Herfindahal Index		**0.01**	**0.0116**	**0.0148**	**0.0167**	-	-	-	-
HI (A+B+C)		**0.0649**	**0.1169**	**0.080**	**0.1099**	-	-	-	-

Source: field survey

From table 1.1 it is seen that, cropping pattern generally varies talukas and regions-wise depending on the irrigation status, soil quality, climate etc. in both the talukas i.e. Radhanagari and Chandgad taluka of Kolhapur district. There has been a significant change in cropping pattern and relative share of various crops in the gross command area during the reference period. There are three agricultural seasons in Radhanagari and Chandgad taluka. Kharif crops are sown in June or July and harvested at the end of October or early November, while rabi crops are sown in October or mid November and harvested in month of February or March. Summer crops are sown in February or early March and harvested in month May or early June. However, farmers in Radhanagari and Jangamhatti irrigation commands mainly cultivated cereals (rice, ragi, and wheat), pulses (gram), cash crops (sweet-potato, vari rice, chilly, banana, cabbage, cauliflower, marigold, nishigandha, potato, sugarcane and cashew nut), oil seeds (groundnut and sunflower), and fodder crops (maize, jowar, grass and bajara). The data on cropping pattern shows area, growth rates and percentage change of various crops before and after the construction of both dams.

In Radhanagari irrigation command kharif crops comprises rice, ragi, gram, sweet-potato,vari-rice, groundnut, jowar, maize, and other fodder crops. Before the construction of dam area under rice was 162.06 acres which decreased to 132.36 acres after the construction of dam. Therefore, growth rate of rice was negative at (-29.70) and it leads to change in area i.e. (-18.33). Before the construction of dam ragi occupied (92.99) acres area followed by groundnut (30.0) acres, maize 27.05, grass and fodder 19.17, jowar only 14.0 acres which decreased ragi to 43.25 groundnut 27.65 acres, maize 14.95, grass and fodder 4.02, jowar 6.3 acres respectively after the construction of dam. In fact the growth of these crops was negative. While before the dam gram occupied 1.232 acres area, followed by sweet-potato 56.12 acres, vari rice 0.05 acres. This increased Gram to 1.427, sweet-potato 62.0 acres, vari rce 0.18 acres after dam. Hence SGR of these crops indicated that the cropping pattern in Radhanagari has been shifted from food crops to non food crops. It means that, the crop diversification away from foodgrains has increased over the years from 1954 to 2014.

In kharif season before the construction of dam the Herfindahal index of Diversification was (0.0349) which decreased to (0.0207) in Radhanagari irrigation command after the dam.

On the other hand, in Jangamhatti irrigation command before the construction of dam area under rice was 152.95 acres followed by ragi 120.12 acres, sweet potato 90.22 acres, groundnut 62.95 acres, grass 40.25 acres and jowar 31.5 acres which was decreased to, rice 123.9 acres

followed by ragi 46.65 acres, sweet potato 70.19 acres, groundnut 44.95 acres, grass 18.42 acres and jowar 5.37 acres respectively after the dam in kharif season. While area under gram was as before dam so it shows a stagnant growth rate but after the dam farmers of Chandgad taluka totally neglected the vari rice which give maximum yield to cultivators. However, except gram all crops in kharif season shows negative rate of growth.

In Jangamhatti irrigation command area before the construction of dam the Herfindahal index of Diversification was (0.026) which decreased to (0.017) after the dam.

In both taluka rabbi crops include wheat, gram, sugarcane, chilly, banana, cabbage, cauliflower, marigold, nishigandha, sunflower, jowar, maize, fodder and grass. In Radhanagari taluka before the dam area under sunflower was 117.5 acres followed by fodder and grass 80.25 acres, wheat 73.87 acres, jowar 59.05 acres, maize 54.5 acres, and gram 31.5 acres which was remarkably decreased to (except jowar -59.05) sunflower 53.5 acres, fodder and grass 23.49 acres, wheat 30.25 acres, maize 50.5 acres, and gram 3.25 acres respectively. While chilly slightly increase from 2.11 to 3.95 acres during the reference period. Sugarcane was the most dominant crop in the taluka. Before dam it occupied only 57.0 acres area which significantly increased to 265.38 acres after the construction of dam. However, SGR of sugarcane and chilly were (208.38%) and (1.85%) respectively. While other crops showed negative rate of growth. In fact, after dam farmers were cultivating cash crops like cabbage 21.76 acres followed by banana 19.0 acres, cauliflower 17.05 acres, nishigandha 5.15 acres and marigold flower 4.01 acres area respectively.

Moreover, in rabbi season the Herfindahal index of crop diversification increased from (0.030) to (0.072) in Radhanagari irrigation command area during the study period Where as in Chandgad taluka taluka before the dam area under sunflower was 133 acres followed by wheat 112 acres, gram 74.2 acres, fodder and grass 87.25 acres, maize 75 acres, and jowar 60.05 acres which was remarkably decreased to sunflower 60.0 acres, wheat 28 acres, gram 12.75 acres , fodder and grass 32.9 acres, maize 72 acres, and jowar 49.05 acres respectively after the dam. While area under chilly slightly increased from 3.04 to 5.10 acres and area under sugarcane significantly increased from 90.0 acres to 346.1 acres during reference period. Hence, SGR of sugarcane (256.10%) and chilly (2.07%) were increased and rest of the crops showed negative rate of growth. However, after the dam farmers preferred cash crops like banana 24.5 acres followed by cabbage 13.73 acres, cauliflower 13.52 acres and marigold flower 8.1 and nishigandha 7. 83 acres area respectively.

Due to dam crop diversification was taking place in the Chandgad taluka, as a result, the Herfindahal index of crop diversification increased from (0.028) to (0.88) in the study area during the reference period.

Moreover, in summer season farmers cultivated rice, chilly, potato, cashew nut, groundnut, maize, fodder and grass in both irrigation commands. Before the construction of dam, area under cashew nut 13.14 acres followed by potato 10.15 acres, rice 8.63 acres, chilly 5.92 acres and bajara 2.81 acres only. This increased to cashew nut 33.48 acres, potato 12.39 acres, rice 8.75 acres, chilly 93.24 acres and bajara 5.19 acres respectively after the dam. However, area occupied by groundnut was 116.54 acres, maize 39.05 acres and fodder 37.0 acres which decreased to groundnut 95.24 acres, maize 25.05 acres and fodder 3.61 acres respectively after the dam. In Chandgad, on the other hand, area occupied by cashew nut 34.18 acres followed by rice 9.05 acres, chilly 9.04 acres before the dam which increased to cashew nut 41.32 acres followed by rice 12 acres and chilly 85.75 acres area after the construction of dam. Hence the growth rate of each of these crops increased i.e. cashew nut 7.14, rice 2.50 and chilly 76.71 during reference period. While area under groundnut was 122.75 acres followed by maize 74.97 acres, fodder 47.05 acres, potato 46.23 acres and bajara 10.95 acres in 1994 which area tremendously decreased to groundnut 88.75 acres maize 46.97 acres, fodder 6.35 acres, potato 34.48 acres and bajara 10.95 acres respectively. The growth rate of groundnut (-34.0), maize (-28.0), fodder (-41.15), potato (-11.75) and bajara (-3.18) showed a negative trend in 2013-14.

Moreover, in case of summer crops in both talukas crop diversification away from foodgrains has increased after the constructions of dams. In Radhanagari taluka Herfindahal index of diversification increased from (0.014) to (0.016) over the years from 1953-54 to 2013-14. Similarly in Chandgad taluka also Herfindahal index of diversification increased from (0.01) to (0.011) over the years from 1994-95 to 2013-14. In fact, in case of summer crops, the level of diversification in Chandgad taluka was very less compared to the Radhanagari taluka.

The season-wise crop diversification before and after dam is presented in Table 1.2 and figure1.1.

Table 1.2

Seasonwise Herfindahal Index of Crop Diversification

Seasons	HID			
	Chandgad		Radhanagari	
	Before Dam	After Dam	Before Dam	After Dam
Kharif Crops	0.0266	0.017	0.0349	0.0207
Rabbi Crops	0.0283	0.0883	0.0303	0.0728
Summer Crops	0.01	0.0116	0.0148	0.0167

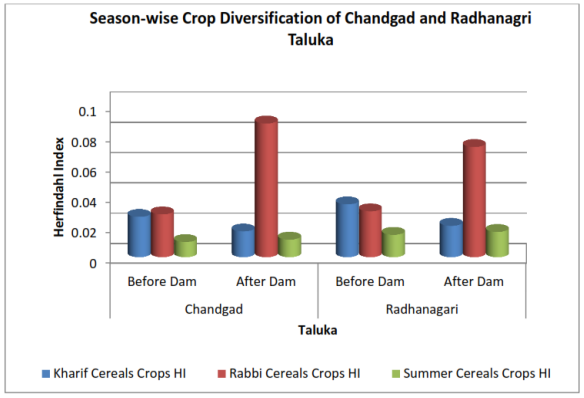

Figure 1.1

Table 1.3

Herfindahal Index of Crop Diversification

	Chandgad		Radhanagari	
	Before Dam	After Dam	Before Dam	After Dam
Total HI	0.0649	0.1169	0.08	0.1099

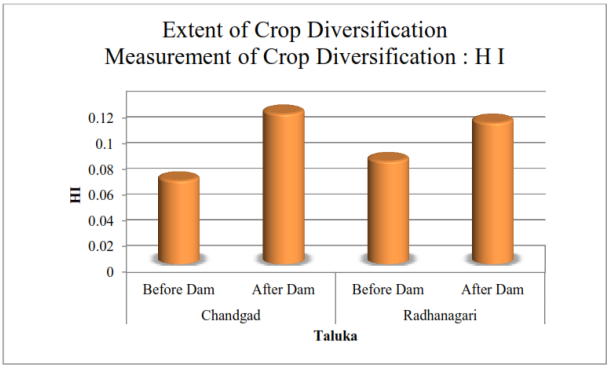

Figure – 1.2

From table 1.3 and figure 1.2 revealed that the crop diversifications in Radhanagari irrigation command area and Jangamhatti irrigation command area before and after constructions of both dams. It is noted that the Herfindahal index of crop diversification in both taluka has increased after the constructions of dams but the level of crop diversification is highest in Chandgad taluka compared to Radhanagari taluka. Still, there is tremendous scope for agricultural diversification in both talukas of Kolhapur district.

Thus after the construction of dams in both the irrigation commands cropping pattern has been totally changed in favour of high value crops.

7. CONCLUSION:

Radhanagari and Chandgad taluka have ample water resources that leads diversifying its crop sector in favour of high value commodities especially non-foodgrain crops. Diversification can generate employment, income, alleviate poverty, and conserve precious resources. In Radhanagari and Chandgad taluka of Kolhapur district diversification in agricultural sector is a very recent phenomenon. It is basically a rice producing talukas but after the construction of both the dams maximum area brought under sugarcane and non-food crops.

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