# DISPARITIES IN IRRIGATION STATUS AND AGRICULTURAL PRODUCTIVITY IN ODISHA

**Sanjib Kumar Hota**
Faculty
MICM,Bhubaneswar, Odisha.
Email: skhota001@yahoo.co.in

**Kirtanya Bisi, Reader in Economics,**
Atabira College, Bargarh, Odisha.
Email: kbisi59.kb@gmail.com

**Abstract**

*The disparities in the area under irrigation and the impact of the change in irrigation status on the productivity of various crops under study across the districts of Odisha have been analyzed by a decomposition analysis in this paper. Further, the relationship between irrigation intensity and cropping intensity is also examined across the districts of Odisha at two points of time 1993 and 2015-16. The findings reveal wide inequality prevailing in the irrigation development across the districts causing unequal development in agricultural sector. Hence, an appropriate solution be brought about through effective policies for strengthening the irrigation potential of the state which will ultimately be helpful in augmenting productivity and reducing disparities*

**Keywords: Disparities, Productivity, Irrigation Status, Gross Irrigated Area, Intensity**

## 1.1 Introduction

Irrigation has been on the priority list ever since the planned development began in India. Huge investment both public and private has gone into creation of irrigation infrastructure through major, medium and minor irrigation projects because assured irrigation is one of the most important factors contributing to increasing production and productivity in agricultural sector. The Green Revolution Technology (water, fertilizer and HYV seeds) of 1960s did not have any impact in eastern India including Odisha due to scarcity of resources needed for its success. The second Green Revolution initiated by the Government of India and the so-called agricultural budget passed by the Government of Odisha in 2013 will be successful if assured irrigation water is provided to farmers.

Studies, Chdha 2003, Dev 2008, Marathia 2003, Suds 2006 and Moorty and Hanjra 2006 reveal strong positive relationship between irrigation development and agricultural growth.

Thus, in this paper an attempt has been made to find out the inter-district variations in irrigation development and categories districts into highly irrigated, moderately irrigated and low irrigated districts. Decomposition of growth analysis is made and relationship between irrigation intensity and cropping intensity is also brought into focus.

## 1.2 Sources of Irrigation and Gap Between Potential Created and Utilised

In Odisha only 35 per cent of the cultivable land is irrigated by various sources, though the estimated water resources of the state is one of the highest in the country that is in order of 11 per cent of the country's total surface water resources. The state has 6.18 million hectares of cultivable land out of which 5.8 million hectares can be brought under assured irrigation through different sources. It has been assessed that about 7 million ha m of surface water (from 11 river basin inside the state) can irrigate about 4.92

million hectares of land and 1.9 million hect. of ground water can irrigate 0.88 million hectares (0.23 million hect. through tube well and 0.65 million hect. through river lift) of land.(Water and Land Management Institute, 1991).

It is evident from Table-1.2 that by the end of 2015-16 net irrigation potential of 3.2 million hect. has been created through major, medium and minor flow irrigation projects by using surface and ground water resources. In addition to the above 1.00 million hect. of net irrigation potential created through unconventional sources like dugwell, ponds,tanks, small checkdams etc. The higest potential has been created in Ganjam district with 361.18 thousand ha followed by Cuttack, Kalahandi, Bargarh and Balasore.The lowest potential has been created in Jharsuguda district with 25.11 thousand ha only. A worrisome aspect of the irrigation sector is the large gap between the irrigation potential created and its utilisation. The gap between the two at the end of 2015-16 is evident from Table-1.2. The higest gap exists in Cuttack district with 11.73 thousand hect. followed by Jajpur and Puri. It implies that despite annual expansion in created potential and capital investment in irrigation sector, there is underutilisation of irrigation capacity.

**1.3 Regional Disparities in the Growth of Irrigation**.

**Table-1.2**

**District-wise Sources of Irrigation, Irrigated area ('000 hect.) and Gap between Potential created & Utilised (upto 2015-16)**

| District | Major, Medium and Minor Flow | Minor(Lift) | Other sources | Total | Gap between potential created and utilized |
|---|---|---|---|---|---|
| Balasore | 48.3 | 63.57 | 132.03 | 244.01 | 66.48 |
| Bhadrak | 105.07 | 32.57 | 54.83 | 192.47 | 41.28 |
| Bolangir | 36.36 | 27.08 | 43.63 | 106.78 | 22.83 |
| Sonepur | 91.89 | 26.19 | 13.73 | 131.81 | 24.1 |
| Cuttack | 168.45 | 42.24 | 50.64 | 261.33 | 111.73 |
| Jagatsinghpur | 51.94 | 17.76 | 37.96 | 107.66 | 2.56 |
| Jajpur | 102.63 | 50.38 | 36.39 | 189.4 | 105.16 |
| Kendrapara | 114.88 | 57.98 | 22.91 | 195.77 | 70.92 |
| Dhenkanal | 69.85 | 21.56 | 29.76 | 121.17 | 46.4 |
| Angul | 47.32 | 22.55 | 38.44 | 108.31 | 37.77 |
| Ganjam | 256.82 | 43.82 | 60.54 | 361.18 | 63.72 |
| Gajapati | 23.97 | 8.33 | 7.40 | 40.7 | 7.13 |
| Kalahandi | 174.65 | 27.06 | 48.6 | 250.31 | 35.69 |
| Nuapada | 34.97 | 11.12 | 23.01 | 69.1 | 7.33 |
| Keonjhar | 70.29 | 27.43 | 43.33 | 141.05 | 34.3 |
| Koraput | 82.35 | 26.42 | 55.13 | 163.9 | 28.14 |
| Malkangiri | 107.42 | 4.82 | 10.77 | 123.01 | 29.26 |
| Nawarangapur | 15.32 | 22.44 | 29.98 | 68.02 | 20.5 |
| Rayagada | 41.48 | 26.92 | 15.59 | 83.99 | 26.11 |
| Mayurbhanja | 110.33 | 37.5 | 62.73 | 210.56 | 57.57 |
| Kandhamal | 16.43 | 8.99 | 13.05 | 38.47 | 7.68 |
| Boudh | 44.35 | 12.04 | 10.67 | 67.06 | 13.41 |
| Puri | 185.59 | 25.69 | 40.69 | 251.97 | 98.86 |
| Khordha | 92.84 | 14.15 | 23.45 | 130.44 | 47.55 |
| Nayagarh | 39.46 | 15.68 | 23.05 | 78.19 | 23.87 |
| Sambalpur | 76.17 | 14.34 | 21.93 | 112.44 | 11.47 |
| Bargarh | 178.76 | 20.25 | 44.01 | 243.02 | 20.41 |
| Deogarh | 18.91 | 3.57 | 11.55 | 34.01 | 5.8 |
| Jharsugda | 6.30 | 6.09 | 12.72 | 25.11 | 2.84 |
| Sundargarh | 51.97 | 23.66 | 47.53 | 123.16 | 0.46 |

Sources: Agricultural Statistics and Economic Survey of Odisha, 1993-94 to 2015-16

Table-1.3 presents data on Gross Cropped Area (GCA), Gross Irrigated Area (GIA),Percentage of Gross Irrigated Area (% of GIA)in 1993-94 and 2015-16 and Average Annual Growth Rate(AAGR) in Gross Irrigated Area for 30 districts of Orissa during the period from 1993-94 to 2015-16. Observation reveals that growth of the gross irrigated area in absolute term has increased in 27 out of 30 districts excepting Sonepur, Kendrapara and Puri where it has registered a decline and average annual growth rate therefore becomes negative. The highest growth rate in irrigation is recorded in Malkangiri (2.04%) followed by Balasore (1.79%) Nawarangpur (1.59%) and Kalahandi (1.36%).

**1.3.1 Classification of Districts based on Gross Irrigated Area**

On the basis of the percentage of gross irrigated area districts are categorized into highly irrigated, moderately irrigated and low irrigated districts as shown in Table-1.3.1. The following cut off points is followed for this purpose:-

(1) Highly irrigated- Above 50%.
(2) Moderately irrigated- Less than 50% but above 35%.
(3) Low irrigated- Below 35% (which is the state average).

As represented in Table-1.3.1, in 1993-94, only three districts were in highly irrigated region which has increased to 6 in 2015-16. The districts which were in moderately irrigated region moved up to highly irrigated region in 2015-16, namely Bhadrak and Bargarh. Balasore which was in low irrigated region in 1993-94 moved up to highly irrigated region in 2015-16. Thus it reveals that disparity among the districts has reduced over time.

**Table-1.3**
**Disparities Growth of Gross Irrigated Area (area in '000hect.)**

| | 1993-94 | | | 2015-16 | | | AAGR of GIA |
|---|---|---|---|---|---|---|---|
| **Districts** | **GCA** | **GIA** | **% of GIA** | **GCA** | **GIA** | **% of GIA** | |
| Balasore | 433.95 | 107.28 | 24.72 | 332.61 | 177.53 | 53.37 | 1.79 |
| Bhadrak | 265.61 | 125.85 | 47.38 | 237.96 | 150.19 | 63.11 | 0.98 |
| Bolangir | 472.22 | 83.40 | 17.66 | 472.05 | 84.04 | 17.80 | 0.008 |
| Sonepur | 184.73 | 110.89 | 60.02 | 198.40 | 107.71 | 54.28 | -0.35 |
| Cuttack | 371.21 | 136.51 | 36.72 | 309.39 | 149.6 | 48.35 | 0.72 |
| Jagatsinghpur | 225.25 | 123.85 | 54.98 | 186.36 | 105.1 | 56.39 | 0.08 |
| Jajpur | 316.11 | 94.86 | 30.00 | 272.72 | 84.24 | 30.88 | 0.05 |
| Kendrapara | 293.36 | 140.66 | 47.94 | 268.45 | 124.85 | 46.5 | -0.08 |
| Dhenkanal | 336.44 | 66.8 | 19.85 | 262.79 | 74.77 | 28.45 | 0.53 |
| Angul | 331.56 | 69.84 | 21.06 | 321.34 | 70.54 | 21.95 | 0.05 |
| Ganjam | 755.19 | 238.39 | 31.56 | 686.09 | 297.46 | 43.35 | 0.73 |
| Gajapati | 121.17 | 27.55 | 22.73 | 141.61 | 33.57 | 23.7 | 0.06 |
| Kalahandi | 568.14 | 76.83 | 13.52 | 606.14 | 214.62 | 35.4 | 1.36 |
| Nuapada | 246.61 | 15.65 | 6.34 | 268.89 | 61.77 | 22.97 | 1.03 |
| Keonjhar | 412.24 | 79.32 | 19.24 | 439.95 | 106.75 | 24.26 | 0.31 |
| Koraput | 415.11 | 66.53 | 16.02 | 394.29 | 135.76 | 34.43 | 1.15 |
| Malkangiri | 194.43 | 18.7 | 9.61 | 221.29 | 93.75 | 42.36 | 2.04 |
| Nawarangpur | 267.28 | 23.77 | 8.89 | 286.1 | 47.52 | 16.6 | 1.59 |
| Rayagada | 268.35 | 30.56 | 11.38 | 251.56 | 57.88 | 23.00 | 0.72 |
| Mayurbhanja | 544.36 | 116.68 | 21.43 | 518.84 | 152.99 | 29.48 | 0.5 |
| Kandhamal | 227.72 | 21.66 | 9.51 | 190.25 | 30.79 | 16.18 | 0.41 |
| Boudh | 124.79 | 25.7 | 20.59 | 139.13 | 53.65 | 38.56 | 1.12 |
| Puri | 296.78 | 161.94 | 54.56 | 286.7 | 155.11 | 54.1 | -0.02 |
| Khordha | 225.15 | 67.74 | 30.08 | 232.65 | 82.89 | 35.62 | 0.34 |
| Nayagarh | 209.27 | 45.77 | 21.87 | 222.76 | 54.32 | 24.38 | 0.16 |
| Sambalpur | 266.13 | 85.65 | 32.18 | 281.59 | 100.97 | 35.85 | 0.22 |
| Bargarh | 487.30 | 230.28 | 47.25 | 447.56 | 222.61 | 50.01 | 0.15 |
| Deogarh | 92.89 | 21.88 | 22.9 | 108.08 | 28.21 | 26.01 | 0.2 |
| Jharsuguda | 103.49 | 20.2 | 19.51 | 107.61 | 22.27 | 20.69 | 0.07 |
| Sundargarh | 404.23 | 75.21 | 18.6 | 377.07 | 122.7 | 32.37 | 0.86 |
| ORISSA | 9461.07 | 2509.95 | 26.52 | 9070.63 | 3204.16 | 35.32 | 0.55 |

Sources: Agricultural Statistics and Economic Survey of Odisha, 1993-94 to 2015-16

**Table- 1.3.1**

**Regional Disparities in growth of Irrigation.- Classification of Districts**

| Status | 1993-94 | 2015-16 |
|---|---|---|
| Highly Irrigated | Sonepur,<br>Jagatsinghpur,<br>Puri | Bhadrak<br>Balasore<br>Sonepur<br>Jagatsinghpur<br>Puri<br>**Bargarh** |
| Moderately Irrigated | Bhadrak<br>Cuttack<br>Kendrapara<br>Bargarh | Kendrapara<br>Ganjam<br>Kalahandi<br>Malkangiri<br>Boudh<br>Khordha<br>Sambalpur<br>Cuttack |
| Low Irrigated | Balasore,<br>Balangir,<br>Jajpur<br>Dhenkanal<br>Angul<br>Ganjam<br>Gajpati<br>Kalanhandi<br>Nuapada<br>Keonjhar<br>Koraput<br>Malkangiri<br>Nawarangpur<br>Rayagada<br>Mayurbhanj<br>Kandhamal<br>Boudh<br>Khordha<br>Nayagarh<br>Sambalpur<br>Jharsuguda<br>Deogarh<br>Sundargarh | Bolagir<br>Jajpur<br>Dhenkanal<br>Angul<br>Gajpati<br>Nuapada<br>Keonjhar<br>Koraput<br>Nawarangapur<br>Rayagada<br>Mayurbhanja<br>Kalahandi<br>Nayagarh<br>Deogarh<br>Jharsuguda<br>Sundargarh. |

Source: From the result of Table 1.3 as above

**1.4 Decomposition of Growth**

The changes in irrigation and its effect on agricultural production and productivity during the time period 1993-94 to 2015-16 was decomposed into area effect, yield effect and interaction effect. The following additive scheme of decomposition was used.

$\ÄP = A_t \times \ÄY + Y_t \times \ÄA + \ÄA\ÄY$

Where

ÄP= Difference in average production during two periods.

ÄA= Difference in irrigated area during two periods.

ÄY =Difference in average yield during two periods.

$A_t$= Average irrigated area under the crop during the base year.

$Y_t$= Average yield of the crop during the base year.

Thus the changes in production were due to:

(1) Area Effect ($Y_t$ .ÄA)

(2) Yield Effect ($A_t$ .ÄY) and

(3) Interaction Effect (ÄA .ÄY)

Decomposition of growth in time period 1993-94 to 2015-16 as shown in Table-1.4 indicates that the growth in rice and cereal production was due to increase in irrigated area in almost all districts except in Kendrapara, Angul, Keonjhar and Sambalpur

where it was negative due to decline in irrigated area. The highest irrigated area effect was in Kalahandi and lowest in Gajapati districts. The yield effect was also considerable except in Cuttack. Gajapati, Malkangiri, Nawarangpur, Puri, Khorda and Nayagarh where it was negative. Another significant feature of growth in irrigation is that expansion in irrigation also increased productivity of rice and cereals. Bhadrak. Sonepur, Jagatsinghpur, Bargarh which were highly irrigated also registered high growth in rice cereals productivity during the period.

In pulses though the area effect was positive for the state as a whole (increase from 127 thousand hectares in 1993-94 to 154 ha in 2015-16) the yield effect was negative in as many as 20 districts. Though the interaction effect was positive its share was very small and hence pulses production declined in 2015-16. In oilseeds the same trend as pulses was observed during the period. The farmers are not willing to take up pulses and oilseeds cultivation as they were less remunerative than rice and cereals. Hence due to increase in irrigation it is increasingly becoming a mono crop state. This is shown in Table No- 1.4.

**Table-1.4**

**Effects of Change in Irrigation status on the production & Productivity of various crops (Decomposition Analysis)**

| | Rice | | | Cereal | | | Pulses | | | Oilseeds | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Districts** | **Area Effect** | **Yield Effect** | **Interaction Effect** | **Area Effect** | **Yield Effect** | **Interaction Effect** | **Area Effect** | **Yield Effect** | **Interaction Effect** | **Area Effect** | **Yield Effect** | **Interaction Effect** |
| Balasore | 53.89 | 5.59 | 2.81 | 53.33 | 5.45 | 2.66 | 4.82 | -0.34 | -1.14 | 8.37 | 1.75 | 2.9 |
| Bhadrak | 19.46 | 50.10 | 6.63 | 19.48 | 50.34 | 6.6 | 0.14 | 0.11 | 0.008 | 1.67 | 0.35 | 1.34 |
| Bolangir | 8.58 | 0.67 | 0.1 | 6.77 | 1.32 | 0.14 | -1.68 | -0.25 | 0.13 | -2.5 | 1.58 | -0.71 |
| Sonepur | 14.06 | 18.85 | 1.83 | 12.98 | 19.42 | 1.73 | -1.84 | -0.14 | 0.08 | -2.85 | -0.12 | 0.07 |
| Cuttack | 10.52 | -20.18 | -1.48 | 9.82 | -20.38 | -1.37 | 4.8 | -0.11 | -0.17 | 10.69 | 0.21 | 0.97 |
| Jagatsinghpur | 37.67 | 25.91 | 22.08 | 28.98 | 31.32 | 17.23 | -5.45 | -0.87 | 0.44 | 0.26 | 2.12 | 0.15 |
| Jajpur | 6.73 | 7.31 | 0.83 | 7.21 | 6.28 | 0.74 | -3.31 | -1.36 | 0.55 | 0.49 | 2.06 | 0.44 |
| Kendrapara | -1.81 | 3.68 | -0.08 | -1.83 | 3.59 | -0.07 | -0.81 | 1.32 | -0.1 | 12.91 | 1.87 | 7.47 |
| Dhenkanal | 1.41 | 16.9 | 0.51 | 1.2 | 16.21 | 0.78 | 1.25 | -0.27 | -0.42 | -0.006 | 0.2 | -0.001 |
| Angul | -10.28 | 5.8 | -1.34 | -10.04 | 6.03 | -1.2 | 0.05 | -0.25 | -0.01 | 1.4 | -0.09 | -0.13 |
| Ganjam | 2.48 | 36.16 | 0.29 | 8.47 | 38.31 | 1.07 | | | | 5.16 | 3.44 | 1.96 |
| Gajpati | 0.13 | -5.38 | -0.02 | 0.91 | -0.3 | -0.01 | | | | -0.005 | -0.03 | 0.0001 |
| Kalahandi | 98.17 | 8.93 | 11.32 | 98.67 | 11.84 | 15.02 | 11.23 | 0.45 | 2.98 | 3.18 | 0.88 | 1.44 |
| Nuapada | 18.48 | 10.75 | 10.84 | 16.88 | 12.33 | 11.03 | 0.75 | -0.06 | -0.06 | 2.93 | 0.19 | 0.27 |
| Keonjhar | -1.3 | 12.37 | -0.25 | -1.44 | 10.17 | -0.22 | 0.71 | -0.2 | -0.12 | -0.03 | -0.46 | 0.01 |
| Koraput | 8.01 | 21.39 | 1.98 | 12.29 | 14.77 | 2.03 | -0.55 | -0.58 | 0.11 | -0.41 | -0.2 | 0.09 |
| Malkangiri | 22.32 | -0.19 | -0.14 | 23.96 | 0.88 | 0.74 | 5.32 | -0.06 | -1.83 | 13.59 | 3.13 | 7.55 |
| Nawarangpur | 9.44 | -0.98 | -0.56 | 16.89 | 11.86 | 10.71 | - | - | - | 0.72 | -0.01 | -0.03 |
| Rayagada | 1.06 | -3.02 | -0.06 | 0.95 | 2.86 | 0.05 | 1.74 | 0.02 | 0.15 | 0.6 | -0.22 | -0.16 |
| Mayourbhanj | 35.35 | 27.43 | 10.99 | 35.37 | 27.94 | 11.1 | 0.10 | 0.007 | 0.0003 | 2.02 | 0.14 | 0.1 |
| Kandhamal | 0.57 | 1.52 | 0.05 | 1.70 | 1.22 | 0.11 | -0.15 | 0.02 | -0.01 | -0.09 | -0.09 | 0.01 |
| Boudh | 7.28 | 1.48 | 0.24 | 7.73 | 1.95 | 0.33 | 0.14 | 0.002 | 0.002 | -0.03 | 0.11 | -0.01 |
| Puri | 0.32 | -34.56 | -0.05 | -0.48 | -34.18 | 0.08 | - | - | - | 6.47 | 0.007 | 0.43 |
| Khorda | 11.62 | -0.19 | -0.03 | 11.29 | 0.53 | 0.09 | 1.20 | -0.02 | -0.20 | -0.07 | 0.2 | -0.01 |
| Nayagadh | 6.56 | -12.38 | -1.37 | 7.21 | -11.45 | -1.41 | 0.29 | -0.13 | -0.09 | -0.15 | -0.09 | 0.02 |
| Sambalpur | -3.1 | 41.62 | -0.98 | -3.55 | 41.79 | -1.11 | -1.92 | -0.96 | 0.57 | -2.00 | -0.6 | 0.25 |
| Bargarh | 35.48 | 43.13 | 4.77 | 35.62 | 42.97 | 4.74 | -0.97 | -1.3 | 0.31 | -8.27 | -0.65 | 0.26 |
| Deogarh | 1.30 | 0.47 | 0.03 | 1.06 | 0.29 | 0.01 | 0.06 | -0.19 | -0.02 | -0.01 | -0.18 | 0.001 |
| Jharsuguda | 10.20 | 1.21 | 1.13 | 10.48 | 1.27 | 1.03 | 0.01 | -0.15 | -0.002 | 0.24 | 0.004 | 0.001 |
| Sundargarh | 7.9 | 21.77 | 4.19 | 7.96 | 22.20 | 3.91 | -0.21 | -0.42 | 0.04 | -0.75 | -1.06 | 0.23 |

### 1.5 Relationship between cropping intensity and irrigation intensity.

Sustainable increase in crop production through increase in cropping intensity and productivity has the potential to change the backwardness of agriculture of Odisha. It is well acknowledged that irrigation development increases the scope for multiple cropping and thereby raises cropping intensity in the region. This makes the region more developed compared to others having poor irrigation development. In view of this the trend relationship between the irrigation intensity and cropping intensity has been worked out across districts for 1993-94 and 2015-16. The observation as shown in Table-1.5 reveals three kinds of relationship between the two.

(1) Increase in irrigation intensity and cropping intensity (21 districts)
(2) Increase in irrigation intensity but decline in cropping intensity (6 districts)
(3) Decline in irrigation intensity but increase in cropping intensity (3 districts)

Therefore though the nine districts exhibit exceptions to our belief, more generally it can be derived that increase in irrigation development causes increase in cropping intensity. Fluctuations in production productivity can be checked by increase in irrigation development.

**Table-1.5**
**Relationship between Cropping intensity and Irrigation intensity**

| | 1993-94 | | 2015-16 | |
|---|---|---|---|---|
| **Name of the District** | **Cropping intensity** | **Irrigation intensity** | **Cropping intensity** | **Irrigation intensity** |
| Balasore | 163 | 148 | 154 | 183 |
| Bhadrak | 148 | 127 | 138 | 135 |
| Bolangir | 144 | 194 | 146 | 156 |
| Sonepur | 163 | 132 | 198 | 167 |
| Cuttact | 189 | 139 | 197 | 154 |
| Jaipur | 180 | 135 | 192 | 146 |
| Jajpur | 168 | 143 | 188 | 155 |
| Kendrapada | 161 | 144 | 186 | 188 |
| Dhenkanal | 148 | 130 | 170 | 145 |
| Angul | 157 | 134 | 168 | 164 |
| Ganjam | 192 | 108 | 181 | 123 |
| Gajpati | 156 | 101 | 192 | 140 |
| Kalahandi | 168 | 122 | 162 | 158 |
| Nuapada | 147 | 104 | 171 | 137 |
| Keonjhar | 139 | 106 | 152 | 170 |
| Koraput | 178 | 118 | 135 | 167 |
| Malkangiri | 138 | 115 | 163 | 162 |
| Nawarngpur | 130 | 134 | 158 | 183 |
| Rayagada | 160 | 109 | 166 | 143 |
| Mayourbhanj | 127 | 113 | 130 | 141 |
| Kandhamal | 147 | 103 | 161 | 164 |
| Boudh | 151 | 106 | 162 | 131 |
| Puri | 157 | 107 | 214 | 173 |
| Khordha | 172 | 107 | 183 | 158 |
| Rayagada | 180 | 101 | 176 | 137 |
| Sambalpur | 140 | 162 | 172 | 165 |
| Bargarh | 144 | 131 | 149 | 158 |
| Deogarh | 138 | 155 | 189 | 152 |
| Jharsuguda | 137 | 188 | 174 | 164 |
| Sundargarh | 128 | 124 | 129 | 138 |

Sources: Agricultural Statistics and Economic Survey of Odisha, 1993-94 to 2015-16

### 1.6 Findings

The growth in the gross irrigated area in absolute term has increased in 27 out of 30 districts excepting Sonepur, Kendrapara and Puri where it has registered a decline and average annual growth rate therefore becomes negative. The highest growth rate in irrigation is recorded in Malkangiri (2.04%) followed by Balasore (1.79%) Nawarangpur (1.59%) and Kalahandi (1.36%).

The Classification of Districts based on Gross Irrigated Area reveals that in 1993-94 only three districts were in highly irrigated region which has increased to 6 in 2015-16. The districts which were in moderately irrigated region moved up to highly irrigated region in 2015-16 namely Bhadrak and Bargarh. Balasore which was in low irrigated region in 1993-94 moved up to highly irrigated region in 2015-16. Thus it reveals that disparity among the districts has reduced over time.

The changes in irrigation and its effect on agricultural production and productivity during the time period 1993-94 to 2015-16 was decomposed into area effect, yield effect and interaction effect. Decomposition of growth in time period 1993-94 to 2015-16 indicates that the growth in rice and cereal production was due to increase in irrigated area in almost all districts except in Kendrapara, Angul, Keonjhar and Sambalpur where it was negative due to decline in irrigated area. The highest irrigated area effect was in Kalahandi and lowest in Gajapati districts. The yield effect was also considerable except in Cuttack. Gajapati, Malkangiri, Nawarangpur, Puri, Khorda and Nayagarh where it was negative. Another significant feature of growth in irrigation is that expansion in irrigation also increased productivity of rice and cereals. Bhadrak. Sonepur, Jagatsinghpur, Bargarh which were highly irrigated also registered high growth in rice cereals productivity during the period.

In pulses though the area effect was positive for the state as a whole the yield effect was negative in as many as 20 districts. Though the interaction effect was positive its share was very small and hence pulses production declined in 2015-16. In oilseeds the same trend as pulses was observed during the period. The farmers are not willing to take up pulses and oilseeds cultivation as they were less remunerative than rice and cereals. Hence due to increase in irrigation it is increasingly becoming a mono crop state.

The relationship between the irrigation intensity and cropping intensity has been worked out across districts for 1993-94 and 2015-16. The observation reveals three kinds of relationship between the two.

(1) Increase in irrigation intensity and cropping intensity (21 districts)

(2) Increase in irrigation intensity but decline in cropping intensity (6 districts)

(3) Decline in irrigation intensity but increase in cropping intensity (3 districts)

Therefore though the nine districts exhibit exceptions to our belief, more generally it can be derived that increase in irrigation development causes increase in cropping intensity. Fluctuations in production productivity can be checked by increase in irrigation development.

### 1.7 Conclusion

It can be concluded based on the findings that wide inequality is prevailing in the irrigation development across districts causing unequal development in agricultural sector of the state. Since public investment in irrigation has been declining and more emphasis is now given to private investment, there is a need for easy flow of direct credit to farmers by the institutional agencies. The commercial banks have to shed their regional bias and explore the possibility of providing higher credit assistance at a lower rate of interest to agriculturally backward regions for raising investment in irrigation, increasing cropping intensity and agricultural production so as to reduce the gap in agricultural growth across the districts. Irrigation should be viewed as a service to the farmers for enhancing the farm production and income. The linkage between irrigation and agricultural growth needs to be strengthened to tap the potential and bring about improvement in farming livelihood of farmers and state economy.

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