

SOME LINKAGES OF IRRIGATION WITH PRODUCTIVITY

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ABSTRACT

India being an economy primarily dependent of agriculture, it is necessary to increase the productivity to feed the growing population with ease. This paper looks at the irrigation and its linkages with productivity (for food grain and non-food grains) and concludes that there is definite positive relationship, so it is imperative to develop irrigation facilities if we need a sustainable growth in agricultural sector.

Keywords: Irrigation, Crop productivity, Land holdings, Performance, Cropping pattern

INTRODUCTION

Assured water supply is followed by prosperity, opportunities for employment, the increment in income and enhancement of the capital formation. Irrigation has played a crucial role in the agricultural development of the country, and it is termed as the lifeline for the sustained growth of agriculture (Reddy and Ramakrishna; 1995).

In the irrigated areas, the yields of the crops turn out to be much higher than that of the un-irrigated areas. Needless to say there exists a definite complementarity between other inputs required with irrigation. The impact of irrigation can be assessed through the differences in the productivity of irrigated and un-irrigated farm lands which varies across different regions.

The different classes of cultivators have been unequally impacted by the development of irrigation. Though, the extent of inequality is not much visible in surface irrigation works. But it is substantially observed by everyone in the case of ground water irrigation. The investment required for construction of wells, electric pump sets and tube wells are beyond the reach of the small cultivators. Moreover, if they somehow arrange the money to set up tube wells, the return will be possible only after a minimum required area is irrigated. Easy loan assistance provided by government agencies has mostly benefitted large farmers. Putting these factors together with the fact that groundwater irrigation has become crucial in the present period the concerns of inequality should be addressed as soon as possible.

The yield of irrigated agriculture has been found to be 2.7 per cent more than the rain-fed agriculture globally (UN, 2012). According to Dhawan (1985), the productivity of Indian agriculture during the whole seventies has increased from 6.8 quintals to around 18.6 quintals per hectare for a crop. However, this increase in productivity is not uniform all over India. The rise in yields for the dry land which got converted into irrigated land varies from 3 quintals of foodgrains per hectare in Bihar to 28 quintals/ha in Maharashtra. For the India as whole the rain-fed yield increased by a multiple of 2.75. While it rises by a multiple of 3.5 for the peninsular south India, by a multiple of 2.8 for the western India, by a multiple of 2.2 in Indo-Gangetic plains and by a multiple of 1.8 in the central India. It was also mentioned that out of the total increase in production by 12 quintals per hectare, not more than 4.5 quintals can be seen as pure yield effect and the rest is due to changes in cropping pattern after irrigation. In the average and low rainfall areas, irrigation system gave farmers, the freedom to shift from the crops like pulses, oilseed and coarse cereals which cannot be cultivated intensively to other set of crops like wheat, rice, sugarcane, fruits and flowers. However, the magnitude of change in crop pattern varies across regions depending on the timely availability, reliability, quality of irrigation and its dependability in case of a shortfall in rain. It was also found that the impact of irrigation on productivity is higher in case of non-food grains crops as compared to food-grains crop and this disparity was highest in the state of Maharashtra. But, that increase in productivity through the scarce water for the crops like rice and sugarcane is socially desirable or not should be examined a fresh (Dhawan, 1985).

No positive relationship between the impact of irrigation on agriculture productivity and the extent of ground water used has been seen in the state wise analysis of yield. And there are two upcoming problems first, the over-exploitation of ground water will have the deleterious impact in the long run and second, development of proper surface irrigation has many positive impacts on ground water and vice-versa. Seepage from the surface water irrigation contributes a lot to the increase in water level of wells in the south and extensive use of tube-wells in the North West (*ibid*).

Irrigation is not only needed in areas receiving lesser rainfall, but it is also necessary to provide assured irrigation to heavy rainfall areas. A survey of the Kal project in the Konkan region shows that there is a substantial improvement in yield with income and employment benefits. The private benefit-cost ratio turns out to 10 while nothing can be said about the social benefit-cost ratio because of the unavailability of data (Dhawan, 1988).

The difference in the yield of irrigated and un-irrigated agriculture turns out to be around 13 quintals per hectare for the year 1983-84. And there is increasing trend in the yields, especially of the irrigated agriculture. While this can't be treated as the pure yield effect but as estimated by

Minhas- Vaidyanathan formula the pure yield effect turns out to 7 quintals out of 13 quintals during 1983-84. Among the rest change in cropping pattern accounts for 2.7 quintals out of the total yield of 13 quintals. Irrigation led to change in the cropping pattern towards high yielding from low-yielding crops. For the food grains as a whole, the difference in the irrigated and un-irrigated yield turns out to be around 11 quintals per hectare. It has also been found that irrigated agriculture can substantially reduce the interstate disparity by minimizing the differences in the yields across the states. But this can only be realised if there is evenness in the development planning for Indian agriculture. Also, rainfall is not solely responsible for the high yields as there is not much difference in the yields of low rainfall states of Rajasthan to that of high rainfall states like Madhya Pradesh, Orissa and West Bengal. It depends on many other factors like adoption of HYV seeds, fertilizers & pesticides, irrigation quality, roads and communication, agricultural extension services, flood control and drainage, rural electrification and land reforms. The ground water is taking lead in the yield impacts on the agriculture but if it is overexploited as it is a common property resource then will be not feasible for the sustainable growth of the agriculture. Without a proper emphasis on surface irrigation, more emphasis on ground water will prove to counter-productive especially in those states where ground water resource availability is not bountiful (Dhawan, 1988).

The result of regression analysis of the 14 states shows that there is a positive relation between the development of irrigation and the cropping intensity at the all India level (Dhawan and Datta; 1992).

Irrigation provides direct benefit to farmers. It is mainly in terms of multiple cropping, better quality of crops, higher yields and larger income. There are large direct benefits to the society living in and around areas where irrigation is provided. These benefits accrue as a result of the establishment of agricultural produce processing units, expansion of consumer articles, greater employment opportunities and increased transport and communications (Sangal, 1991).

5.1 Irrigation and crop Productivity Since 1970-71

5.1.1 Foodgrains

In the early years of independence, the focus of our economy was to reduce the dependence on imports and become self-sufficient in the production of food grains. So a tremendous amount of investment was made to bring more area under irrigation so that the production can be increased.

Table 5.1: Food grains Area, Production, Yield and Area under Irrigation

| Year | Area (Million hectares) | Production (Million Tonnes) | Yield (Kg/hectare) | % Coverage under irrigation |
|---------|-------------------------------|-----------------------------------|-----------------------|--------------------------------|
| 1970-71 | 124.32 | 108.42 | 872 | 24.1 |
| 1980-81 | 126.67 | 129.59 | 1023 | 29.7 |
| 1990-91 | 127.84 | 176.39 | 1380 | 35.1 |
| 2000-01 | 121.05 | 196.81 | 1626 | 43.4 |
| 2010-11 | 126.67 | 244.49 | 1930 | 47.8 |
| 2011-12 | 124.75 | 259.29 | 2078 | 49.8 |

Source: Agriculture Statistics at a Glance 2014, Ministry of Agriculture and Co-operation, Directorate of Economics and Statistics, Government of India.

The percentage of food grain area under irrigation increased from 24.1 per cent in 1970-71 to 35.1 per cent in 1990-91. While the per hectare productivity increased from 872kg in 1970-71 to 1380kg in 1990-91. Till this period surface irrigation was also used as an important source of irrigation and groundwater has emerged as a prominent source of irrigation. The irrigated area under food grains increased at an annual rate of 0.55 while the production increased at an annual rate of 3.4MT (refer table 5A.1). During the 1990-91 and 2010-11 the irrigated area under the food grains increased annually at the rate of 0.75 and reached to 49.8 per cent in 2010-11 from 35.1 per cent in 1990-91. The yield in the same period rose from 1380 kg per hectare to 2078 kg per hectare. The area under the food grains declined from 127.67Mha to 124.75Mha, but the production grew at an annual rate of 4MT.

However, the improvement in the yield is not solely due to irrigation but it also depends on many factors like HYV seeds, fertilisers, pesticides, changing cropping pattern, etc. But the benefits of these can only be realised after the assured supply of water. Especially in the case of HYV seeds assured and timely water supply is a necessary condition without which benefits can't be harnessed.

Wheat

Around 50 per cent of the area under wheat production was irrigated in 1970-71 which increased to 81.1 per cent in 1990-91. While the productivity increased from 1307 kg per hectare to 2281 kg. The irrigated area under wheat production increased at an annual rate of 0.48 and the

production increased at an annual rate of 1.5MT. The coverage of wheat area under irrigation increased by more than 11 per cent between 1990-91 and 2011-12, it was 81.1 per cent in 1990-91 and has risen to 92.9 per cent by 2011-12 while the per hectare yield increased from 2281 to 3177. The irrigated area under wheat production increased annually at the rate of 0.39Mha and production increased at an annual rate of 1.89MT.

Table 5.2: Wheat Area, Production, Yield and Area under Irrigation

| Year | Area | Production | Yield | % Coverage under irrigation |
|---------|-------|------------|-------|-----------------------------|
| 1970-71 | 18.24 | 23.83 | 1307 | 54.3 |
| 1980-81 | 22.28 | 36.31 | 1630 | 76.5 |
| 1990-91 | 24.17 | 55.14 | 2281 | 81.1 |
| 2000-01 | 25.73 | 69.68 | 2708 | 88.1 |
| 2010-11 | 29.07 | 86.87 | 2988 | 92.1 |
| 2011-12 | 29.86 | 94.88 | 3177 | 92.9 |

Source: Agriculture Statistics at a Glance 2014, Ministry of Agriculture and Co-operation, Directorate of Economics and Statistics, Government of India.

Rice

From 1970-71 to 1990-91 the percentage irrigated area under rice increased from 38.4 to 45.5 and the yield increased from 1123 to 1740 kg per hectare. The area irrigated increased at annual rate of 0.25Mha while the production increased annually at the rate of 1.57MT. During 1990-91 to 2011-12 the percentage coverage under irrigation increased from 45.5 to 58.7 in 2011-12 and the yield increased from 1740 kg to 2393 kg per hectare. The production increased at an annual rate of 1.47MT while the irrigated area increased annually at the rate of 0.30Mha.

Table 5.3: Rice Area, Production, Yield and Area under Irrigation

| Year | Area | Production | Yield | % Coverage under irrigation |
|---------|-------|------------|-------|-----------------------------|
| 1970-71 | 37.59 | 42.22 | 1123 | 38.4 |
| 1980-81 | 40.15 | 53.63 | 1336 | 40.7 |
| 1990-91 | 42.69 | 74.29 | 1740 | 45.5 |
| 2000-01 | 44.71 | 84.98 | 1901 | 53.6 |
| 2010-11 | 42.86 | 95.98 | 2239 | 58.6 |
| 2011-12 | 44.01 | 105.3 | 2393 | 58.7 |

Source: Agriculture Statistics at a Glance 2014, Ministry of Agriculture and Co-operation, Directorate of Economics and Statistics, Government of India.

Maize

The per hectare yield of the maize increased from 1279 kg in 1970-71 to 1518 in 1990-91 while the area under irrigation increased from 15.9 per cent in 1970-71 to 19.7 per cent in 1990-91. During the same period, the area under irrigation grew annually at the rate of 0.01Mha while the production of maize increased at the rate of 0.07 MT. While the coverage under irrigation expanded much during 1990-91 to 2011-12, it rose from 19.7 per cent in 1990-91 to 25.3 per cent by 2011-12 and the yield increased from 1518 kg to 2478 kg per hectare. The irrigated area grew at an annual rate of 0.05Mha, and the production increased annually at the rate of 0.13MT.

Table 5.4: Maize Area, Production, Yield and Area under Irrigation

| Year | Area | Production | Yield | % Coverage under irrigation |
|---------|------|------------|-------|-----------------------------|
| 1970-71 | 5.85 | 7.49 | 1279 | 15.9 |
| 1980-81 | 6.01 | 6.96 | 1159 | 20.1 |
| 1990-91 | 5.9 | 8.96 | 1518 | 19.7 |
| 2000-01 | 6.61 | 12.04 | 1822 | 22.4 |
| 2010-11 | 8.55 | 21.73 | 2542 | 24.3 |
| 2011-12 | 8.78 | 21.76 | 2478 | 25.3 |

Source: Agriculture Statistics at a Glance 2014, Ministry of Agriculture and Co-operation, Directorate of Economics and Statistics, Government of India.

5.1.2 Non- foodgrains

Liberalization Era in India witnessed an increase in the commercialization of the agriculture which led change in the cropping pattern. More emphasis was given on the cash crops and their area started expanding.

Table 5.5: Cotton Area, Production, Yield and Area under Irrigation

| Year | Area | Production (@) | Yield | % Coverage under irrigation |
|---------|-------|----------------|-------|-----------------------------|
| 1970-71 | 7.61 | 4.76 | 106 | 17.3 |
| 1980-81 | 7.82 | 7.01 | 152 | 27.3 |
| 1990-91 | 7.44 | 9.84 | 225 | 32.9 |
| 2000-01 | 8.53 | 9.52 | 190 | 34.3 |
| 2010-11 | 11.24 | 33 | 499 | 33.8 |
| 2011-12 | 12.18 | 35.2 | 491 | 35.9 |

Source: Agriculture Statistics at a Glance 2014, Ministry of Agriculture and Co-operation, Directorate of Economics and Statistics, Government of India. @ - Production in million bales of 170 kg each

For the cotton the area under production has increased from 7.61Mha to 12.18Mha from 1970-71 to 2011-12, percentage coverage under irrigation more than doubled from 17.3 per cent to 35.9 per cent but the yield increased by almost five times from 106 kg in 1970-71 to 491 in 2011-12. From 1970-71 to 1990-91 the irrigated area increased annually at the rate of 0.05Mha while the yield increased from 106 kg to 225 kg per hectare. But after the 1990s, Bt. Cotton was introduced in India which significantly increased the yields of the farmers and is now commonly accepted and the area under cotton production expanded from 7.4Mha in 1990-91 to 12.4Mha in 2011-12, but still doubts exists with regards of the long term environmental and health impact of Bt. Cotton in India. The coverage under irrigation increased from 32.9 per cent in 1990-91 to 35.9 per cent in 2011-12, while the per hectare yield more than doubled from 225kg to 491kg.

Table 5.6: Sugarcane Wheat Area, Production, Yield and Area under Irrigation

| Year | Area | Production | Yield | % Coverage under irrigation |
|---------|------|------------|-------|-----------------------------|
| 1970-71 | 2.62 | 126.37 | 48322 | 72.4 |
| 1980-81 | 2.67 | 154.25 | 57844 | 81.2 |
| 1990-91 | 3.69 | 241.05 | 65395 | 86.9 |
| 2000-01 | 4.32 | 295.96 | 68578 | 92.1 |
| 2010-11 | 4.88 | 342.38 | 70091 | 92.5 |
| 2011-12 | 5.04 | 361.04 | 71668 | 94.3 |

Source: Agriculture Statistics at a Glance 2014, Ministry of Agriculture and Co-operation, Directorate of Economics and Statistics, Government of India.

Sugarcane required assured timely water supply to reap more production from it. The area irrigated increased at an annual rate of 0.06Mha and by 1990-91, 86.9 per cent of the area under sugarcane was irrigated and the production increased annually at the rate of 5.73 MT. The yield increased from 48322 kg in 1970-71 to 65395 kg in 1990-91. During 1990-91 to 2011-12 the area under irrigation increased at the rate of 0.07Mha per annum but the production increased annually at the rate of 5.71 MT and the yield increased from 65395 kg to 71668 kg per hectare.

CONCLUSION

In a nutshell, there is definite positive relation between the area under irrigation and the yield of the crops although the magnitude differs for different crops. So there is need to put more emphasis on the development of irrigation facilities in India to feed its growing population.

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