IRRIGATION AND RURAL DEVELOPMENT OF INDIA

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ABSTRACT: Investment in irrigation has remained a debatable issue despite irrigation's massive impact upon civilization since ancient days. After the Industrial revolution, if we observe the structural change of the world towards industrialization (Kuznets, 1966,1971), mainly because of the *terms of trade tilt* towards the finished goods, out of given land area, debate emerged whether to use land optimally for industrialization or towards irrigation to promote agriculture. Obvious debate raised regarding land use and that created the debate: whether to retain self-sufficiency in food - the leftist agenda or to attain specialization in finished good and import food from the peripheral countries at the least cost to attain highest benefit from gain in terms of trade - the rightist agenda in a developed country's parliament (Circular Cumulative Causation Theory, Gunnar Mydral, 1956; The Terms of Trade Fifty Years Later-Convergence and Divergence, Hans Singer, 1998, Dependency Theory, Raul Prebisch and Hans Singer). Definitely historical development process has assimilated the two extreme goals through their necessities in hard days. Draught days felt needs for irrigation and loss in competition felt need for specialization in finished goods. So, a Democratic Capitalist Welfare Economy kept both the routs open towards food self sufficiency as well as specialization in manufacturing finished goods. Examples are the historical development process of 13 Developed Countries like USA, UK, Germany and 4 Developing Countries like Argentina, Egypt etc. (Kuznets, 1971). From this angle we are going to focus upon the importance of irrigation on rural development of India.

Key Words: Cumulative Draught, Irrigation, Rural Development, Agricultural Growth, Gross Fixed Capital Formation, Population, Panel OLS.

JEL Classification: C22, C67, O11, O15, O41.

Introduction: Since independence in 1947, the prime challenge in front of the Indian Government was to attain self-sufficiency in food production because of the devastating agricultural situation left behind by the British Raj (The Colonial Legacy, Bipan Chandra (Bimal Jalan ed., 1992)). "The growth of the foodgrains output was negative during the fifteen years prior to independence." - (Agriculture: Policy and Performance, C. H. Hanumantha Rao (Bimal Jalan ed., 1992) – "The intermediaries in agriculture, like zaminders and jagirdars, had grown in the colonial period in large parts of the country, denuding the investible resources and sapping the motivation of the actual tillers of the soil. Thus at the time of independence, we inherited a stagnant agriculture with a deficient infrastructure, traditional technology and outmoded and exploitative institution." So, in independent India, to attain the self-sufficiency in food production, Irrigation was the warhead. The objective was to take out the agriculture of the uncertainties of monsoon. In 1910-11 to 1914-15, only 17.9% of the agricultural land was actually irrigated which remained same for almost the next 4 (four) decades such that we got the same 17 percent of irrigated land out of total agricultural land from the British in 1950-51. Remaining 82 percent remained unirrigated, at the 'Hand of the God'. This uncertainty of monsoon could be reduced by only encroaching more and more agro lands into irrigation periphery, firstly because to increase agricultural productivity and second to reduce the

uncertainties of monsoon. The First Plan is the Plan of Irrigation Projects – Rs. 446 Crores (15 percent) of total plan outley was spent in irrigation – Bhakra, Hirakund, Mettur, Chambal, Kosi etc. and Damodar Valley dams entail the thrust given upon agricultural development, if compared to the previous British Regime. The objective of creation of these dams was on one hand to increase the command area (of agricultural arable land) and on the other hand to reduce reliefs (debarments) or to make the irrigation viable by breaking rocks, within potential agricultural land base.

However, if we observe today, after 73 years of Independence, still 52 percent of the agricultural land is unirrigated. Especially, in the context of the First Plan, the later Plans were so defocused that from 1950-51 to 1970-71, only 6 percentage points improvement happened to percentage net irrigated area (Source: Govt. of India Report from Irrigation Commission, 1972). During the same period, the growth rate of Agricultural GDP was a paltry 2 percent except the accidental growth rate outlier year 1967-68. Probably external grants in the phase of acute draught was responsible for that. During that phase, population growth rate of the country was close to 3 percent. Naturally the irrigation with 77 percent net unirrigated area mattered most crucially (Table-1).

In this context, let's shift ourselves towards the World experience of irrigation and it's significant impact upon agricultural development through an Econometric Panel Data Survey.

Our Panel includes 34 Developed and Developing Countries for the period 1988-2017. We have taken the Aquastat Database (2020) for our study which takes 5 year average as a single point in the dataset.

Our Panel OLS shows significant (1% level) positive impact of agricultural growth upon the percentage of cultivatable area equipped for irrigation (caei) which is nothing but percentage of net irrigated area, and on the opposite side, significant (1% level) positive impact of the percentage of cultivatable area equipped for irrigation (caei) upon agricultural growth. That indicates the importance of irrigation upon agricultural growth and agricultural growth upon irrigation for an average country (Table-2 and Table-3).

However, the incorporation of per capita GDP as an indicator of development seems to have a significantly negative impact (1% level) upon both of these. Thus, not to forget 'Structural Change'. According to the Engel's Law, As income increases, consumer's proportion of primary good consumption reduces and proportion of finished manufacturing and services consumption increases. So, with increase in per capita income or per capita GDP, demand for industrial finished commodities and productive services increase in proportion to agricultural primary inelastic items. As, agricultural commodities are inelastic in nature, so with increase in income, proportion of their demand doesn't rise much. Rather, the finished goods will pour the bundle of an average consumer with increasing income. That is why we get an inverse relation of agricultural growth with per capita income. So is the case with 'caei' (Table-4 and Table-5).

However, if we observe the impact of gross fixed capital formation upon caei and agricultural growth, then both are positive and significant (1% level), signifying nation state's importance upon self-sufficiency on food production because most of the agricultural investments including HYV seeds, Fertilizers, irrigational facilities (operating circularly) are financed by the nation states (Table-4 and Table-5).

Population has significant positive impact because they are the households having demand for food and associated agricultural primary items (Table-4 and Table-5).

Fortunately, we get India to be significantly positive outlier in this regard, corresponding to the original relationship between caei and agricultural growth. If it is the case of the overall relationship, then certainly corresponding to the services spurt enjoyed by the Indian economy, naturally India seems to be a negative outlier corresponding to irrigation estimation. Rather it is astonishing that it fails to become a negative outlier in case of agricultural growth (although the coefficient sign is negative, but the p-value is insignificant. It is clear that irrigation proves it's point of necessity in historical development process as well as in self-sufficiency in agro-rural development(Table-6, Table-7, Table-8 and Table-9).

Despite that we cannot forget (i) our agriculture still mostly monsoon dependent, i.e., still we are not fully capable to combat 'Draught Cumulation' (one has already happened in India during 1962-63 to 1967-68 and another from 1984-85 to 1987-88 and another from 1998-99 to 2001-2002) (various sources including Wikipedia (2020); J.S. Samra (2004) 'Review and Analysis of Draught Monitoring, Declaration and Management in India', Ghosh Madhusudan (2003) etc.) because still in 2019-20, 52 percent falls to net unirrigated area and thus agriculture still heavily monsoon dependent; (ii) our population is still growing at 2 percent (calculated from Economic Survey of India data) compared to just 0.5 percent growth rate of China (not to forget that within 10-15 years, India will surpass China in absolute population to become the world's most populous country). Not to forget too that China's land area is 9.597 million km^2 whereas India's land area is 3.287 million km^2, i.e., China is three

times bigger than India in terms of it's land size and accommodation. Whatever be China's stance towards their agricultural development, we must admit that in near future, we have to feed the same population like that of china with one-third of their land size – significant challenge. In absolute amount, irrigated land in China is much more than that of India. So, irrigation's importance is evident.

Following the causation of 'Draught Cumulation' further, during 1984-85 to 1986-87, we faced ((-0.25) percent) average growth rate in agriculture. During 1999-2000 to 2001-2002, we again faced ((-0.275) percent) average growth rate due to draught with population growing at a stagnant rate of 2 percent (Source: United Nations Statistical Division (2020). So, to ensure agricultural productivity even during 'Draught Cumulation', irrigation insurance to 100 percent cultivatable land is necessary, whatever be the level of technology is being applied in agriculture.

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TABLES:

| TABLE 1: IRRIGATED LAND PERCENTAGE OF GROSS AGRICULTURAL LAND ||
YEAR	Percentage of Agricultural Land actually Irrigated
1910-11 to 1914-15	17.90%
1915-16 to 1919-20	19.00%
1920-21 to 1924-25	17.40%
1925-26 to 1929-30	17.10%
1930-31 to 1934-35	17.60%
1935-36 to 1939-40	18.60%
1940-41 to 1944-45	19.20%
1945-46-1949-50	19.10%
1950-51	17.00%
1970-71	23.00%
Source: Govt. of India Report of Irrigation Commission, 1972	

| TABLE 2: PANEL OLS OF AGRICULTURAL GROWTH ||||
| Dependent Variable: AGGDPGWH ||||
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCAEI	0.684292	0.027771	24.64021	0
Source: Own Calculations				

TABLE 3: PANEL OLS OF LNCAEI

Dependent Variable: LNCAEI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGGDPGWH	0.57724	0.053263	10.83748	0

Source: Own Calculations

TABLE 4: PANEL OLS OF AGRICULTURAL GROWTH

Dependent Variable: AGGDPGWH

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCAEI	-0.225988	0.181396	-1.245824	0.2143
LNGFCFRATGDP	1.714787	0.323984	5.292807	0
LNPCGDP	-0.326355	0.054862	-5.948682	0
LNPOP	0.109607	0.063966	1.713508	0.0882

Source: Own Calculations

TABLE 5: PANEL OLS OF LNCAEI

Dependent Variable: LNCAEI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGGDPGWH	-0.028529	0.02441	-1.16876	0.2439
LNGFCFRATGDP	1.214813	0.042916	28.30672	0
LNPCGDP	-0.166546	0.012457	-13.36956	0
LNPOP	0.167043	0.013294	12.56502	0

Source: Own Calculations

TABLE 6: PANEL OLS OF AGRICULTURAL GROWTH

Dependent Variable: AGGDPGWH

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCAEI	0.672345	0.023317	28.83502	0
INDIA15	1.014104	0.497277	2.039313	0.0427

Source: Own Calculations

TABLE 7: PANEL OLS OF LNCAEI

Dependent Variable: LNCAEI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGGDPGWH	0.561704	0.052594	10.68005	0
INDIA15	1.629687	0.193845	8.407173	0

Source: Own Calculations

TABLE 8: PANEL OLS OF AGRICULTURAL GROWTH

Dependent Variable: AGGDPGWH

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCAEI	-0.227948	0.187313	-1.216936	0.2251
LNGFCFRATGDP	1.721815	0.340307	5.059598	0
LNPCGDP	-0.329168	0.063006	-5.224382	0
LNPOP	0.113175	0.073257	1.544909	0.124
INDIA15	-0.102335	0.634446	-0.161299	0.872

Source: Own Calculations

TABLE 9: PANEL OLS OF LNCAEI				
Dependent Variable: LNCAEI				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGGDPGWH	-0.028454	0.025039	-1.136404	0.2572
LNGFCFRATGDP	1.241695	0.047856	25.94649	0
LNPCGDP	-0.180814	0.014237	-12.70001	0
LNPOP	0.185562	0.014192	13.07501	0
INDIA15	-0.584229	0.063691	-9.172817	0
Source: Own Calculations				