



Is Agricultural Development The Cornerstone Of Structural Change Of The Indian Economy? Advanced Discourse Upon The Indian Economy- Period 1950-2020

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ABSTRACT: Irrigational investment 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 agricultural development. 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 (Myrdal, 1956; Singer, 1998; Prebisch-Singer). Definitely historical development process has assimilated the two extreme goals. 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). Here we are in a discourse corresponding to the Indian Economy that agricultural growth without structural change/transformation leads us to 'Hindu rate of Growth' whereas structural transformation leads us to high rate of growth about which, agricultural growth is just a bi-product. From this angle we are going to focus upon the importance of irrigation and structural change on agricultural development of India.

Key Words: Irrigation, Rural Development, Agricultural Growth, Gross Fixed Capital Formation, Structural decomposition, Cointegration.

SECTION 1: INTRODUCTION

During the colonial era, due to existence of the stagnant agriculture especially corresponding to the food grains sector, India had to import lots of food grains (also as 'Aid'), especially, wheat from outside due to negligence of the 'GOI', especially having thrust upon the cash crops production. Even after independence, Indian agriculture was severely monsoon dependent. So, independent Government of India had no option but to develop the agricultural sector through the infrastructural transformation of irrigational development to the agricultural lands and through land reforms.

Corresponding to 'Irrigation', the objective of the government was to increase the percentage area of irrigation facilitated arable land out of total arable land from just/mere 13.8 percent in 1951 (source: Wikipedia) to relatively much higher level through the implementation of the Five Year Plan Programmes.

Corresponding to 'Land Reforms', the objective of the government was to ensure the stepwise implementation of the 'Land Reforms' through the processes of (i) Abolition of intermediaries, (ii) Tenancy Regulation, (iii) Ceiling on Land Holdings, (iv) Attempts to consolidate disparate land holdings, (v) Proposition for Cooperative Farming. (The First 5-Year Plan gave a predominant importance to the development of agriculture and irrigation out of a total actual investment of Rs. 1960 crores made in the first plan. Rs. 601 crores i.e. 31% was allocated for agriculture) also through adopting the Five Year Plan Programmes.

In the 'First Plan' (1951-1956), the target of the Indian government was to ensure the increase in agricultural production through adoption of the policies oriented towards irrigational and institutional reforms, by spending almost 31 percent of the total 'Plan Outlay' on agricultural sector alone. At the end of the 'First Plan', the target of the agricultural production was more than fulfilled, solely because of favorable monsoon, despite of week implementation of the irrigational and institutional reforms. And here lied the crucial problem regarding the plan implementation towards agriculture, because, from the 'Second Plan' (1956-1961), the attention shifted heavily from agriculture towards industry in terms of development and accordingly, agriculture paid the price in terms of modest production in 'Second Plan', but miserable production during the 'Third Plan' (1961-1966) (for instance, during 1961, India was on the brink/verge of 'Mass Famine' (Source: Wikipedia, 2019)), mainly due to unfavourable monsoon, showing the failure of the policies regarding irrigational reforms as well as institutional reforms (Datt and Mahajan (2018)).

Failure of the 'Third Plan' (1961-1966) in terms of failure of both the industrialization and agriculture had raised many questions regarding the reasons of failure. One of the most important explanation behind the failure was lack of purchasing power of the rural mass due to low agricultural production and heavy informal debt orientation of the farmers during the 'Third Plan', leading to excess supply of the industrial produce and correspondingly, decaying profits in the industrial production and loss of employment opportunities, slowly leading towards 'Industrial Deceleration'.

In these circumstances, 'Plan Holiday' or 'Yearly Plans' for the three years viz., 1966-1967, 1967-1968 and 1968-1969 were introduced, but gone in vain in terms of objectivity.

Here comes the role of the 'Capital Intensive Agricultural Production Methods' in India as an alternative of 'Institutional Reforms' as booster of agricultural production and the growth of agricultural sector itself and as a whole, as well as rural development (in terms of increment in per capita purchasing power and improvement in the standard of living as a whole of the rural India) through a stepwise process over decades.

Although, the process of 'Green Revolution' actually started from the end margin of the Second Plan (1956-1961), i.e., from 1960, with selection of seven districts out of the seven states, especially Punjab, Haryana, Delhi, Rajasthan and Uttar Pradesh, specially taking 'Wheat' as the experiment crop, however, with the miserable failure of the 'Third Plan' (1961-1966), the process of capitalization of agriculture through 'Green Revolution' got sluggish during that period. From mid 1960s (say, 1965), with the development of the High Yielding Variety (HYV) seeds of wheat by Professor Norman Borlaug of Mexico and its implementation in India in 1965 and introduction of High Yielding Variety Programme (HYVP) for the khariff crops (Rice) since 1966, the process of research and its application was in progress, but in a limited manner, especially due to the consequences of the failure of the 'Third Plan' (1961-1966).

Now, in this context, the capital intensity of the 'Green Revolution' has to be analyzed in brief. Green Revolution implies the incorporation of improved High Yielding Variety (HYV) Seeds, improved fertilizers and pesticides, improved machines for agricultural purposes etc. Now, use of the improved machineries in agriculture entails the physical capital intensity in agriculture and use of HYV seeds, improved fertilizers and pesticides through research and development entails the human capital intensity in agriculture. Now, relative to the previous labour intensive method utilization during 1947-1960, agricultural output was low per hectre. However, incorporation of capital intensive 'New Agricultural Strategy' of Green growing Revolution, had raised the agricultural output per hectre, step by step, especially in a condition of slowly irrigational facilities and heavy monsoon dependence of agricultural sector post 1960s, stepwise. This explains briefly the capital intensity of Green Revolution and its impact on the agro sector of the Indian economy.

However, from 1969, with the start of the 'Fourth Plan' (1969-1974), the process of 'Green Revolution' through capital intensive technology, got a sustained progress. A new orientation was imparted to agricultural policy. Modest targets were fixed for agricultural production and realistic allocations were made for agriculture and irrigation. Although the 'Fourth Plan' (1969-1974) failed to achieve its target in terms of agricultural production almost as a whole, however, the important aspect is the continuation of the Green Revolution programme through applied research on main crops (Wheat, Rice etc.).

During the 'Fifth Plan' (1974-1979), the fruits of the 'Green Revolution' started to provide benefits in terms of producing in excess of target for the main crops (Wheat and Rice) for the first time since the failure of the 'Third Plan' (1961-1966), showing the inner strength of the human capital intensive agricultural technique

(Datt and Sundharam, 2009; Datt and Mahajan, 2018). However, due to the First Oil Price Shock of 1973-74, rapid inflationary pressure grew upon the whole economy mainly due to the inelastic demand for crude oil (total crude oil import contributing 53 percent of total import of the economy). For that reason, firstly, huge trade deficit emerged, secondly, in order to maintain continuation of Plan Outlays, Government had to reach to the World Bank for loans, thirdly, due to inflation, wage costs surged up, leading to inflation of food items and other necessary goods, thereby, leading further to the demand deficiency for industrial durable goods especially and agricultural commodities in general. As a result, even during the phase of 'industrial deceleration', the relative over production than demand had led to unemployment as well as reduction in industrial production especially, with further dampening impact upon per capita purchasing power. Due to the effects of First and Second Oil Price Shocks, the average rate of growth of the agricultural sector was just 1.7 percent.

Since the 'Fifth Plan' (1974-1979), for the next two consecutive Plans, viz., 'Sixth Plan' (1980-1985) and 'Seventh Plan' (1985-1990), the trend continued. From 1983-1984, the Second Phase of Green Revolution started exclusively and has shown a steady growth in agricultural production. However, the trend reversed to deceleration in agriculture after 1990-1991 (the phase of adoption of the policies of 'Liberalization, Privatization and Globalization (LPG)'), having slow growth rates of 2.8 percent during 1991-2001 and 2.1 percent during 2002-2007 corresponding to the 'Plans'.

However, regarding the structural change of the Indian Economy, we have to observe the change from 1950-1951 to 2013-2014. In 1950-1951, the share of the agricultural sector was just 51.61 percent in 2004-05 constant price and 50.05 percent at the current price, but then it has fallen to 15.16 percent at 2004-05 constant price and 17.39 percent at current price. This can be shown from the following Table-1.

YEAR	CONSTANT 2004-05 ESTIMATE			CURRENT PRICE ESTIMATE		
	A	I (incl. Construction)	S (excl. Construction)	A	I (incl. Construction)	S (excl. Construction)
1952-53	51.61	16.22	29.71	50.05	14.38	35.22
1962-63	44.39	21.76	31.92	39.89	20.61	39.92
1972-73	38.56	24.92	35.25	40.28	21.29	38.27
1982-83	34.25	25.85	39.03	32.88	25.19	41.53
1992-93	28.89	26.77	44.05	28.74	25.77	45.22
2002-03	20.13	27.39	52.48	20.75	26.23	53.02
2012-13	13.69	26.76	59.59	17.39	25.75	56.86
2016-17*	15.16	23.16	61.67	17.35	21.23	61.42

* Denotes the Base Year as 2011-12 and Industry incl. Construction and Services excludes Construction.

Source: Own Calculations from RBI Indian Economy Database 2014.

Actually the compound average rate of growth (CAGR), from 1950-1951 to 1960-1961 period up to 2000-2001 to 2007-2008 period, remained stagnant at close to 3 percent, mainly due to the split phases of agricultural deceleration during 1970-1971 to 1980-1981 and during 1990-1991 to 2000-2001 and 2000-2001 to 2007-2008. However, even then, maintenance of a stagnant average rate of growth with rapidly

falling share of agriculture seems to provide the required explanation for steady performance of the agricultural sector despite phases of deceleration.

Decades	1953-54 to 1962-63	1963-64 to 1972-73	1973-74 to 1982-83	1983-84 to 1992-93	1993-94 to 2002-03	2003-04 to 2012-13
Av. Growth Rate of GDPFC	3.95	3.3	3.94	5.22	5.97	7.92
Av. GR of A	2.46	2.04	2.96	3.56	2.31	3.87
Av. GR of I (excl. CONSTR.)	6.95	4.49	5.01	5.67	6.43	7.07
Av. GR of I (incl. CONSTR.)	7.06	4.67	4.32	5.6	6.23	7.7
Av. GR of M	6.98	4.43	4.52	5.15	6.94	7.75
Av. GR of S (incl. CONSTR.)	5.06	4.42	4.55	6.32	7.58	9.31
Av. GR of S (excl. CONSTR.)	4.66	4.27	4.94	6.48	7.85	9.3
Av. GR of CONSTR.	7.52	5.15	2.86	5.4	5.74	9.48
Av. GR of THRTSC	6.02	4.18	5.5	5.54	8.81	9.9
Av. GR of BIDRB	3.09	3.56	4.95	8.96	7.71	10.51
Av. GR of CSP	4.32	4.89	4.29	5.8	6.65	6.81

NOTE: A=Agriculture & Allied, I=Industry (excl. Construction), M=Manufacturing, S=Services (incl. Construction), CONSTR.=Construction; Source: Own Calculations from RBI Database (2014), India

Now, in this paper, next, we are going to conduct a time series study of structural change of each of the twenty nine (29) states for 57 years in terms of the value added and sectoral share of agriculture through both the Zivott-Andrews Method and Amit Sen's Method in Section 2. Then, we are going to discuss how rural development enhances by the rise in agricultural Gross Value Added through capital investment in agriculture, availability of loan credit and irrigational expenditure by the government of India. Finally, conclusion follows.

SECTION 2: STRUCTURAL CHANGE OF THE VALUE ADDED OF THE AGRICULTURAL SECTOR FOR THE COUNTRY:

In this section we are going to discuss the structural change of the value added of the agricultural sector, industrial sector and services sector for the Indian economy. For that, we need to follow the 'Endogenous Structural Change Methodology' of Zivott and Andrews (1992) and Amit Sen (2003).

Endogenous Structural Break Methodology: Nelson and Plosser (1982) opine that most of the macroeconomic variables are difference stationary (DS) rather than trend stationary (TS). For a TS process, the effect of random shock is temporary around a trend whereas for a DS process, permanent effect is generated by the random shock. In addition, for a DS process, the variance of the series depends on time.

The Augmented Dickey Fuller (ADF) Test is an unit root test that is conducted to detect whether a series is TS or DS. The ADF test here consists of estimating the following regression:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-i} + \varepsilon_i \dots \dots \dots (1)$$

Where ε_i is a pure white noise error term and where $\Delta Y_{t-i} = (Y_{t-i} - Y_{t-i+1})$. The test procedure is as follows:

The null hypothesis is $H_0 : \delta = 0$. Rejection of the null hypothesis implies that the underlying series is TS and failure of the rejection that the underlying series is DS. Here it is important to note that the coefficient of Y_{t-1} does not follow the standard 't-distribution' which was solved by Fuller by getting limiting distribution of this coefficient and finally these distributions were approximated empirically by Dickey (1976). From a much larger set of replications, the relevant critical values are being derived by McKinnon (1990). Now, if β_2 in equation (1) is found to be significant then there exists trend in the series. Further, if β_1 is significant then there exists drift in the model. In the ADF test, ΔY_t depends also on ΔY_{t-i} (where $i=1,2,3 \dots m$; $m < T$).

As Perron (1989) has shown that in the presence of structural break, even a trend stationary series may be mis-identified as an unit root process though the standard unit root test. Therefore he has suggested a procedure that is appropriate for test of unit root in the presence of one time structural break in the series which is assumed to be exogenously determined from consideration of visual examination of the plots of the data.

Zivot and Andrews (1992) has shown that Perron's methodology of finding out the structural break is based primarily on visual observation and monitoring of the data structure and therefore the break point is determined exogenously and not endogenously. They have shown that in order to determine the break point endogenously, the following models are to be explained and used up:

$$\Delta Y_t = \beta_1^A + \beta_2^A DU_t + \beta_3^A t + \delta^A Y_{t-1} + \sum_{i=1}^m \alpha_i^A \Delta Y_{t-i} + \varepsilon_i \dots \dots \dots (2)$$

$$\Delta Y_t = \beta_1^B + \beta_2^B DT_t + \beta_3^B t + \delta^B Y_{t-1} + \sum_{i=1}^m \alpha_i^B \Delta Y_{t-i} + \varepsilon_i \dots \dots \dots (3)$$

$$\Delta Y_t = \beta_1^C + \beta_2^C DU_t + \beta_3^C DT_t + \beta_4^C t + \delta^C Y_{t-1} + \sum_{i=1}^m \alpha_i^C \Delta Y_{t-i} + \varepsilon_i \dots \dots \dots (4)$$

Here, $DU_t = 1$ if $t < TY$

And $DU_t = 0$ if otherwise.

Further, here, $DT_t = t - TY$ if $t < TY$

And $DT_t = 0$ otherwise.

The following points are important:

Model A, exhibited by equation (2) allows an endogenous break in the level of the series (Crash Model). Model B, exhibited by equation (3) allows an endogenous break in rate of growth of the series (Changing

Growth Model) and Model C allows endogenous break in both level and growth of the series (Mixed Model).

Here, if DT_t is positive (negative) and significant, then there is acceleration (deceleration) in the growth. T stands for total time period and Y stands for time break, i.e., $Y=T_B/T$ where T_B refers to the break period. The above three equations (2), (3) and (4) can be estimated by OLS method and with the break fraction Y ranging from $2/T$ to $(T-1)/T$. Regarding the choice of the lag, Perron (1989) has suggested that lag lengths (i.e., the value of 'm') are determined using t-tests on the coefficients α_i . The value 'm' is selected if the t-statistics on α_i for $i>m$ is less than 1.64.

However, the present paper does not follow Perron's procedure as this procedure is sensitive to a particular value of 't'-statistic around 10 percent level of significance. Rather this paper uses visual descriptions of the series and the correlogram. All the series are of AR(2) type and so only the second order lags are being considered here.

Now from the estimated regression of each model, the value of the t-statistics for testing the null hypothesis $\delta=0$ can be obtained. Zivot and Andrews (1992) proved that for each model, among the overall (T-2) regressions one can choose that year as break year which gives the minimum value of t-statistics corresponding to the coefficient of Y_{t-1} . Further, that model (among the three models) seems to be the best fitted model that gives the minimum 't'-statistics value of the coefficient of Y_{t-1} . The estimated results are compared with the critical values given by Zivot and Andrews to determine whether the series is TS or DS.

Further Amit Sen (2003) has stated that Zivot and Andrews (1992) could be improved by considering the maximum 'F' statistics instead of taking the minimum 't'-statistics and also argued that model 'C' has a higher power than model 'A' or model 'B'. So Sen (2003) has considered model 'C' and suggested the following test:

$$F^{Max} = \text{Max}_{T_B \in \{[\lambda_0 T], [\lambda_0 T]+1, \dots, T-[\lambda_0 T]\}} F_B(T_B) \dots \dots \dots (5)$$

ENDOGENOUS STRUCTURAL BREAK POINTS FOR THE INDIAN ECONOMY (THREE MAJOR SECTORS) :

From the economic standpoint of view, the points of structural change is quite important for an economy and in that respect, single endogenous structural break point analysis is important in this respect that it shows the most crucial point of departure from one trend of production to another trend.

According to our estimation procedure, A sector includes Agriculture and Allied activities, I sector includes Mining and Quarrying, Manufacturing, Construction, Electricity, Gas and Warehouse (EGWs) and S sector includes Trade, Hotels and Restaurants (THR), Transport, Storage and Communication (TSC), Banking and Insurance (B&I), Dwellings, Real Estate and and Business Services (DRB), Other Private Services, Public

Administration and Defence (PA&D) etc.. In Table-3 and Table-4, we can observe the relevant break dates corresponding to the three major sectors.

In that respect, in case of Indian Agriculture, both Table-3 and Table-4 show that the most crucial structural break point is in 1967, (following both Zivott & Andrews Test and Amit Sen's Test of Structural Break) i.e. the effective start of the (human) capital intensive 'Green Revolution', showing the fact that even without having sufficient attention towards the institutional reforms in the form of 'Land Reforms' ; although being an positive outlier in irrigation (we discuss it in the next section) , the country has been able to transform its agricultural productivity to a great extent, even in the phases of 'Industrial Deceleration' of 1960s to 1970s and low purchasing power of the agriculture oriented mass. In addition to that, the first and second oil price shocks have made the economic situation more difficult. The significant point is that the research and development in agriculture to boost up the process of green revolution has continued without hindrance to enhance agricultural production, mainly due to sincere government assistance to encourage this issue. Later on, however, agricultural productivity has grown during the 1980s along with industrial growth to create a relatively comfortable atmosphere.

In case of Indian Industry sector, the most crucial structural break point is 1979 in Table-3 (Period 1950-2007) according to the Zivott and Andrews Test and according to the Amit Sen's test and is 2009 in Table-4 (Period 1950-2016) according to the Zivott and Andrews Test and it is in 2008 according to the Amit Sen's test. If we take the period of study as 1950-2007, then the most crucial structural break point is 1979 for the take off of the industrial sector from industrial deceleration. However, if we take the study period as 1950-2016, then due to the worldwide depression because of 'Global Financial Crisis, 2008', India's trade collapsed alongside global trade, especially in the industrial front and for the manufactured items that had created perhaps a massive shock upon the industrial production during this period so that there happened a sudden and steep fall in the share of the industrial sector.

In the case of Indian Services sector, although the growth is mainly driven by 'technology transfer' from the centre to periphery, especially since 1965 (see the representative country Trade(=Export+Import)/GDP Ratio in Table-13; see Krugman and Obstfeld, 2015) the most crucial structural break point is in 1979, according to the Zivott Andrews Test and the Amit Sen's test, if we take the period of our study as 1950-2007; because of the existence of a steep shift from Hindu Rate of Growth of GDP in 1979 (Nayyar (2011), Balakrishnan & Parameswaran (2011)). However the structural break point is 2008 according to the Zivott Andrews Test and the Amit Sen's test if we take the study period as 1950-2016. This is again the contribution of the 'Global Financial Crisis, 2008'. Both the exports of the Information Technology (IT) and Information Technology Enabled Services (ITES) and Communications had collapsed and 'Outsourcing' got dampened leading to the fall in the 'Invisibles' exports, thereby leading to the worsening of the balance of trade deficit, current account deficit and balance of payments deficit.

So, in general, the LPG Regime (Liberalization, Privatisation, Globalisation Policies have suitably affected the growth of the Indian Tertiary and Industrial sectors since 1979; but then 'Global Financial Crisis, 2008' had adversely affected both the Secondary (Industrial) as well as Tertiary (Services) sectors of the economy. Even then, it is an admitted fact that the economic growth of India remained steady despite the shocks created by 'Global Financial Crisis, 2008'.

TABLE 3: STRUCTURAL BREAK POINTS FOR THREE MAJOR SECTORS		
PERIOD (1950-2007)	LEVEL	
INDIA	ZIVOTT ANDREWS BREAKPOINT	AMIT SEN'S BREAKPOINT
SHARE OF AGRICULTURE IN GVAFC (SHAG)	1967	1967
SHARE OF INDUSTRY (incl. CONSTRUCTION) IN GVAFC (SHIND)	1979	1979
SHARE OF SERVICES (excl. CONSTRUCTION) IN GVAFC (SHSERV)	1979	1979
SOURCE: OWN CALCULATIONS FROM CSO DATA		

TABLE 4: STRUCTURAL BREAK POINTS FOR THREE MAJOR SECTORS		
PERIOD (1950-2016)	LEVEL	
INDIA	ZIVOTT ANDREWS BREAKPOINT	AMIT SEN'S BREAKPOINT
SHARE OF AGRICULTURE IN GVAFC (SHAG)	1967	1967
SHARE OF INDUSTRY (incl. CONSTRUCTION) IN GVAFC (SHIND)	2009	2008
SHARE OF SERVICES (excl. CONSTRUCTION) IN GVAFC (SHSERV)	2008	2008
SOURCE: OWN CALCULATIONS FROM CSO DATA		

SECTION 3: STRUCTURAL CHANGE OF THE INDIAN ECONOMY: INPUT-OUTPUT

APPROACH:

In this section we examine the structural change in the four major sectors of the Indian economy through input-output approach. We want to observe the structural change of the Indian economy from 1973-74 to 2007-08. For that we have condensed the Input-output transaction tables in 4x4 matrices.

We know that

$$(I - A)^{-1} F = X \dots \dots \dots (6)$$

$$X = BF \dots \dots \dots (7)$$

Here we are going to observe the change in the output structure from 1973-74 to 2007-08 that will be decomposed into the final demand effect, input structure effect and interaction effect (Decomposition 1) in the first decomposition and input structure effect and final demand effect (Decomposition 2) in the second decomposition.

In Decomposition 1, we have the following solution:

$$\Delta X = \Delta BF_0 + B_0 \Delta F + \Delta B \Delta F \dots \dots \dots (8)$$

Following this solution, we have the following result in decomposition in 1973-74 to 2007-08 period:

TABLE 5: DECOMPOSITION 1				
	ΔBF_0	$B_0 \Delta F$	$\Delta B \Delta F$	ΔX
A	-9.37573	-18.4247	1.94164	-25.8587
I	6.590157	7.964468	-0.08143	14.4732
S1	3.516928	5.572846	-1.33763	7.752146
S2	-0.73135	4.887341	-0.52258	3.633404
Source: Own Calculations				

In this decomposition, the agricultural sector shrinks due to structural change of output. The Industrial sector and the productive services sector (S1) gains significantly due to both final demand effect and input structure effect. Gain of consumption services (S2) is also significant by the final demand effect.

In Decomposition 2, we have the following solution:

$$\Delta X = \Delta BF_1 + B_0 \Delta F \dots \dots \dots (9)$$

Decomposition 2 is free from interaction effects and concludes the same as decomposition 1.

TABLE 6: DECOMPOSITION 2			
	ΔBF_1	$B_0 \Delta F$	ΔX
A	-7.43409	-18.4247	-25.8587
I	6.508729	7.964468	14.4732
S1	2.1793	5.572846	7.752146
S2	-1.25394	4.887341	3.633404
Source: Own Calculations			

SECTION 4: A DISCOURSE TO ESTABLISH THAT AGRICULTURAL GROWTH WITHOUT STRUCTURAL CHANGE/TRANSFORMATION LEADS US TO HINDU RATE OF GROWTH WHEREAS STRUCTURAL TRANSFORMATION LEADS US TO HIGH RATE OF GROWTH ABOUT WHICH, AGRICULTURAL GROWTH IS JUST A BI-PRODUCT

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 agricultural development. 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 (Myrdal, 1956; Singer, 1998; Prebisch-Singer). Definitely historical development process has assimilated the two extreme goals. 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 and structural change on agricultural development of India.

In this paper, it has already been observed implicitly that devoid of structural change, agricultural growth leads India to 'Hindu Rate of Growth' and when associated with structural change (of course structural change in positive dimension towards Industry and Services) leads India to 'Modern High Rate of Growth' (Section 2 and 3).

Now there is a clear opinion that devoid of structural change, agricultural growth is sluggish and agricultural growth increases with increasing per capita income as well as structural transformation. Several economists like Mellor et.al. are against this thesis. According to them, (i) this thesis is not followed for high income countries, and (ii) agricultural growth influences economic transformation rather than the opposite (pp. 11-46, J.W. Mellor, 'Agricultural Development and Economic Transformation', Palgrave Macmillan, (2017)).

Sinha (2021) argues that structural transformation from 'perishable savings' to 'machines' is a necessity for promoting agricultural growth. But Mellor points out the reverse – "The rapid growth of small commercial farmer dominated agriculture accelerates the economic transformation and is essential to the rapid decline in dominantly rural poverty."

The question arises: Isn't it the fact that savings in perishable commodities leads to saturation and not growth thereby leading to sluggish agricultural productivity? Then what is the turning point?

Sinha (2021) argues that without structural transformation, per capita income/ GDP in agriculture cannot rise sustainably. Therefore, structural transformation from perishable goods to machines is the root cause for agricultural growth and poverty reduction. Savings in perishable goods cannot switch the agricultural growth to the next level. But if savings in perishable goods is transformed into manufacturing machines through INNOVATION, then agricultural growth can rise, being capital intensive from labour intensive. Thus, INNOVATION is the root cause of structural change that pulls agricultural growth. The same will be true for manufacturing growth when machines will be turned to services.

Now, what is Structural Transformation?

As per capita income rises, individual's average propensity to consume falls and average propensity to save increases. What he will do with rising saving? He will accumulate capital stock (work education/ technology) and create 'Machines'. Machines will make Production easier and faster. Now agriculture demand is a necessary demand which saturates at low level of income and has very low elasticity corresponding to income rise. And in addition, they are perishable too. So they cannot be treated as 'Capital' or 'Machine'. So with rising per capita income and rising saving, demand for durable capital stock (Machines) emerged to enhance and protect agricultural produce and to fulfill other needs to further accumulate capital stock and to enhance per capita income further. Here came 'Manufacturing' or 'Machines' as a sector of development which, in further growth process, worked as the 'capital' sector, having higher demand elasticities (as per capita income

rises, demand for further improved technology rises and thus demand for machines rises) than the agricultural sector and switching the economy towards higher and higher growth and expansion. Rural economy becomes 'Urban' and as the size of the GDP rises (size of the 'Pie' rises), agriculture's growth also rises despite having lower share of agriculture in the growth process. This is called 'Structural Transformation'. The key factor for agricultural development is the 'Linkage' of 'Manufacturing' towards 'Agriculture'.

But according to Mellor (2017), (1) "Small commercial farmers dominate agricultural production in most low and middle income countries. They are not poor and spend a substantial portion of their incremental income from farming on labor intensive non-tradable goods and services from the large rural non-farm sector."

(2) "Because small commercial farmers dominate agricultural growth and foster rapid growth in the rural non-farm sector, this plays an important role in economic transformation."

But these definitions are not universal and are biased towards farmers.

According to us, the two definitions are biased towards farmers heavily and only rudimentary. Expansion of the Manufacturing sector pulls up the employment of the rural sector according to the marginal productivity (rather the basic average product wise rural wage in agriculture). So, higher income for employees meaning higher saving, higher saving means higher investment (higher capital accumulation) and higher investment means higher growth. Thus Manufacturing becomes the driver of growth, structural transformation as well as agricultural growth.

Amartya Sen opines (as mentioned in Mellor (2017), pp. 2, J.W. Mellor, 'Agricultural Development and Economic Transformation', Palgrave Macmillan, (2017)) that "Famine, hunger and poverty are due to lack of income on the part of the poor, not lack of food in the economy." We are questioning: whether wage is real wage (Food) or nominal wage (money income) according to Marginal Productivity? Thus, Food is the most fundamental requirement to eradicate poverty according to Marginal Productivity Theory. This is the most pivotal issue in the discourse of Economic Transformation and Agricultural Growth. Food is the most pivotal content to eradicate famine, hunger and poverty on the part of the poor. Devoid of food, money income could do nothing to eradicate famine, hunger and poverty on the part of the poor. Even with money income, the basic and fundamental requirement is 'Food'. So what is 'Income' here, is nothing but 'Food'.

If Income is provided to people without providing them food, then that will lead to Hyperinflation in the economy. People can spend their income either on food or in 'All Other Goods' (AOG). Now with income, if one cannot buy food, then there is no point in buying AOG. Therefore, here, Income=Food and Food=Income. Otherwise, with Income only, **Hyperinflation** is a must to occur. This has happened in Greece, Venezuela and Egypt. Additionally, devoid of food, if income is increased, especially in the condition of depression, then whatever be the size of the injection of money income, that will lead to

Liquidity Trap, i.e., people are unable to invest their money in either bond market or goods market and so due excess supply in the economy, economy reaches to zero due to abrupt fall in the price level to zero. That is not the case if food=income and income=food. In that case, through the multiplier effect of public investment (food=income and income=food), demand pulls production so that food will buy machines and machines will buy services.

So, not the lack of income but the lack of food makes a poor poverty stricken. On the other hand, if income is granted to poors along with food, then also the question arises- what will the poors do with that income if infrastructures are not built for expenditures(Example-India)

? This makes Income Null & Void.

Here we have performed a cross sectional regression corresponding to 15 developed and developing countries to show that agricultural growth is positively related to per capita income (Structural Transformation). Countries are: COUNTRIES: ETHIOPIA, RWANDA, TANZANIA, BANGLADESH, PAKISTAN, GHANA, INDIA, BOLIVIA, NIGERIA, EGYPT, INDONESIA, GUATEMALA, CHINA, USA, AUSTRALIA.

Dependent Variable: GRAGRPC

Method: Least Squares

Date: 01/16/24 Time: 22:24

Sample: 1 15

Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNPCI	0.624068	0.087221	7.155045	0.0000
R-squared	0.217044	Mean dependent var	4.860000	
Adjusted R-squared	0.217044	S.D. dependent var	3.092572	
S.E. of regression	2.736456	Akaike info criterion	4.915545	
Sum squared resid	104.8347	Schwarz criterion	4.962748	
Log likelihood	-35.86658	Hannan-Quinn criter.	4.915042	
Durbin-Watson stat	1.440385			

This shows that Structural Transformation is the pivot for Agricultural Growth.

SECTION 5: IMPORTANCE OF PCGVAFC, CAPITAL INVESTMENT, LOAN CREDIT AND IRRIGATIONAL EXPENDITURE: EMPIRICAL STUDY: RESULT AND ANALYSIS:

The objective here is to observe the influence of Per Capita Agricultural Gross Fixed Capital Formation (PCAGFCF), Per Capita Agricultural Credit Issue (PCAGCRDISU) and Agricultural Net Irrigated Area (AGNETIRIG) Per Capita Agricultural Gross Value Added at Factor Cost (PCAGVAFC). PCAGVAFC implies the value added distributed to an average rural man. So, improvement or growth (over time) in the PCAGVAFC implies the enhancement in the welfare of the rural mass at the most basic sense of development. Table-2 has shown that the average compound growth rate of Agricultural GDP has remained at almost 3 percent whereas the same of GDPFC has remained at 5 percent. If we observe the growth rate of population, then we can find that the average compound rate of growth of population is 2 percent. So, the growth rate of PCGDPFC is 3 percent and the growth rate of PCAGVAFC is 1 percent (net of population growth). So, on an average, 2 percentage points difference has been maintained by the Agricultural sector's per capita value added growth, behind PCGDPFC growth since 1950-51 to 2011-12.

It is observable from the statistics that the standard of living of the rural mass In india, if the most basic criterion of development is chosen, is improving over time in terms of PCAGVA. The Table-5 shows this through the rising trend of PCAGVA in 2010 US\$ constant prices. But, seeing the Table, we may become dissatisfied, may be agitated within ourselves, especially when we compare our trend of PCAGVA with other representative developed and developing countries like Argentina, Chile, Australia, Canada, France, Netherlands, Spain etc.. because not only their PCAGVA is higher than India, but also, the rate of increase of PCAGVA is higher than us in general. However, if we inspect deeply into this matter, then it will be clear that low population (absolute) as well as low population growth is, in general the prime reason of their higher PCAGVA and it's steady growth. India, although has admirable GDP rank in the World (third largest by Purchasing power parity GDP), but, when it gets normalized by population, it gets poultry. Even, although China is more populous than us and is the highest population country in the world, the gap between the aggregate population between India and China is narrowing and soon we will be the highest population country in the world, surpassing China (see Table-6). Thus, it may be said that the rate of growth in PCAGVA has been eroded by the population growth steadily over time. (In addition, it is to be mentioned that the PCAGVA of United Kingdom, Germany, Japan, Mexico, other SAARC Countries have trended towards comparability with Indian PCAGVA to 2017.)

However, if we compare ourselves with China, accepting the fact that China has shown a modest trend in PCAGVA (comparable with United States), despite being highest populous country, then we have to admit the fact that, China has performed the structural change from agriculture to industry (manufacturing) and towards services (engined by production services related to manufacturing (Datta, 1989, Sinha, 2015), corresponding to per capita value added as well as employment. The share in value added (per capita) and employment is highest for the services and lowest for the agriculture in China (see Table-7 and Table-8). India, although has, performed the structural change towards services, in terms of it's share in per capita

value added, however, the rate of structural change towards industry as well as services is very slow compared to its position in world development. Whereas in China, only 17.5 percent of the aggregate employment is employed in the Agricultural sector, in India, 42.7 percent of the aggregate employment is directly employed in agriculture in 2017. In Services, China contributes 56 percent of its aggregate employment, but India contributes only 34 percent (roughly).

As the largest section of the aggregate employment is directly related to agriculture in a highly populous country like India, hence, naturally that has led to 'overmanning' in agriculture to a great extent, if it is observed relative to the Industrial sector and/or Services Sector. As a result, the PCAGVA has risen at a very slow rate. Recognising that the rural literacy rate is 71 percent in India (NSSO Survey, 2018), (moderate, when compared to other developing nations), a chunk of rural employes (skilled and educated), if moved from Agriculture to Industry (Manufacturing) and/or Services for employment, may have shed the load of overmanning in agriculture, raising the PCAGVA from relatively subsistent average level towards higher level corresponding to the marginal productivity of the primary inputs labour and capital taken together. But it could not happen mainly because of 'Stickiness', especially of rural people towards land despite subsistence wage availability over time. In this sense, a steadily rising trend of PCAGVA in rural India, despite all sorts of debarments and barriers, shows considerable attention of Rural Poverty Alleviation Programmes (like MGNREGA, Food for Work Programme, Digital India Programme, Pradhanmantri Kaushal Vikash Yojana, Pradhanmantri Jan Dhan Yojana, Sukanya Samridhhi Yojana, Swavalamban, National Career Service, etc.) through infrastructure building (like PMGSY, Pradhanmantri Gramin Awaas Yojana, Rashtriya Krishi Vikash Yojana etc.). The rigid Industrial labour laws, providing industries and services taken together much higher PCGVA than their marginal productivity, has remained also the prime reason of debarment behind rural-urban migration for employment (Lewis Model, Analytical Development Economics, Basu (2003)).

In these circumstances, we will focus upon the role played by gross investment in agriculture, loan credit issue and and irrigational expenditure (proxied by net irrigated area) upon the per capita agricultural gross value added (PCAGVA) through a log-linear model. The regression results show that the impact/influence of gross investment in agriculture and irrigational expenditure (proxied by net irrigated area) (one period lagged) are positive and significant at 1 percent level upon the per capita agricultural gross value added (PCAGVA). But the effect of an increase in aggregate loan credit issue upon the PCAGVA is negative and significant at 1 percent level. The objective of the 'Bank Nationalisation was to reach to every marginal farmer, marginal entity through credit facilities in order to employ them in agriculture or other self-employment schemes. However, certainly, there was 'Formal Credit Corruption through the involvement of the informal lenders' in the 'Formal Agricultural Credit Issue Process' including various self-employment schemes related to agriculture. So, the issue had a long standing demand for a practical solution. Since 2014, through the Direct Benefit of Transfers (DBT) Schemes and 'Pradhanmantri Jan Dhan Yojana, the situations are changing. Hopefully, there will be a positive continuous effort from the end of Reserve Bank of India

(RBI) towards minimizing this phenomenon of 'Formal Credit Corruption through the involvement of the informal lenders'.

TABLE 7: COINTEGRATION STUDY				
Johansen Juselius Unrestricted Cointegration Rank Test				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	Prob.**
No. of CE(s)	Eigenvalue	Statistic	Critical Value	
None *	0.590927	67.20762	47.85613	0.0003
At most 1 *	0.359443	34.13474	29.79707	0.0149
At most 2 *	0.330831	17.65428	15.49471	0.0233
At most 3	0.07265	2.790692	3.841466	0.0948
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
	0.330831	17.65428	15.49471	0.0233
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	Prob.**
No. of CE(s)	Eigenvalue	Statistic	Critical Value	
None *	0.590927	33.07288	27.58434	0.0089
At most 1	0.359443	16.48046	21.13162	0.198
At most 2 *	0.330831	14.86359	14.2646	0.0402
At most 3	0.07265	2.790692	3.841466	0.0948
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
1 Cointegrating Equation(s):		Log likelihood	264.8843	
1 Cointegrating Equation(s):		Log likelihood	264.1776	
Normalized cointegrating coefficients (standard error in parentheses)				
LNPCAGVA	LNAGCRDISU	LNAGFCF	LNAGNETIRIG(-1)	
1	0.361028	-0.89001	-1.543614	
	-0.10889	-0.19625	-0.46598	
Source: Own Calculations from CSO, RBI, INFRASTRUCTURE DEVELOPMENT REPORT, INDIA				

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