IMPACT OF PUBLIC INVESTMENT ON AGRICULTURE SECTOR IN INDIA

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The public investment is important factors to promote agricultural sectors. Some of the reasons for slower growth in public investment in agriculture are diversion of resources from investments to current expenditure in the form of subsidies, large expenditure incurred on maintenance of existing projects, inordinate delays in completing the project on hand, relatively lower allocation for irrigation, rural infrastructure and research, lack of effective credit support and credit infrastructure in rural areas. There has been a secular decline in public investment till Tenth Five Year Plan period. In the Eleventh Five Year Plan period, there has been an increase in public investment significantly. However, this is not enough and the investment in agricultural research is still less than 1 percent of GDP.

Public investment in agriculture is crucial not only for the development of agriculture but also because of the economy's dependency on agriculture. Investment in irrigation structures for agriculture has social, ecological and environmental externalities that are largely positive. Agricultural investment has the potential to have significant effects on health, nutrition and poverty reduction. Unless there is massive step up in public expenditure on agriculture, investment would be extremely counterproductive. There may be increase in agricultural exports but would not be accompanied by increase in agricultural output. Consequently, inflation would increase sharply and there would be an adverse effect on non-agricultural output and employment. Hence, the overall impact of agricultural investment in its aggregate is at increasing welfare and development.

INTRODUCTION

Agriculture is one of the determining factors in the development of the human society. The share of agriculture is downward from 30 percent in 1990-91 to 13.9 percent in 2013-14. The public investment is important factors to promote these sectors in recent years. The public investment in agricultural sector has also promoted private investment by way of what is termed as the crowding in phenomenon. However, the rate of total investment in agriculture declined from 2.43 percent in 1979-80 to the low of 0.59 percent in 1994-95 and then recovered with a marginal increase to 1.28 percent in 2006-07 (Mani, Bhalachandran and Pandit, 2011). A clear shift in public policy away from public investment in general and particularly in agriculture is quite clear. Some of the reasons for slower growth in public investment in agriculture are diversion of resources from investments to current expenditure in the form of subsidies, large expenditure incurred on maintenance of existing projects, inordinate delays in completing the project on hand, relatively lower allocation for irrigation, rural infrastructure and research, lack of effective credit support and credit infrastructure in rural areas. The share of public investment in total investment declined from 50 percent in the early 1980s to 20 percent in 2000s. It may be noted that 90 percent of the private investment is made by farmers for on-farm production. The growth rates of investment showed that public sector investment showed a negative growth in the early 1980s and 1990s and a growth of 15 percent in 2000s. On the whole, the growth rate of public and private investment is the highest in the decade of 2000s (Dev, 2012). There has been a secular decline in public investment till Tenth Five Year Plan period. In the Eleventh Five

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Year Plan period, there has been an increase in public investment significantly. However, this is not enough and the investment in agricultural research is still less than 1 percent of GDP.

Theories on Public Investment

Economist like Keynes, Inving Fisher, Jorgenson (1963), Markowitz (1952), and Brainerd and Tobin (1968) were explored the theories of public investment. Keynes stated that the investments are determined by the optimal st ock of capital. Keynes also influenced the 'accelerator' theory of investment, known for its applications to business cycles by Samuelson. In addition that, Jorgenson (1963) neoclassical theory of investment basically formalizes ideas put forward by Fisher. Brainerd and Tobin (1968) is also noted that the development of Tobin Q to incorporate expectations.

In India, there is long debate among policy makers and academicians relating to the public investment on agriculture is important or not in the growth of the economic development. Dhawan and Yadav (1997) studied public investment in agriculture and reported that one rupee of state borrowings (from the market as well as non market sources like the centre) resulted in an increase of about a little less than 1/3rd of a rupee in public capital formation in agriculture. The bulk of the public investments in Indian agriculture are for the purpose of development of irrigation infrastructure. Rao (1994) opined that broadening the domestic agricultural base by stepping up public investment in irrigation, research and extension and in social development such as education and skills formation holds the key to the exploitation of possible gains from trade as well as to ensuring that such gains are widely shared by different regions and classes of farmers. Ramakumar (2012) analyzed trends in agricultural investments in India between the 1950s and the 2000s and suggested that overall agricultural investments need to be raised to at least 36 percent of the agricultural GDP, as compared to the current levels of about 21 percent. Major and medium irrigation projects require special attention, as irrigation is instrumental not just in raising yields. Mishra and Chand (1995) in their study public investment in agriculture in the form of infrastructure are and will continue to be important on its own for agricultural growth. Just as public investment in major and minor irrigation system is necessary and desirable, so is public investment in rural roads, power supply systems, input delivery depots and market yards, the former counted as investment in agriculture and the latter for agriculture.

Gandhi (1996) studied investment behaviour in Indian agriculture over the period from 1950s to 1990s. Substantial changes were observed in the post 1980 period. Government investment which rose almost continuously until the early 1980s shows a decline in 1992. Between 1980 and 1986 private investment has fluctuated substantially and also shown some decline. Dev (2002) argued that there is greater need for public investment in agriculture, irrigation, credit availability, better marketing of agricultural products, research and development along with adequate pricing and other incentives for private investment that would help revive agricultural growth. Dev (2011) reported that the growth rates of investment in agriculture showed that public sector investment showed a negative growth in the 1980s and 1990s and a growth of 15 percent in 2000s. On the other hand, growth rate of private investment increased gradually from 2.5 per cent in the 1980s to 4.1 percent in the 1990s and 5.2 percent in 2000s. On the whole, the growth rate of public and private investment is the highest in the decade of 2000s. The main objective of the paper is to examine the trends of public investment in Indian agriculture from 1980-81 to 2010-11. The second is to the determinants of public investment in agriculture in India and study the long run impact of public investment on agricultural growth.

Research Methodology

The source of data is National Accounts Statistics (NAS) published by Central Statistical Organisation (CSO), various issues. Apart from this, other sources like Economic survey, GOI, Various issues, Handbook on Indian Economy by RBI and data from research journals were also used. The growth rates, percentage analysis, averages and auto correlation were used.

Most of the studies have used raw time series to examine the relationship between private investment and other variables. This can give spurious relationship if the assumption of stationarity of the series is not satisfied (Granger and Newbold, 1974). In order to establish the true relationship between the variables, it is necessary to analyze the time series properties of data. This is to establish whether the variables are stationary or non-stationary. Most macro economic variables are non - stationary or integrated of order one, I (1). Stationarity is important because if time series are characterized by non-stationarities, the classic t-tests are considered to be inappropriate. Most of the earlier studies which used regression approach have assumed that the series in question are stationary.

RESULTS AND DISCUSSION

In India, the rate of investment in agriculture from 1980-81 to 2013-14 is given in Table 1. The ratio of Gross Capital Formation in agriculture sector to GDP to 12.3 percent and it has been increasing over the years. Decadal average for the year 1981-82 to 1990-91 was 9.74 percent and it was 9.62 and 16.69 per cent for 1991-92 to 2000-01 and 2001-02 to 2013-14 respectively. The share of GCF in agriculture to GDP was highest in the decade 1981-82 to 1990-91 (3 percent), with a low in 1991-92 to 2000-01 (2.4 percent) and then a moderate rise in 2001-02 to 2013-14 (2.8 percent). The same trend was noticed in the rate of investment in agriculture sector also.

Table 1: Decadal Averages for the Rate of Investment in Agriculture in India

Year	GCF(AA)/ GDP(AA)	GCF(AA)/ GDP	GCF(A)/ GDP(A)	GCF(A)/ GDP
1980-81 to 2012-13	12.31	2.81	13.50	2.62
1980-81 to 1990-91	9.74	3.14	11.01	2.99
1990-91 to 2000-01	9.62	2.48	10.59	2.31
2001-02 to 2012-13	16.69	2.82	17.99	2.57

Source: Central Statistical Organization, New Delhi, AA - Agriculture and Allied, A- Agriculture, GCF- Gross Capital Formation, GDP- Gross Domestic Product

Table 2: Growth Rates of Investment in Agriculture Sector (Percent)

Year	Public investment	Private investment	Total investment
1980-81 to 1984-85	-1.06	-3.40	-2.30
1985-86 to 1989-90	-4.56	5.74	1.47
1990-91 to 1994-95	1.66	-10.01	-6.71
1995-96 to 1999-00	-1.94	18.47	12.90
2000-01 to 2003-04	7.52	3.39	4.16
2004-05 to 2009-10	5.80	9.91	9.13

Source: Central Statistical Organization, New Delhi

From Table 2, it can be inferred that the growth rate in public investment in general has been negative until 2000 except during the period 1990-91 to 1994-95 that has recorded positive growth rate (1.66 percent). The period 1985-86 to 1989-90 recorded very low growth rate of public investment in agriculture (-4.56 percent). After 2000, the growth rate of investment in agriculture has been positive. But there has been mixed trend in growth rates in private investment in agriculture until 1990-91 to 1994-95 where the growth rate has been negative and positive alternatively. But the period 1995-96 to 1999-2000 recorded very high growth rate in private investment (18.47 percent) that immediately follows very low growth rate of -10 percent during the period 1990-91 to 1994-95.

Total investment in agriculture has been positive since 1995-96 to 1999–00. During the period 1995-96 to 1999-00, growth rate in total investment has recorded the highest of 12.90 percent. This is because of the highest growth rate recorded for private investment in the corresponding year. But in general, total investment in agriculture has been low because of negative or very low growth rate in public investment in agriculture.

Determinants of Public Investment in Agriculture

By situating the existing literature within a conceptual framework, it explores what are the driving factors behind the amount of public funds allocated to and for agriculture and the differential attention that different types of public investments receive in resource allocation decision making.

Hence, the long-run relationship between the public and private investment in agriculture has been studied by employing Johansen Co-integration test for the last 30 years, using time series data from 1980 to 2010. The data were used from 1980 to 2003 data is in 1999-2000 prices (24 observations) and from 2004 to 2010 data is in 2004-05 prices (6 observations) and number of observations: 30.

Table 3: Private Investment in Agriculture: 1980 to 2003

Auto correlation	Partial Correlation	AC	PAC	Q-Stat	Prob
. |****** |	. |******	0.788	0.788	16.840	0.000
. |***** |	. |* . |	0.650	0.077	28.825	0.000
. |*** |	.**| . |	0.434	-0.263	34.430	0.000
. |**. |	. *| . |	0.252	-0.115	36.405	0.000
. |* . |	. *| . |	0.080	-0.072	36.614	0.000
. | . |	. |* . |	0.008	0.130	36.616	0.000
. | . |	. |* . |	-0.018	0.104	36.627	0.000
. | . |	. *| . |	-0.063	-0.161	36.780	0.000
. | . |	. |* . |	-0.004	0.153	36.781	0.000
. | . |	. *| . |	-0.027	-0.132	36.814	0.000
. | . |	. | . |	-0.015	-0.018	36.824	0.000
. | . |	. *| . |	-0.064	-0.085	37.038	0.000

Source: Central Statistical Organization, New Delhi; Sample: 1980 2003, included observations: 24, AC - Auto Correlation Coefficient, PAC – Partial Auto Correlation, Number of Lags Included: 12

Table: 3 represents that the Auto Correlation value is gradually going down which means that probably the data is non-stationary. The Q-Statistics and their corresponding p-value all are zero. Hence, we reject the null hypothesis and accept the alternate hypothesis.

Table 4: Public Investment in Agriculture: 1980 to 2003

Auto correlation	Partial Correlation	AC	PAC	Q-Stat	Prob
. |****** |	. |****** |	0.799	0.799	17.321	0.000
. |***** |	. |* . |	0.676	0.104	30.282	0.000
. |**** |	.**| . |	0.488	-0.221	37.361	0.000
. |**. |	. *| . |	0.325	-0.108	40.648	0.000
. |* . |	. | . |	0.183	-0.028	41.745	0.000
. |* . |	. | . |	0.082	0.016	41.976	0.000
. | . |	. | . |	0.019	0.028	41.989	0.000
. *| . |	.**| . |	-0.092	-0.217	42.316	0.000
. *| . |	. *| . |	-0.178	-0.128	43.637	0.000
.**| . |	. | . |	-0.226	0.064	45.913	0.000
.**| . |	. | . |	-0.248	0.050	48.869	0.000
.**| . |	. *| . |	-0.263	-0.069	52.470	0.000

Source: Central Statistical Organization, New Delhi; Sample: 1980 2003, included observations: 24, AC - Auto Correlation Coefficient, PAC – Partial Auto Correlation, Number of Lags Included: 12

The above table represents that the Auto Correlation value is gradually going down which means that probably the data is non-stationary. The Q-Statistics and their corresponding p-value all are zero. Hence, we reject the null hypothesis and accept the alternate hypothesis.

Table 5: Private Investment in Agriculture after taking First Difference: 1980 to 2003

Auto correlation	Partial Correlation	AC	PAC	Q-Stat	Prob
***| . |	***| . |	-0.472	-0.472	5.8150	0.016
. |**. |	. | . |	0.249	0.034	7.5157	0.023
. |* . |	. |**. |	0.091	0.284	7.7548	0.051
.**| . |	. *| . |	-0.207	-0.100	9.0564	0.060
. | . |	.**| . |	0.001	-0.301	9.0565	0.107
. *| . |	***| . |	-0.194	-0.392	10.330	0.111
. |* . |	. |**. |	0.202	0.220	11.789	0.108
***| . |	. *| . |	-0.358	-0.068	16.707	0.033
. |**. |	. | . |	0.319	0.030	20.885	0.013
. *| . |	. | . |	-0.071	0.005	21.110	0.020
. | . |	. | . |	-0.004	0.033	21.111	0.032
. |* . |	. | . |	0.183	0.056	22.866	0.029

Source: Central Statistical Organization, New Delhi; Sample: 1980 to 2003, Included observations: 23, AC - Auto Correlation Coefficient, PAC – Partial Auto Correlation, Number of Lags to Included: 12

The above table explains that after converting the variable into stationary by taking first difference, the Auto Correlation value becomes small. We suspect that our variable Private Investment in Agriculture become stationary. The Q-Statistics and the corresponding p-value are significant. Here the p-value is more than 5 percent level of significance. So we cannot reject the null hypothesis; rather we can accept the null hypothesis.

Table 6: Public Investment in Agriculture after taking First Difference: 1980 to 2003

Auto correlation	Partial Correlation	AC	PAC	Q-Stat	Prob
. *| . |	. *| . |	-0.164	-0.164	0.7002	0.403
. |* . |	. |* . |	0.208	0.186	1.8846	0.390
. *| . |	. | . |	-0.108	-0.053	2.2172	0.529
. | . |	. *| . |	-0.054	-0.120	2.3042	0.680
. | . |	. |* . |	0.067	0.082	2.4464	0.785
. | . |	. | . |	-0.064	-0.019	2.5841	0.859
. | . |	. | . |	0.057	-0.000	2.6998	0.911
. | . |	. | . |	0.001	0.037	2.6998	0.952
. |* . |	. |* . |	0.084	0.088	2.9921	0.965
. *| . |	. *| . |	-0.079	-0.082	3.2672	0.974
. |* . |	. |* . |	0.183	0.163	4.8694	0.937
. *| . |	. *| . |	-0.144	-0.069	5.9471	0.919

Source: Central Statistical Organization, New Delhi; Sample: 1980 to 2003, Included observations: 23, AC - Auto Correlation Coefficient, PAC – Partial Auto Correlation, Number of Lags to Included: 12

The above table explains that after converting the variable into stationary by taking first difference, the Auto Correlation value becomes small. We suspect that our variable Public Investment in Agriculture become stationary. The Q-Statistics and the corresponding p-value are significant. Here the p-value is more than 5 percent level of significance. So we cannot reject the null hypothesis; rather we can accept the null hypothesis.

CONCLUSIONS AND POLICY IMPLICATIONS

Agriculture was and remains the most defining factor in the development of the human society and continues to play a vital role in Indian economy. The share of agriculture in agriculture and allied sector remains more or less the same and averages to 84 percent right from 1980 onwards. But the share of forestry and logging in agriculture and allied sector shows a declining trend. In contrary, the share of fisheries sector in agriculture sector shows an increasing trend. This shows that there are structural changes within agriculture and allied sector. Major source of finance for public sector plan for the year 2012-13 shows that more than 50 percent of the finance was sourced from borrowing (including long and medium term) and 28 percent from contribution of public enterprises. Others include balance from current revenue, small savings, central assistance and net capital inflow from abroad. The growth rate in public investment in general has been negative until 2000 except during the period 1990-91 to 1994-95 that has recorded positive growth rate (1.66 percent). After 2000, growth rate of investment in agriculture has been positive. But there has been mixed trend in growth rates in private investment in agriculture until 1990-91 to 1994-95. Total investment in agriculture has been positive since 1995-96 to 1999-00. There exists long run relationship between public and private investment in agriculture.

Public investment in agriculture is crucial not only for the development of agriculture but also because of the economy's dependency on agriculture. Investment in irrigation structures for agriculture has social, ecological and environmental externalities that are largely positive. Agricultural investment has the potential to have significant effects on health, nutrition and poverty reduction. Unless there is massive step up in public expenditure on agriculture, investment would be extremely counterproductive. There may be increase in agricultural exports but would not be

accompanied by increase in agricultural output. Consequently, inflation would increase sharply and there would be an adverse effect on non-agricultural output and employment. Hence, the overall impact of agricultural investment in its aggregate is at increasing welfare and development.

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