Factors Determining Private Agricultural Investment: A Comparative Case Study of Two States of India

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The study endeavours to examine the pattern and determinants of agricultural investment in two states of India viz., Haryana and Odisha. The existing literature points out that public investment in agriculture is one among the strongest determinants of private investment and output in agriculture. Accordingly, emphasis has been laid to accelerate the rate of public investment. The present study using primary data in two diverse regions of India is an attempt in that direction. Data from 150 households from both states have been collected using proportionate stratified random sampling method. The study finds that private farm investment as well as output are relatively lower in Odisha, being an agriculturally lagged region. It is further seen that private investment in agriculture has been significantly influenced by canal irrigation, institutional credit, and land size in Odisha. While in Haryana, farmer's education, land size and institutional credit positively and significantly affected private farm investment. Capital use in agriculture turned out to be positive and significant variables influencing agricultural productivity in both regions. The study thus recommends to ensure public policies on the aspects of irrigation infrastructure, research and extension, improvement rural infrastructure etc. in stimulating private investment and agricultural output. Public investment in

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agriculture on these components would bridge inter-regional inequalities and ensure inclusiveness as it promotes employment opportunities and sustainable growth in agriculture. In the context of Odisha, being a poorer state, these policies could serve as important tools of poverty alleviation.

Keywords: Private investment; public investment; agriculture; productivity; inducement impact.

1. ITRODUCTION

Agriculture sector provides food grain to the entire economy apart from providing impetus to other sectors of economy through demand and supply channel in India. The sector also plays a major role in provision of employment in rural sector. However, its contribution to the Gross Domestic product has been declining at the rate higher than the reduction in population depending on it. In Indian economy, agricultural sector has performed very poorly in the post reform period [1,2,3]. It was concluded that while the growth rate of GDP in the agricultural sector registered well in the early period of reforms, there was significant deceleration in the growth rate in the later period especially in the front of food grain production. The existing literatures concluded that public investment in agriculture is essential for promoting private investment and enhancing agricultural output. Therefore, one of the important reasons put forwarded for such deceleration has been decline in public investment in agriculture especially on irrigation and other rural infrastructures such as; rural electricity consumption, rural roads, formal credit etc. The Eleventh Five Year Plan also identified public investment in agriculture as one of the important factors determining of agricultural growth in India [4]. Consequently, the Plan laid specific emphasis on public investment in agriculture.

However, the first two decades of twenty first century witnessed a remarkable growth in agriculture which could be attributed to renewed policy trust by government after 2005 through various development plan in agriculture [5]. It was estimated that compound annual growth of Gross Value Added in agriculture was 3.63 percent. An estimate by Chand [6] reveals that Gross Value Added in agriculture grew by 3.29 percent from 2005-6 to 2016-17. Sharma [7], found that crop diversification is an important factor of agricultural growth which started in the eighties through launching of technology mission on oilseeds.

Nevertheless, there appears to be a noticeable inter-regional inequalities in agricultural growth across several states in India. These divergence in growth has further led to uneven non-farm sector growth. In an estimate by Bhalla [3], the growth rate of crop output decelerated from 3.61 percent from 1980-83 to 1990-93 to merely 1.00 percent from 1990-93 to 2003-06 in Eastern Region, and Odisha, one among the lagged state in India registered a negative growth rate (-0.67 percent per annum). In an estimate by Chand et.al. [2], the net state domestic product in agriculture in the state of Odisha grew at the rate of 0.11 percent during the period 1995-96 to 2004-05. The author noted a deceleration in the growth of area irrigated and consumption of electricity in the state during the same period. During 2010s, the annual compound growth of net state value added in agriculture in the state was 1.96 percent which was far below the all India level of 3.62 percent [7]. The study also showed that Assam, Bihar, West Bengal and Uttar Pradesh are few other states that were far below all India level. On the other hand, Andhra Pradesh, Gujarat, Madhya Pradesh, Haryana and Tamil Nadu did fairly well in agricultural growth during same period.

The level of agricultural productivity in the state of Odisha is quite lower compared to the other states and at all India level. The stagnant cropping pattern, poor quality and quantity of input use led to poor income earning capabilities of farmers. The poor returns from agriculture must be attributed to lack of adequate infrastructure in the state which includes irrigations, rural electricity, transport and communications, bank credit etc. that come from public initiative. Since agriculture remains the mainstay of state's economy and sustenance of the life of people, a poor performance of agriculture has severe implication on food security in the state. Further, growth experience of Indian economy in post reform period has been nested with service sector with gross negligence to the commodity sectors such as agriculture and industry. Agriculture being the primary sector of Indian economy, negligence to this sector in primarily agrarian dominated states would adversely affect the other sectors of economy in terms of sustainable growth. Therefore, inclusiveness would be expected to

be sounded more when growth in agriculture sustained with adequate farm income and employment opportunities in rural areas that may percolates other sectors of economy. Hence, public investment in agriculture and improvement in basic rural infrastructure play a vital role in overall development of these states. This also serves the purpose of bridging inter-regional inequalities in agricultural development in India.

2. REVIEW OF LIERATURE

The issue of investment in agriculture discussed widely among scholars in the late eighties and first half of nineties. The discussion mostly centers around the overall trends of public and private investment in agriculture and the inducement impact of public investment on private investment. Most of the scholars reached the conclusion that there was a clear indication of declining public investment in agriculture especially during eighties [8], Rao [9], Dhawan [10], Gandhi [11]. Further, using National Accounts Statistics, a positive relationship between public and private investment has been noted which implies public investment necessarily induced private investment in Indian agriculture (Krishnamurthy and Rath [12], Shetty [13], Rao [9], Gulati and Bathla [14], Chand and Kumar [15]. At the disaggregated level, Dhawan [10] studied the impact of government investment on canal irrigation and it's likely impact on private farm investment in Indian agriculture, more specifically, canal irrigation constituting a substantial portion of public investment stimulate private investment in agriculture. It was further asserted that institutional lending to agricultural development in India is more concentrated in irrigated than in dry land tract. Chand and Kumar [15] observed that the impact of agricultural subsidies on private investment was also positive, but firmly concluded that long term returns from public capital formation are more than double the returns from subsidies. It was also found that terms of trade for agriculture as well as institutional credit were strong determinant of private sector capital formation. With broad series [1], Gulati and Bathla [14] found that private investment is positively influenced by public investment in Indian agriculture. Kumar et. al. [16] examines the impact of public investment and input subsidy on private agricultural

investment. The study finds a significant interstate variations in spending on fixed capital formation, and a significant positive impact of public investment in agriculture and irrigation on private agricultural investment. Akber et.al. [17] using 'nonlinear auto-regressive distributive lag' (NARDL) model from time series data for a period of 45 years from 1971 to 2015 confirms a strong crowding-in effect of public investment on private investment in short run, but relatively a weak complementarity between the two over long-run.

Several other studies indicated that investment on rural infrastructure directly or indirectly meant for agricultural sector have an important role to play for enhancing agricultural investment and output. Binswanger et. al. [18] with the help of district level time series data found that education infrastructure and rural banks play an overwhelming role in determining investment, input and output decisions. The expansion of commercial banks into rural areas had a large effect on fertilizer consumption and on fixed private farm investment. Canal irrigation and rural electrifications have also significant impact on agricultural output. Fan et al [19] analyzing the state level data in India concluded that government spending on agricultural research and development, irrigation, rural infrastructures including road and electricity have all contributed to the growth in agricultural productivity and reduction in rural poverty. In a similar study, Fan et al. [20] worked out the effect of public expenditure on agricultural productivity and rural poverty reduction across Chinese provinces. Government spending on agricultural research and development substantially improved agricultural production followed by investment on rural education. Roy and Pal [21] in a state wise analysis of agricultural investment and productivity observed agricultural productivity is central to rural poverty alleviation and infrastructural and technological changes in turn play a key role in determining productivity. Kumar et, al. [22] also established a strong relationship between rural infrastructural development and the level of net agricultural state domestic product in the Indo-Gangatic Plain of India. It was concluded from the study that there is a significant scope for increasing the value of output from agriculture in backward states by improving the rural infrastructure. In an another study, Bathla [23] finds a significant increase in expenditure on irrigation system in less developed states helped to increase agricultural growth and stimulated private investment,

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[1] *It has been pointed out that bulk of public investment in agriculture is accounted for by investment in irrigations as defined by CSO series. Broad series includes investment in other rural infrastructure such as rural electricity, markets, rural roads etc apart from investment in irrigations.*

therefore, it was suggested to increase budgetary outlays in the poorer states and capital deepening for higher agricultural productivity and income.

2.1 The Present Study

In the backdrop of declining investment in agriculture and interstate inequalities in agricultural growth in India, the present study examines the pattern and determinants of private agricultural investment of cultivating households in the context of Odisha and Haryana agriculture with the help of primary data. Since both states are diverse in terms of agricultural development, the findings will help to underline policy packages specially for the less developed state of Odisha.

3. DATA AND RESEARCH METHODOLOGY

At the farm level, the data have been collected through a proposed field survey using structured questionnaires. Haryana and Odisha are the two states where the pace of agricultural growth and development has been quite different and therefore wide disparities in their level of agricultural investment and output. The state of Haryana had the advantage of early adoption of new technology leading to large scale investment in farm machinery and infrastructure. It may be mentioned that an irrigated belt in Odisha has been chosen to facilitate comparison with that of Haryana. The selection of district in each state has been made on the basis of the level of agricultural development. One district from each state has been selected based on three criterias such as; percentage of rice production in the state, percentage of gross area irrigated and fertilizer consumption (Kg/Hect). Percentage of rice Production to the total production is taken as an indicator and given more weightage simply because it is the main crop in Odisha and thus more suitable to facilitate comparison. Based on these two indicators, Karnal in Haryana and Bargarh in Odisha have been selected. Four villages from each district have been chosen randomly. A sample of 150 farmers, from each state has been selected with due representation of all farm size categories forming a total sample size of 300. The general sample design is a proportional stratified random sampling. In the final stage, the units are households. From amongst 300 households chosen, majority of farmers belong to small farm farmers category defined as cultivating land from 0.1 acre to 5 acre. Medium farmers defined as cultivating land

from 5.1 acre to 10 acres constituted 23.3 percent and 26.6 percent in Odisha and Haryana respectively. And, large farmers cultivating land more than 20 acres constituted a little above 10 percent in both regions.

The estimate of farm investment among the farming households in Odisha and Haryana has been arrived at using the money expenditure methods, which is similar to that followed by the All India Debt and Investment Survey (AIDIS) in the various rounds of National Sample Survey. Under money expenditure method, the sum total of expenditures that are devoted to investment or addition to capital asset is taken into account. Several items of expenditure which are essential for agricultural production has been considered in the study include; farm houses and cattleshed, land improvement, modern and traditional implements, irrigation implements, milch and draught animals etc. In case of farm assets such as; farm houses, cattle shed, poultry shed, wells etc, the cost of maintenance and repairs has been taken into account. While in case of fixed and high valued assets like tractor, irrigation equipments etc., annual value of allowances for wear and tear of machinery has been calculated by straight line depreciation methods. It is a method of allocating the cost of a capital asset over the anticipated life of the asset. The straight-line method (as suggested below) is the most popular and simple way to find depreciation.

3.1 Original Cost of asset- Trade-in-Value

Service life of asset (in years): In this method, it is assumed that depreciation occurs at a constant rate per unit of time. But in practice, depreciation of the asset may not remain the same in each year. However, the method is simple to calculate and the margin of error is quite less [24]. In case of low valued traditional implements such as sickle, *kudal, khurpi* etc, cost at the time of purchase has been considered provided they are in running conditions. Hence, the sum of all expenditures that add to capital stock of farmers have been considered as investment in agriculture.

4. RESULTS AND DISCUSSION

4.1 An Estimate on Magnitude and Pattern of Farm Investment

Haryana being a developed state, it is expected that the quality of farm capital equipments and

their monetary values are much better than Odisha. Therefore, returns to investment in terms of higher productivity is higher among farmers in Haryana. Based on the method depicted above, private investment in agriculture per cultivating household by farm size in both regions has been depicted in Tables 1 and 2. It may be seen that investment in agriculture under different items increases as the farm size increases. Investment under modern implements including tractor and accessories among cultivating households in Odisha constituted 51.2 percent of the total investment taking all categories of households together, though it happened to be the major share among the large farmers. Among small farmers, the proportion of investment under modern implements constituted only 20.5 percent, the major share come from investment for milch animals. Some of the traditional implements like *Desi* plough, bullocks and bullock carts etc., the small farmers have higher share. It may be mentioned that these traditional implements are especially suited for small holding, and these implements being portable in character required lots of time and efforts, which the small farmers can afford to use them. The table also brings out that the magnitude of investment by small farmers is very low compared to the medium and large farmers in both study regions.

Investment on modern farm machineries and implements along with irrigation implements also constituted a major share for the cultivating households in Haryana. They formed nearly 58 percent of the total investment. Mentioned may be made that while a variety of farm machineries such as tractor, combine harvester, ripper, threshers have been owned and used in Haryana agriculture, in case of Odisha, tractor and power tiller constituted the source of farm machineries.

One of the important observations in the present field level investigation is that large farmers by virtue of owning farm assets through huge investment were able to maximize their total income by hiring same to the small farmers on a rent. Tractor plays a vital role in the adoption of farm machinery in study regions of Odisha. In view of increasing cost of maintenance and time consuming traditional inputs such as bullocks and bullock carts, even small farmers in Odisha are increasingly abandoning them. This is also true in Haryana agriculture. It is thus observed that use of farm machineries even among small

farmers has been quite impressive by hiring from their large counterparts on a rent. It could be one possible reason as to why the yield per acre among the small farmers is higher, apart from a high labour land ratio. However, there are several inconvenience in hiring farm machineries by the small farmers, most importantly they can not avail those machineries at their own convenience and time which could lead to delay in plantations and crop loss at the time of harvesting. Therefore, the small farmers may be encouraged to invest on this item so as to increase their productivity further and maximise their households' income by putting them in several uses by forming farmers cooperative.

In order to analyse the difference in farm production in both regions, we have estimated the returns from farm production especially in case of rice crop. This is because rice happens to be the major crop grown in the study regions in Odisha. Therefore, to facilitate comparison only rice crop has been considered. Table 3 presents the net returns from rice production on per acre and per cultivator basis in both states. The figure of net return has been arrived at by deducting the cost of cultivation from the gross values of sales.

Some important observations that can be made from the table are; one, net returns from rice production in Haryana is higher than in Odisha, secondly; smaller sized farms are more productive compared to their large counterparts. and thirdly; income per household is an ultimate indicator of households economic well being. The farmers in Haryana are more productive because the quality and quantity of inputs, and farm capital assets they are using is much better and that the magnitude of investment in agriculture is much higher than the farmers in Odisha. The second observation led us to conclude an inverse farm size productivity which was a concluded by scholars [25-28] is still relevant today. Higher productivity among small farmers is observed due to better labour-land ratio among them compared to large farmers. The small farmers however could be even more productive and maximise their household' income if they could form cooperative and invest on their agriculture on the front of farm machineries and implements. This would also release labour to the non-farm sector and consequently help to maximise their household income to better their economic well being.

Table 1. Households' Capital Formation in Agriculture by Farm Size (Per Household in Rs), Odisha

	Small farmer	Medium farmer	Large farmer	All size
Farm houses, cattle shed and land improvement	121(10.3)	852(15.5)	2107(15.7)	516(14.4)
Irrigation development (Elec pump, well and other sources)	96(8.2)	430(7.8)	949(7.1)	271(7.6)
Modern Implements including tractor and accessories	241(20.5)	3005(54.5)	8584(63.9)	1831(51.2)
Traditional Implements include bullock cart, *desi* plough, *khurpi*, *kodal*, sickle etc.	84(7.1)	126(2.3)	83(0.6)	93(2.6)
Draught animals (Bullocks, He buffaloes)	199(16.9)	406(7.4)	331(2.5)	260(7.3)
Milch animals (Cow, she buffaloes)	321(27.3)	598(10.9)	1086(8.1)	472(13.2)
Others including goatry, piggery, poultry etc.	114(9.7)	94(1.7)	294(2.2)	130(8.6)
Total	1176(100)	5511(100)	13434(100)	3573(100)

Source: Field Survey

Table 2. Households' Capital Formation in Agriculture by Farm Size (Per Household in Rs), Haryana

	Small farmer	Medium farmer	Large farmer	All size
Farm houses, cattle shed and land improvement	95(2.3)	874(5.6)	2955(6.1)	648(5.2)
Irrigation development (Elec pump, well and other sources)	1550(38.0)	3579(22.8)	9863(20.4)	3088(24.7)
Modern Implements (including tractor and accessories, combine harvester, ripper, fodder cutter etc)	1181(29.0)	9520(60.6)	32915(68.1)	7218(57.8)
Traditional Implements include bullock cart, *desi* plough, *khurpi*, *kodal*, sickle etc.	377(9.3)	252(1.6)	28(0.1)	301(2.4)
Draught animals(Bullocks, He buffaloes)	208(5.1)	674(4.3)	967(2.0)	426(3.4)
Milch animals(Cow, she buffaloes)	612(15.0)	716(4.6)	1382(2.9)	731(5.8)
Others including goatry, piggery, poultry etc.	51(1.3)	106(0.7)	220(0.5)	86(0.7)
Total	4074(100)	15721(100)	48330(100)	12498(100)

Note: Figures in the bracket represents percentage to the total. Source: Field Survey

Table 3. Net Income from Production(in Rs. for Rice crop)

Farm Size	Odisha		Haryana	
	Per acre	Per household	Per acre	Per household
Small farmers	4899	13344	7466	18344
Medium Farmers	3801	25347	5863	34634
Large farmers	4680	91247	7138	106060
All size	4505	24896	6778	31802

Souce: Field Survey

4.2 Factor Determining Private Investment at the Farm Level

The differences in productivity in agriculture between Haryana and Odisha as has been observed in the above section could largely be attributed to the difference in the quality and quantity of input use and the pattern and magnitude of farm investment in their respective agriculture [29-31]. The present section deals with the factors affecting private farm investment and output among cultivating households in both Odisha and Haryana using a multiple regression framework. Several independent variables considered in the study are; proportion of canal irrigation, farmers education, and availability of institutional credit which are in the domain of public authority. In fact, the impact of canal irrigation on private investment is one of the suitable indicators of public investment in the sample region of Odisha since the major source of irrigation in study region is canal irrigation. Size of land can also affect private farm investment in agriculture as large farmers are expected to invest more on their agriculture compared to small farmers. In another equation, output per acre has been taken as dependent variable which are influenced by land size, educational level of farmers, capital use in agriculture and intensity of cropping. Two dummy variables are; education and use of capital. In case of dummy for education, two groups are created one literature and the other as illiterate. In case of dummy for capital use, two groups are one, those who use modern capital and the other who rely on traditional implements. Using the above variables, a stepwise multiple regression analysis has been run to show the impact of several specified independent variables on agricultural investment and output.

In the first equation, Table 4 investment per acre has been taken as dependent variable and several independent variables included are land size, institutional credit, education (dummy) in the study region of Haryana. The results suggest that land size, educational level of farmer and institutional credit positively and significantly influenced investment in agriculture. This indicates farm investment per acre increases as the farm size increases and that institutional credit plays a vital role financing farm investment. Educational level of farmers also turns out to be positive and significant at 5 percent level of significance. In Odisha as well (Table 5), farm investment by the cultivating households are positively influenced by institutional credit and farm size. This suggests that large farm have adequate access to institutional credit in both regions and farmers with greater access to institutional bank credit do have higher investment for their agriculture. The proportion of canal irrigated area also positively influenced private farm investment. A positive coefficient of proportion of canal irrigation indicates that public investment in the form of canal irrigation positively influenced private investment in agriculture. In fact, the presence of canal irrigation have induced farmers to acquire farm implements and machineries, induced investment on land improvement, irrigation equipments, adoption of chemical fertilizers and HYV seeds etc. It is to be noted that the canal irrigated belt in the study region is protective in nature. This induces farmers to invest on private irrigation tools like well irrigation, diesel pump etc. Canal irrigation thus complements digging well or owning a pumpset. Further, the impact of canal irrigation also bears with the livelihood pattern of the people apart from the benefit of crop production. For instance, fishing has been largely practiced among several households in the study region in the canal irrigated belt of Odisha.

The second model considers output per acre as a function of land size, cropping intensity, education (as dummy) and capital use (as dummy) in Haryana. While in Odisha, the independent variables are land size, education (as dummy) and capital use (as dummy). The results clearly depicts that farm size defined by operational holding bears a negative relationship with output per acre in both regions. Interestingly, education also bear an inverse relationship with output per acre in both regions. This could be because most of the small farmers being illiterate are endowed with higher labour-land ratio with intense desire to raise farm production to support their households. On the other hand, large farmers being more educated tend to prefer more leisure. Cropping intensity is another independent variable included in the regression analysis in the context of Haryana agriculture which turned out to bear positive and significant relationship with output per acre.

Table 4. Regression Results: Haryana

Model 1 Dependent variable: Investment per acre					Model 2 Dependent variable: Output per acre				
Independent variables	**Constant**	**Beta**	**t- value**	**Sig.**	**Independent variables**	**Constant**	**Beta**	**t- value**	**Sig.**
	538.1		2.920	.004		23557.6		9.217	
Land size		.500	7.492	.000	lsize		-.372	-4.904	.000
credit		.199	3.106	.002	Education (Dummy)		-.180	-2.663	.009
Education (dummy)		.177	2.734	.007	Cropping intensity		.173	2.634	.009
Adj R² 0.40					Capuse (dummy)		.194	2.607	.010
N=150									
					Adj R² 0.39				
					N=150				

Table 5. Regression Results: Odisha

Model 3 Dependent variable: Investment per acre					Model 4 Dependent variable: Output per acre				
Independent variables	**Constant**	**Beta**	**t-value**	**Sig.**	**Independent variables**	**Constant**	**Beta**	**t-value**	**Sig.**
	131.1		.589	.557		12286.1		57.062	.000
credit		.296	3.974	.000	Land size		-.423	-5.648	.000
Land size		.290	3.866	.000	Education (Dummy)		-.188	-2.705	.008
Canal irrigation		.165	2.259	.025	Capuse (Dummy)		.152	2.067	.041
Adj R² 0.21					Adj R² 0.31				
N=150					N=150				

The results presented above indicate that the use of capital is a strong factor influencing farm productivity. The coefficient of capital use turns out to be 0.19 in Haryana and 0.15 in Odisha significant at 0.05 percent level. It thus makes clear that use of capital have significant role to play in enhancing farm production. It is to be noted that not all categories of farmer own capital assets which are lump sum in nature. Small farmers turned out to become efficient as they hire agricultural implements and machineries from their large counterparts on a rent. Due to increasing cost of maintaining bullocks and bullock carts and other traditional implements, even small farmers are increasingly substituting machineries and implements by hiring these modern implements. The analysis thus, provides significant insights to the fact that though small farmers do not own high payoff farm implements, their use are quite at par with the big farmers in terms of hiring them from the later. Nevertheless, a comparison of the ratio of farm capital per cultivator household suggests that farmers in Odisha lag far behind than farmers in Haryana. The small farmers in a backward agriculture such as Odisha have therefore to depend more on the large farmers or to the owners of capital asset. Because of few ownership of farm asset in Odisha agriculture, the dependent had to wait or stand in queue to hire them; some times they had to pay a higher rent or as demanded by the owners. In some cases, crop loss are reported by these dependent farmers as they can not avail the hired machineries.

5. CONCLUSION

The present study with the help of a field level investigation estimated the pattern and magnitude of private farm investment and factors influencing them in two states of India viz., Odisha and Haryana. The study observed that agricultural investment among the cultivating households in Haryana is much larger than among the households in Odisha. And further that, the composition of farm investment is better in Haryana agriculture; in that the investment under farm machineries and implements including irrigations had a major share than Odisha agriculture. This resulted with a higher farm production in Haryana on both per acre and per household basis.

The study also attempted to identify several factors that may influence private investment and output in agriculture. Private investment in agriculture has been significantly influenced by canal irrigation, institutional credit, and size of farm. While in Haryana, farmer's education, land size and institutional credit positively and significantly affected private farm investment. Canal irrigation and institutional credit could be considered as the important variables that are under the public domain; and as these variables turned out to be positive and significant, we may conclude that public investment have induced private investment in the context of both Haryana and Odisha agriculture. The facilities of assured canal irrigation in Odisha proves to have a cumulative impact on agricultural income and investment. Flow of agricultural income as a result of canal irrigation induced farmers to acquire farm machineries and implements and several other inputs which helped to increase farm productivity. Capital use in agriculture turned out to be positive and significant variables influencing agricultural productivity in both regions. Farm size and educational level of farmer however, bears a negative relationship with output indicating that small farmers are more efficient and have poor educational attainment. However, base education and specific farmer's education is highly needed to improve productivity further and to help release of surplus labour to other sectors of economy.

6. IMPLICATION AND POLICY RECCOMMENDATIONS

Keeping in view the fact that large proportion of population depending on it, there is a need to accelerate agricultural growth to address the issue of food and livelihood security in the coming years in Odisha. Public investment in agriculture in the form of rural infrastructures, irrigation development, research and development, cold storages, institutional credit, etc. plays a greater role in stimulating private investment and agricultural output which should be a top priority in the state. Minor irrigation programmes, soil and water conservation measures and research and development to improve productivity in rain fed areas hold the key. Public investment in agriculture would ensure inclusiveness as it promotes employment opportunities and sustainable growth in agriculture. This will also promote non-farm development through demand and supply linkages and could serve as an important tool of poverty alleviation.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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