



A comparative study of Capital Productivity in Agriculture: Interstate Analysis

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ABSTRACT

As a source of livelihood, agriculture and allied activities remain the largest sector of Indian Economy till now. The growth of this sector has rapidly goes down and the share of this sector to GDP is also declining which was 29.53% in 1990-91 to 10.32% in 2016-17. The share of plan outlay was 14.9% in first plan which was decline to 3.70% in eleventh plan. Here researcher is taken capital in term of public investment and then compare the capital productivity & its intensity among some states. This study is based on secondary data and tested by F statistics. Many factors account for the difference in public investment in different state i.e. resources of the state Government, grants from the Central Government, fertility of soil, prospects of further agricultural growth and political considerations are some of the factors responsible for difference in level of public investment per hectare in different states. For example, political considerations have prompted the Central Government to announce special economic assistance of Jammu and Kashmir, during every phase of study. Sufficient resources of the state government and fertility of soil and the future prospects of agricultural growth account for a high level of public investment in the state of Punjab. All Analysis shows that there is a regional disparity in public expenditure, therefore sectorial GSDP in agriculture is also differing. Intensity of public investment and Capital Productivity show that no any states which use constant Intensity of public investment and Capital Productivity during this period. It is also clear that no any trend in both i.e. Intensity of public investment and Capital Productivity and its range is very high too. Therefore no any certainty to find fixes output by unexpected public expenditure. At last it can said that investment on agriculture and allied sector has less impact on sectorial GSDP or it can be said that these investment is actually just like an expenditure that are spending on agriculture and allied activity which doesn't improve any productivity of the agriculture sector.

Keywords: *GSDP, Public Investment, Capital Productivity and Intensity of public investment.*

1. INTRODUCTION

As a source of livelihood, agriculture and allied activities remain the largest sector of Indian Economy till today. It is also known as the form of Indian culture. Therefore, government pay attention on this sector seriously and try to get rid of the obstacles that are responsible for declining the growth of his sector. The growth of this sector rapidly goes down and the share of this sector in GDP is also declining. it was 29.53% in 1990-91 that would decline 10.32% in 2016-17. Growth of this sector is 3.60 in first plan while it was

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7.9% (at current prices) in eleventh plan while the share of plan outlay is 14.9% in first plan and 3.70% in eleventh plan overall in India.

Agriculture sector majorly depends on agricultural productivity-Labour, Land and Capital. On which, Capital is one of them that can improve the productivity of Labour and land too. Therefore, here researcher is taken capital in term of public investment and then compare the capital productivity & its intensity among some states.

2. REVIEW OF LITERATURTE

Singh Poonam (2014), “Trends of Public and Private Investment in Indian Agriculture: An Inter State Analysis”, assess pre and post period of economic reforms in terms of investment in agriculture. She takes secondary data from 1980-81 to 2005-06 that is more than two decades. It is collected from NAS-CSO (Various Issues), Government of India, New Delhi; RBI (Various Issues) for State level; AIDIS, NSSO. She uses Compound Annual Growth rate. She gets estimated quadratic regression functions-

$$GCF_{ag} = 14590.71 - 177.36t + 20.68t^2$$

$$GCF_{pb} = 7936.49 - 337.72t + 8.66t^2$$

$$GCF_{pvt} = 6654.21 - 160.37t + 12.02t^2$$

She compared the data between national and state level and founds decreasing trend in the pre-period of economic reforms at national level as well as in most of the states. She states that the reason of this decline is subsidy rather than investment for fertilizer, credit, electricity, irrigation and other agricultural inputs. Therefore she suggests for improving more investment on infrastructure. She highlights the need to establishing better alliances between farmers and food processing industry to faster growth in agriculture sector. The new strategy of agriculture growth and diversification of agriculture from traditional crop cultivation to horticulture etc. would require more investments on cold storage, rural roads, communication, marketing network and facilities, warehouse etc. So simultaneously efforts should be made to revitalize agriculture through introduction of bio-technology and other innovations. This would require substantial increase in investment on research & development for agriculture also.

Goyal A. K. and Kumar S. (2016), “Agricultural production trends and cropping pattern in Uttar Pradesh: An Overview”, shows that the backbone activity of rural population in Uttar Pradesh is agriculture and for sustained growth in two sectors, increase in production and productivity is essential. This paper divides Uttar Pradesh into seven sections on two bases i.e. cropping pattern and production trends of agriculture. In this study they found that four major crops-All food grains, all cereals, and all vegetables in the period of 1960-61 to 2011-12. They use secondary data and collect it from Uttar Pradesh Planning Commission, official website of government of India & Uttar Pradesh, Agriculture Statistics at a glance, various issues. They show area of land productivity of major crops in average form that is called

Agricultural Productivity and conclude that overall for period 1950-51 to 2011-12; the production has increasing trend for major crops. Productivity has increased and state agricultural growth rates are more satisfactory than national averages. Cropping pattern has improved in the state, which is good for an agricultural based state. But still there is scope for better progress. Huge quantity of water could be saved by diversification of cropping pattern from these crops to less water consuming crops. Technological improvement and change in the agricultural practices in general and change in the agricultural practices in general and irrigation practices in particular, could also help to reduce the water consumption in rice, wheat and sugarcane.

Bathla Seema (2017), “Public Investment in Agriculture and Growth: An Analysis of Relationship in the Indian Context”, examines the relationship between investment and irrigation in 17 states during 1980-81 to 2013-14. She uses time series data of public investment in agriculture irrigation and sectorial state domestic product of agriculture and allied activities and the time span is 1981-82 to 2013-14 to cover different phases off policy reforms. The inter-relationship between investment and agricultural growth is tested at a dis-aggregate level using state-wise expenditures from the Finance Accounts. Given that agriculture and irrigation are state specific subjects, such analysis has important implications for resource allocations and possible tradeoff between investment and subsidy to encourage and sustain agricultural growth. She uses OLS model and Generalized Methods of Moments technique. Secondary data has been used at state level. Which are Finance Accounts, Government of India, Various Issues 1981-2013; All India Debt and Investment Survey (AIDIS) and NAS; Agricultural Statistics at a glance various issues. Her estimated equations are-

$$\text{Log GSDPA}_t = \alpha \text{logPublic AgriR\&D}_{t-1} + \beta \text{logPublic Irrigation}_{t-1} + \varphi \text{logX} + s_t + v_t + \varepsilon_t$$

Where, gross state domestic product agriculture per capita (GSDPA) in period t, is explained by per hectare public investment in agriculture R&D and irrigation (both lagged), X is a vector of variables viz. lagged private investment in agriculture, per capita non-agriculture income, weather conditions represented by rainfall, availability of land, and labor (employment/ha). The α, β and φ represents the respective coefficients of the explanatory variables.

$$\begin{aligned} \Delta \text{Log GSDPA}_t &= \alpha (\Delta \text{log Public R\&D}_{t-1}) + \beta \text{log}(\Delta \text{Public Irrigation}_{t-1}) + \varphi (\Delta \text{log X}) \\ &+ \Delta v_t + \Delta \varepsilon_t \end{aligned}$$

The data base relates to 17 states. These include Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Naidu, Uttar Pradesh and West Bengal. She comes to this conclusion that significant increase in investment on irrigation in less developed states would be support for improving productivity and persuade private investment. She found variation in public investment at interstate level. She

highlights the importance of physical policy in agriculture policy. Therefore she recommends increasing budgetary outlay for poorer states.

3. OBJECTIVES OF THE STUDY

There are two objectives of the study-

- 1) To examine the GSDP and public investment of agriculture sector in selected states.
- 2) To compare the intensity of public investment in agriculture sector among the state.
- 3) To analyse capital productivity of agriculture sector among the selected states.

4. HYPOTHESES OF THE STUDY

There are two hypotheses of the study-

- 1) H_0 : There is no any significance difference in GSDP of agriculture sector among the selected states.
- 2) H_0 : No any difference of public investment in agriculture sector among the selected states.

5. KEYWORD OF THE STUDY

5.1 SECTORIAL GDP OF AGRICULTURE

Sectorial GDP is calculated by GDP of current price (2011-12) with multiplication of percentage share of agriculture sector to total GDP at current price (2004-05).

$$GDP_t^A = GDP_{t,on 2011-12}^T * SOA_{t,on 2004-05}$$

and subscript t represent the t-th year.

5.2 CAPITAL IN AGRICULTURE

Public investment is used at capital in this study. Here, researcher used the data of public expenditure on agriculture and allied activities, rural development, research and Education, Minor Irrigation and Major Irrigation, Soil and Water conservation, with Flood Control s a capital input for agriculture sector. It is summation of revenue expenditure and capital expenditure,

$$K_t^1 = \sum PE_t^A$$

$$\text{or, } K_t^1 = \sum (RE_t^A + CE_t^A)$$

Where, K stands for capital, PE stands for public expenditure, RE stands for revenue expenditure, CE stand for capital expenditure, A stands for agriculture & allied activities.

5.3 AGRICULTURAL PRODUCTIVITY

Agricultural productivity is a measure of the efficiency with which inputs are used in agriculture to produce an output. A precise measure of productivity is the ratio of output to all inputs used in the production process or **Agricultural productivity**² is measured as the ratio of agricultural outputs to agricultural inputs. This output value may

² Ahuja, H.L. (2016), "Micro Economics," S Chand & Company, New Delhi, ISBN 978-93-525-3187-5

be compared to many different types of inputs such as Capital and Land (yield or crop yield). These are called partial measures of productivity. It is known as Capital productivity and Land Productivity respectively. Therefore,

$$\text{Capital Productivity} = \frac{TPA}{K}$$

Where, TPA is total production, K is investment 'in' or 'for' agriculture. In this study, capital productivity is calculated by given above definition. It is considered as in four forms for the present study –

$$CP_t^1 = \frac{SGDP/SGSDP}{K_t^1(N/SL)}$$

5.4 INTENSITY OF PUBLIC INVESTMENT

With an intention to find out the pattern of investment on different items of public investment, intensities were estimated as per cent of sectorial gross domestic product for agriculture (SGDP/SGSDP).

$$IOK_t^1 = \frac{K_t^1(N/SL)}{SGDP/SGSDP}$$

Where, N stands for National, SL stands for State level. K_t^1 Stands for capital such as public expenditure in agriculture & allied activities.

6. RESEARCH DESIGN

6.1 RESEARCH METHOD- Study is based on explanatory research.

6.2 NATURE OF DATA- Quantitative data is used.

6.3 TYPES OF DATA-Secondary data are used.

6.4 COLLECTION SOURCES OF DATA-Data is collected from secondary sources such as State Finance Report-RBI & Handbook of Statistics, on Indian States-RBI 2019.

6.5 TIME PERIOD OF THE STUDY-Time span is taken from 2011-12 to 2016-17.

6.6 UNIT OF ANALYSIS-Sectorial Gross State Domestic Product of Agriculture, Public Expenditure (Revenue and Capital Expenditure) on Agriculture and Allied activities.

6.7 ECONOMIC TECHNIQUES- Productivity of public investment (Output-Investment ratio) and Intensity of public investment (Investment –Output Ratio) are used as economic techniques.

6.8 ECONOMETRICS/STATISTICAL TOOLS-Arithmetic Mean, Standard Deviation, Coefficient of variation and f-statistic are used as econometric and statistical tools.

7. ANALYSIS OF DATA

7.1 ANALYSIS OF GSDP AT INTERSTATE LEVEL

Sectorial GDP is highest in Uttar Pradesh than Other state during 2011-2017 but rate of Change of this period is highest in Madhya Pradesh that is 159% (two and half time increase) followed by West Bengal that is 68.5%. In UP, Rate of change is equal to 56.9%. It shows that the share of sectorial GSDP of these States are different during this period.

TABLE-1: Agriculture Sectorial GSDP at Factor Cost (Base Year 2011-12) In Lakh

Year	State				
	U.P.	W.B.	Punjab	Haryana	M.P
2011-12	12415418	7245329	5007937	4088737	7333369
2012-13	14951864	8682450	5314252	4457601	10540450
2013-14	16250096	10626231	5760170	4951547	12457846
2014-15	15633361	10171379	5715593	4636731	13094566
2015-16	17638489	11593411	5936438	4727367	13632853
2016-17	19489787	12206453	6630614	5469577	19044920
CAGR	7.80551	9.082537	4.789029	4.968928	17.24093
Average	16063169	10087542	5727501	4721927	12684001
SD	2407659	1849708	556601.1	466860.1	3867955
COV	14.98869	18.33656	9.718045	9.887067	30.49476
F-statics	27.3151				
p Value	0 (significant)				

Source: Handbook of statistics on Indian States-RBI;

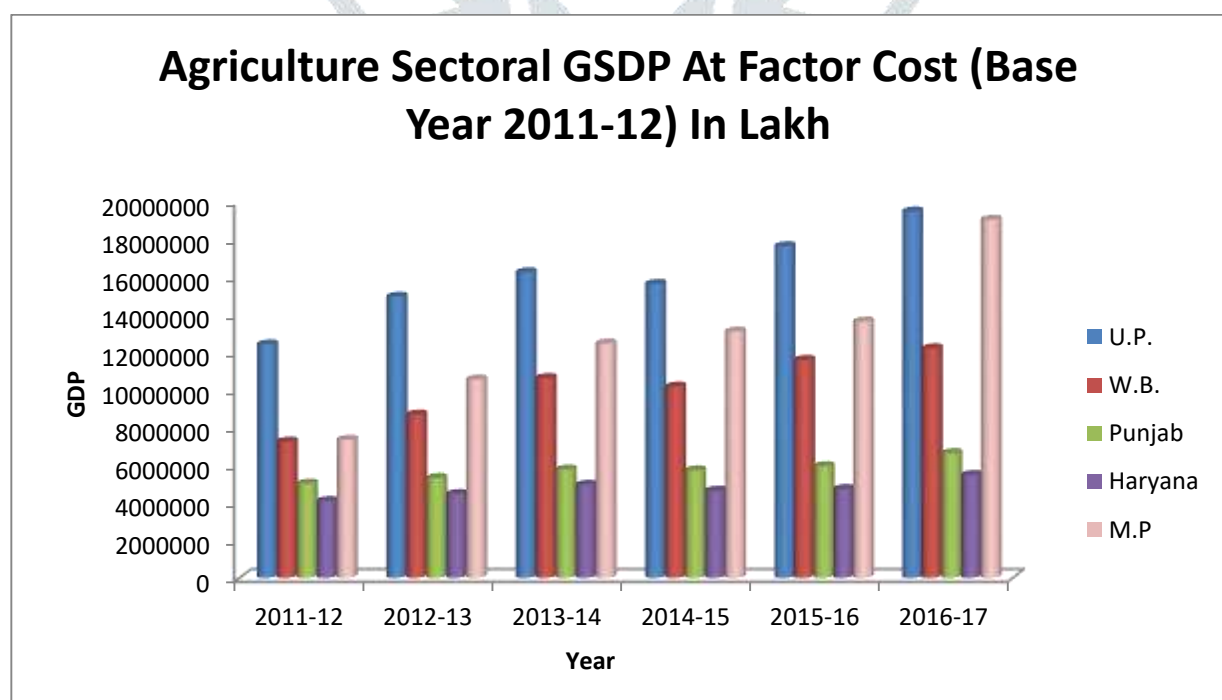


FIG-1: Agriculture Sectorial GSDP at Factor Cost (Base Year 2011-12) In Lakh

7.2 ANALYSIS OF PUBLIC INVESTMENT AT INTERSTATE LEVEL

Government investment in different states is different and rate of change within the states is also differing during the same period. Highest investment spends in Madhya Pradesh and it has increasing trend too. Other states had many fluctuations. Punjab has highest rate of change i.e. 57.1% that means more than nine times. MP has second highest rate of change i.e. 113.4% that means more than two times. In UP, very minute change has been done in public investment i.e. 28.8%. Which shows state government or central government has not desperately spent investment in or for agriculture.

TABLE-2: PUBLIC INVESTMENT (In Million) INTERSTATE LEVEL

Year	State				
	U.P.	W.B.	Punjab	Haryana	M.P
2011-12	35241.7	20943.4	8648	24525.9	51573.8
2012-13	54869.3	27214	12808.9	33651.1	63666.8
2013-14	51234.6	25226.5	15111.7	7707.5	64004.7
2014-15	70330.4	32070.5	46773.1	9588.9	84619.8
2015-16	64840.5	48028.4	70966.9	26341.2	102210
2016-17	45418.6	38735	58041.1	29324.7	110044.4
CAGR	4.318856	10.79225	37.34199	3.023137	13.46358
Average	53655.85	32036.3	35391.62	21856.55	79353.25
SD	12785.97	9932.788	26625.6	10703.39	23432.69
COV	23.82959	31.00479	75.23138	48.9711	29.52959
F-statics	9.4035				
p value	0.0001 (significant)				

Source: State finance report RBI

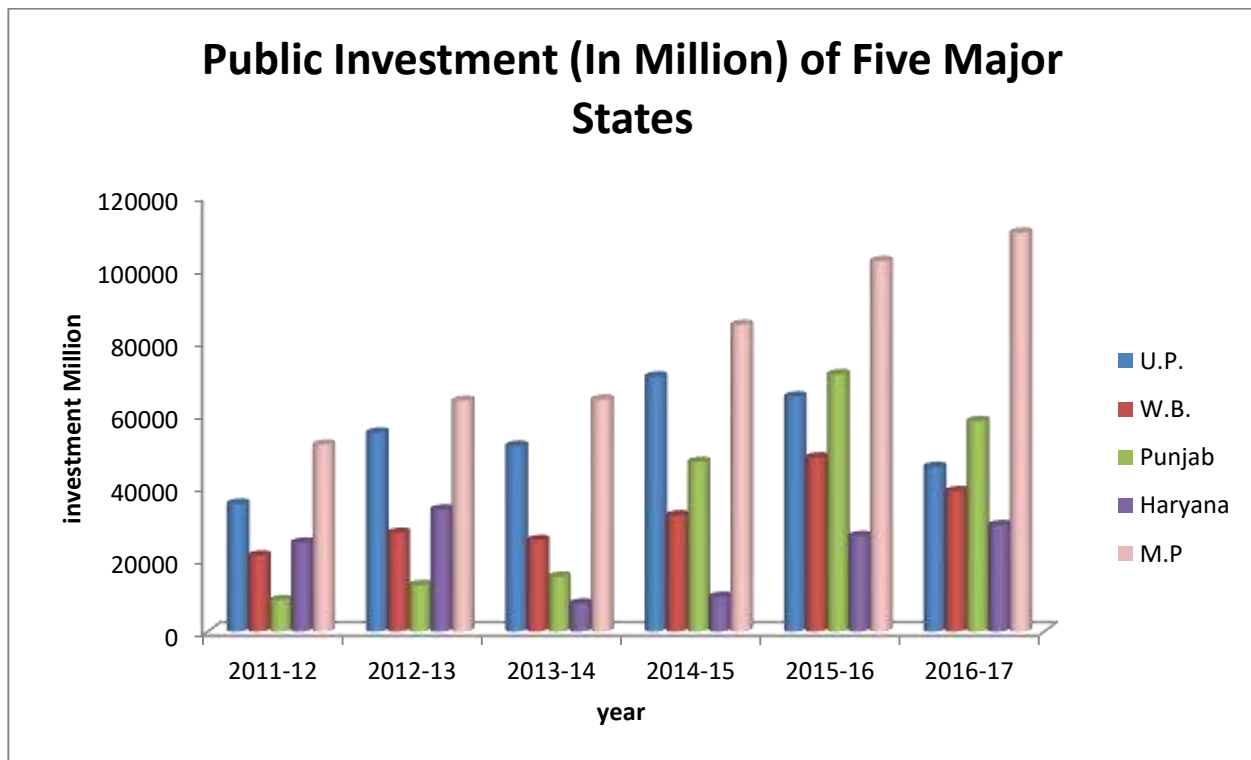


FIG-2: Public Investment (In Million) of Five Major States

7.3 ANALYSIS OF INTENSITY OF PUBLIC INVESTMENT AT INTERSTATE LEVEL

Intensity of Public Investment is highest in Punjab in 2015-16 i.e. 11.9%, followed by Haryana in 2012-13 i.e. 7.55%, MP in 2015-16 i.e. 7.50%, West Bengal in 2015-16 i.e. 4.14% and UP 2014-15 i.e. 4.50% within series. While among all states, Punjab has highest Intensity of Public Investment since 2014-17 while MP has highest in 2011-12 and 2013-14 as well as Haryana in 2012-13. Finally we say that Many Fluctuations are found in Intensity of Public Investment in all States.

TABLE-3: Intensity of Public Investment

Year	Intensity of Public Investment (IOK_t^1)				
State	U.P.	W.B.	Punjab	Haryana	M.P
2011-12	2.84	2.89	1.73	6.00	7.03
2012-13	3.67	3.13	2.41	7.55	6.04
2013-14	3.15	2.37	2.62	1.56	5.14
2014-15	4.50	3.15	8.18	2.07	6.46
2015-16	3.68	4.14	11.95	5.57	7.50
2016-17	2.33	3.17	8.75	5.36	5.78

Source: Estimated by researcher

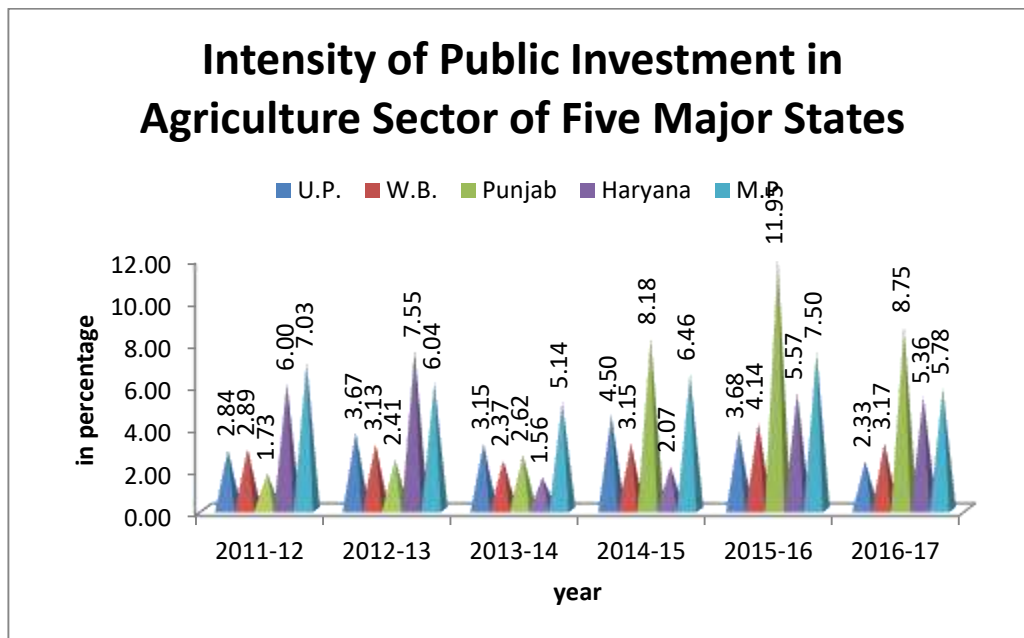


FIG-3: Intensity of Public Investment in Agriculture Sector of Five Major States

7.4 ANALYSIS OF CAPITAL PRODUCTIVITY AT INTERSTATE LEVEL

Capital Productivity has also differed from state to state. Highest Capital Productivity is found in UP i.e. 42.9% in 2016-17 while in West Bengal, It is 42.12% in 2014-15; in Punjab 57.91% in 2011-12, 64.24% in 2013-14 in Haryana and 19.46% in 2013-14 in MP. Over all Haryana has the highest Capital Productivity during this period.

TABLE-4: Capital Productivity in Five Major states

State	Capital Productivity (CP_t^1)				
	U.P.	W.B.	Punjab	Haryana	M.P
2011-12	35.23	34.59	57.91	16.67	14.22
2012-13	27.25	31.90	41.49	13.25	16.56
2013-14	31.72	42.12	38.12	64.24	19.46
2014-15	22.23	31.72	12.22	48.36	15.47
2015-16	27.20	24.14	8.37	17.95	13.34
2016-17	42.91	31.51	11.42	18.65	17.31

Source: Estimated by researcher

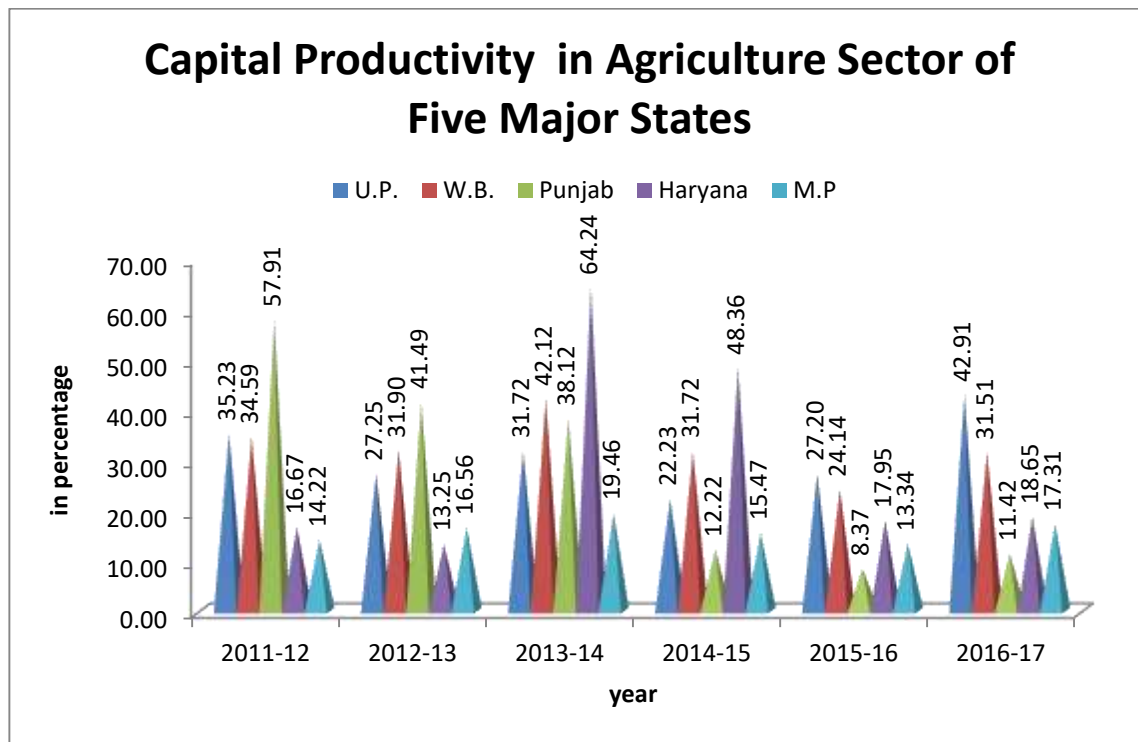


FIG-4: Capital Productivity in Agriculture sector of Five Major States

8. CONCLUSION OF INTERSTATE ANALYSIS

Many factors account for the difference in public investment in different states. Resources of the state Government, grants from the Central Government, fertility of soil, prospects of further agricultural growth and political considerations are some of the factors responsible for difference in level of public investment per hectare in different states. For example, political considerations have prompted the Central Government to announce special economic of Jammu and Kashmir, during every phase of study. Sufficient resources of the state government and fertility of soil and the future prospects of agricultural growth account for a high level of public investment in the state of Punjab.

All Analysis shows that there is regional disparity in public expenditure, therefore sectorial GSDP in agriculture is also differing. Intensity of public investment and Capital Productivity show that neither state have constant Intensity of public investment and Capital Productivity during this period. It is also clear that no any trend in both i.e. Intensity of public investment and Capital Productivity and its range is very high too. Therefore no any certainty to find fixes output by unexpected public expenditure. At last it can said that investment on agriculture and allied sector has less impact on sectorial GSDP or it can be said that these investment is actually just like an expenditure that are spending on agriculture and allied activity which doesn't improve any productivity of the agriculture sector.

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