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Analysis of growth rates of agricultural subsidies and capital formation in agriculture sector of India

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Abstract
This paper tries to analyse the decadal growth rates and trends of agricultural subsidies and capital formation in agriculture sector of India during the period between 1970-71 to 2019-20 and also analyses the impact of economic reforms of 1991 on farm subsidies and capital formation in agriculture sector. Problems or issues related farm subsidies and capital formation in the agriculture sector are also analysed and prioritized by using Garrett ranking technique. The major findings of this study include the growth rate of agricultural subsidies negatively impacted by the economic reforms of 1991 as the growth rates of subsidies are decreased more rapidly during post-reforms period as compared to pre-reforms period. But, these economic reforms helped the capital formation of agriculture sector to revive its growth rate that was showing decreasing trend in the pre-reforms period. This study also identified the declining trend of public investments.

Keywords: Agricultural subsidies, capital formation, investments, growth rates, constraints, agriculture

1. Introduction
Indian agriculture sector has gone through different structural growth phases influenced by several technological interventions, different institutional and government policy regimes (Akber and Paltasingh, 2021) [1]. Green revolution during the decade of mid 1960's and the economic reforms that were introduced into India during early 1990's are noteworthy phases that influenced the growth of agriculture sector especially the agricultural subsidies and capital formation in agriculture sector of India. Growth rate of agriculture sector before the green revolution phase was used to be around 2% and after the adoption of green revolution technologies the growth rate of agriculture sector revived by rising to the levels of 2.5 to 3% (Akber and Paltasingh, 2021) [1]. The green revolution helped the agriculture sector to maintain the steady growth for the next decades 1970's and 1980's. Further this growth rate was detained by the challenges that have hurtled through the economy in 1990's by the introduction of economic reforms (Chand and Parappurthu, 2012) [7]. However, the growth rate of agriculture sector was recovered in mid 2000's. In the last two decades the agriculture sector experienced the buoyant growth rate which is roughly around 4%.
Agricultural subsidies which were introduced into Indian agriculture sector during mid 1960's by the recommendations of Jha committee 1964, showed the substantial growth rates. According to Ramaswami, 2019 the total expenditure on agricultural subsidies were roughly 2 to 2.25% of the GDP. The agricultural subsidies contributing to the total farmers income is around 21%. The government expenditure on fertilizer subsidies increased by 30 times during the period between 1976 to 2000 (Fan *et al*., 2007) [9]. The percentage share of fertilizer subsidies in total subsidies from the central government increased from 20% to over 50% (Richa, 2004) [15]. The growth rate of fertilizer subsidies in 1990's was 12.85% (Richa, 2004) [15]. The growth rates of credit subsidies in 1960's was 12.62% which increased to 22% in 1970's. From 22% in 1970's, growth rate of credit subsidies fallen to 7.31% and 4.74% in 1980's and 1990's respectively (Fan *et al*., 2007) [9]. Similarly, the irrigation subsidies also showed decreasing trend in the growth rates from 1960's to 1990's as its the growth rates estimated as 20%, 10%, 5% and 1% respectively during the periods between 1960's, 1970's, 1980's and 1990's respectively (Fan *et al*., 2007) [9].
Capital formation in agriculture sector shown the significant increase in the growth rate during the post economic reforms period as compared to the pre economic reforms period (Bathla, 2017) [4, 5]. According to Bathla and Hussain, 2021 [3] since 1960, the real capital formation in the agriculture sector of India increased by nine fold.

The decade of 1970's was the period during which the agriculture sector experienced the highest growth rate of capital formation which is of 7.89% (Bathla and Hussain, 2021) [3]. If we consider the percentage of total agricultural investments to the overall investments has decreased, particularly more rapidly in the 1990's to 7.9% of GDP and then to 7.4% of GDP between 2000-01 and 2005-06, compared to the 1980's level which was at 11.4 per cent of GDP (Golait an Lokare, 2008) [10].

Most of the previous studies mainly focused on studying the impact of economic reforms only on the growth rate patterns of investments in the agriculture sector and also neglected analyzing the problems related to agricultural subsidies and capital formation in the agriculture sector. So this study was selected to analyse the impact of economic reforms on the growth rate patterns of both agricultural subsidies and investments in the agriculture sector and also focused on prioritizing the problems related to agricultural subsidies and capital formation with the objectives 'To analyse the decadal trends of agricultural subsidies and capital formation in the agriculture sector and To analyse and prioritize the problems related to agricultural subsidies and capital formation in the agriculture sector.'

2. Materials and Methods

All the necessary information that is required for the research study was collected from both the primary and secondary data. The primary data in the form of inputs and opinions was collected through google form survey. Opinions and inputs were collected from the subject experts in the agricultural economics from various Indian Council of Agricultural Research (ICAR) research institutions and the research institutions under the Ministry of Agriculture and Farmers welfare, GOI and various State Agricultural Universities (SAU's).

The secondary data required for this study is time-series data at the national level. The period of data for the variables such as capital formation (public and private investments), Gross Domestic Product from agriculture (GDPag), included in the study was from 1970-71 to 2019-20 and the agricultural subsidies was from the year 1970-71 to 2015-16.Data were collected from various sources like reports from Directorate of Economics and Statistics (Agriculture Statistics at a Glance, Pocket book of Agriculture Statistics, etc.), Ministry of Agriculture and Farmer's Welfare, Economic Survey, Central Statistical Office (CSO), National Sample Survey Office (NSSO), Government of India; Reserve Bank of India, Hand book on Indian Economy; databases like Indiastat.com and Centre for Monitoring Indian Economy (CMIE), various research papers by different authors, etc.

2.1 Compound Annual Growth Rate (CAGR)

For analysing the decadal growth rate trends of variables Compound Annual Growth Rate techniques was used.

Compound Annual Growth Rate: $Y = A\ Bt$

Applying log on both the sides,
$\log Y = \log A + t \log B$

Where,
Y= Gross capital formation in agriculture/ farm subsidies.
A= Constant
B= Regression coefficient
As $B = 1+r$, $r = B-1$
Therefore, r = (Antilog B-1) x100.
Where r = Compound annual growth rate.

2.1 Henry Garrett Technique

Henry Garrett technique was used to rank or prioritize the problems and issues related to farm subsidies and capital formation in agriculture sector. As per this method, respondents were asked to provide their response regarding the relevancy of all the problem statements in a four point continuum i.e., extremely relevant, Mostly relevant, considerably relevant and Irrelevant and these four point continuum were given ranks as 1, 2, 3 and 4 respectively. Outcome of such rankings is converted into the score value with the formula:

Percentage position = (100(Rij-0.5))/Nj

Where,
Rij – Rank given for the factor ith variable by the jth respondents.
Nj – Number of variables ranked by the jth respondents.

The percent position estimated is converted into scores with the help of Garrett's table. Then for each problem, the scores of each individual are added and then total value of scores and mean values of score are calculated. The problems having highest mean value is considered as the most serious problem or issue that is related to farm subsidies or capital formation in agriculture.

3. Results and Discussions

Trends agricultural subsidies and capital formation in the agriculture sector was given in the Fig. 1. The trend line of agricultural subsidies showing the increasing trend as the subsidies increased from Rs. 1.39 billion to Rs. 1883.3 billion during the period between TE 1972-73 to TE 2015-16 with the compound annual growth rate of 18.1%. This indicates that the total agricultural subsidies increased by 1355 times in absolute terms during the same period. Capital formation in the agriculture sector increased from Rs. 192.86 billion to Rs. 3243.71 billion during the period between TE 1972-73 to TE 2019-20 with the annual compound growth rate of 6.9%. During this period the capital formation in the agriculture sector increased in absolute terms by 17 times. Temporal behaviour of trend line of public sector investments in agriculture sector is also showing the increasing trend as the public investments increased from Rs. 72 billion to Rs. 421.98 billion during the period between TE 1972-73 to TE 2019-20 with the annual compound growth rate of 3.9%. In the same period public investments increased by 6 times in absolute terms. Private investments also shown the increasing trend as the investments increased from Rs. 121.83 billion to Rs. 2821.73 billion during the period between TE 1972-73 to TE 2019-20 with the annual compound growth rate of 8%. In this period private investments increased by 23 times. From the analysis of the growth rates and. trend lines of capital formation in agriculture and private investments in the Fig. 1 are showing the similar trend. So as compared to public investments, private investments have the significant effect on the increment of capital formation in agriculture sector of India.

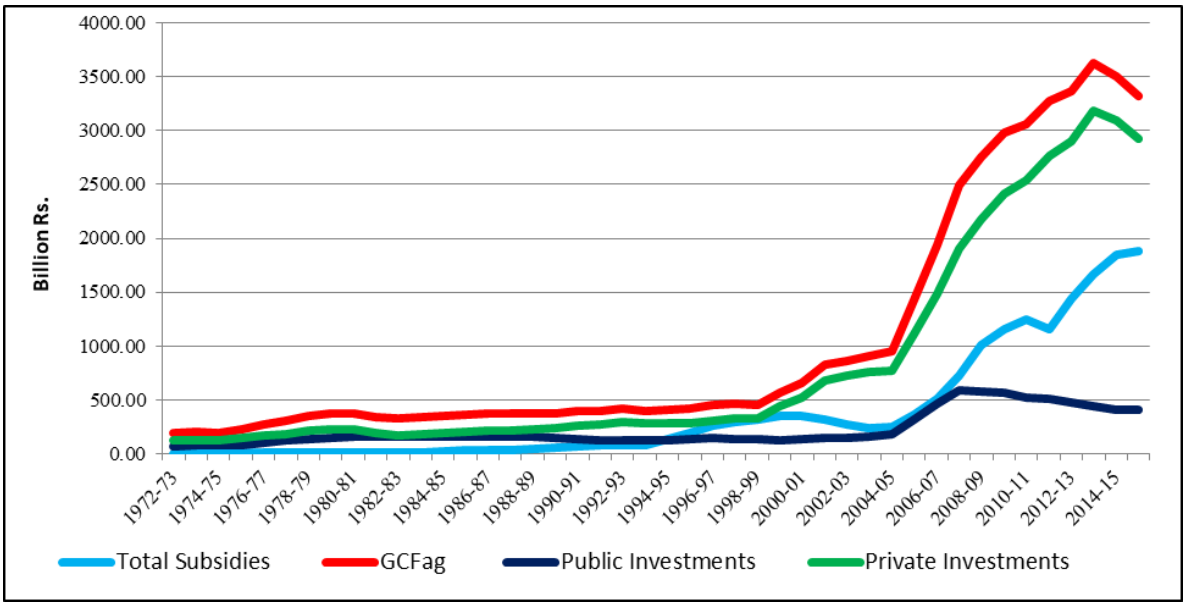

Fig 1: Trends of agricultural subsidies and capital formation in agriculture sector

3.1 Decadal trends of agricultural subsidies and capital formation in the agriculture sector

Decadal compound annual growth rate trends of total agricultural subsidies and various other input subsidies at current prices were represented in the Fig.2. Compound annual growth rates for all input subsidies except the irrigation subsidies, showed the declining trend as they declined in each decade though the growth rates are positive. The growth rates of total agricultural subsidies in the Period of 1970's, 1980's, 1990's, 2000's and period between 2010-11 to 2015-16were 38.2%, 17.7%, 16.7%, 4.7% and 4, 7% respectively. The compound annual growth rate of total agricultural subsidies during the entire study period i.e., 1970-72 to 2015-16 at current prices is 4.7%.

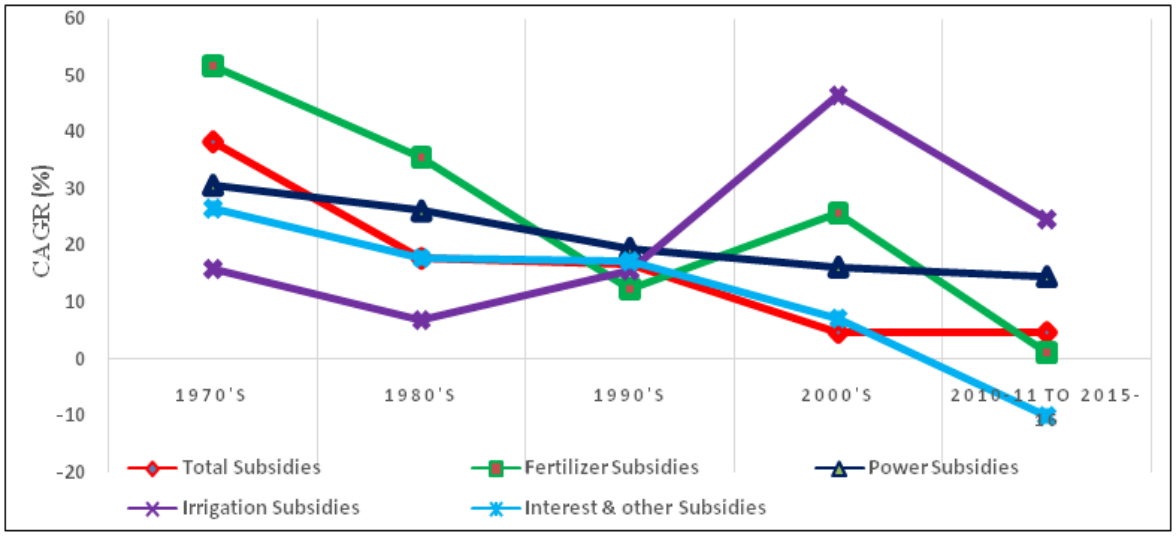

Fig 2: Trends of decadal compound annual growth rates (CAGR) of agricultural subsidies

The growth rates of the total fertilizer subsidies in the same periods as above were 51.6%, 35.6%, 12.4%, 25.8%, 1.2% and 20.1% respectively. The growth rates of the total power subsidies in the all the periods are 30.7%, 26.2%, 19.6%, 16.3%,14.6% and 20.6% respectively. The growth rates of the total irrigation subsidies in all six periods are 15.8%, 6.8%, 15.5%, 46.6%, 24.7% and 15.9% respectively. The growth rates of the total interest & other subsidies in the decades of same as above are 26.5%, 17.7%, 17.1%, 7.2%, -10.1 and 12.4% respectively in the same periods.

From Fig. 2 it can be observed that trends of compound annual growth rates of subsidies except the irrigation subsidies decreased more rapidly after the introduction of economic reforms during the period of 1990's. It gives an indication that the input subsidies declined after the economic reforms during 1990's and after Period of 1990's in percentage terms. So, from the trends of CAGR of the total agricultural subsidies and various agricultural input subsidies, it is clear that these subsidies declined after the economic reforms were introduced in the year 1991. In the pre-economic reforms period i.e., in the Periods of 1970's and 1980's most of the agricultural subsidies showed higher growth rates than after the post-economic reforms period (in the decades of Period of 1990's, 2000's and the period between 2010-11 to 2015-16).

Trends of Compound Annual Growth Rates (CAGR) of agricultural capital formation for various decades is presented in the Fig. 3 at current prices. In all the periods under study, gross capital formation in agriculture (GCFag); GCFag through public and private investments showed significant

annual growth though with varied growth rates. Highest growth rate was recorded during the Period 2000's corresponding to post reform period in case of total GCFag and GCFag private investment. Growth in the GCFag significantly lowered from Period of 1970's to 2010's as its CAGR has fallen from 18.2% to 6.8%. Overall CAGR of GCFag during entire study period i.e., Period between 1970-71 to 2019-20 was estimated at 6.9%. CAGR of GCFag in 1980's, 1990's and 2000's was estimated at 10.3%, 14.4% and 23.1% respectively.

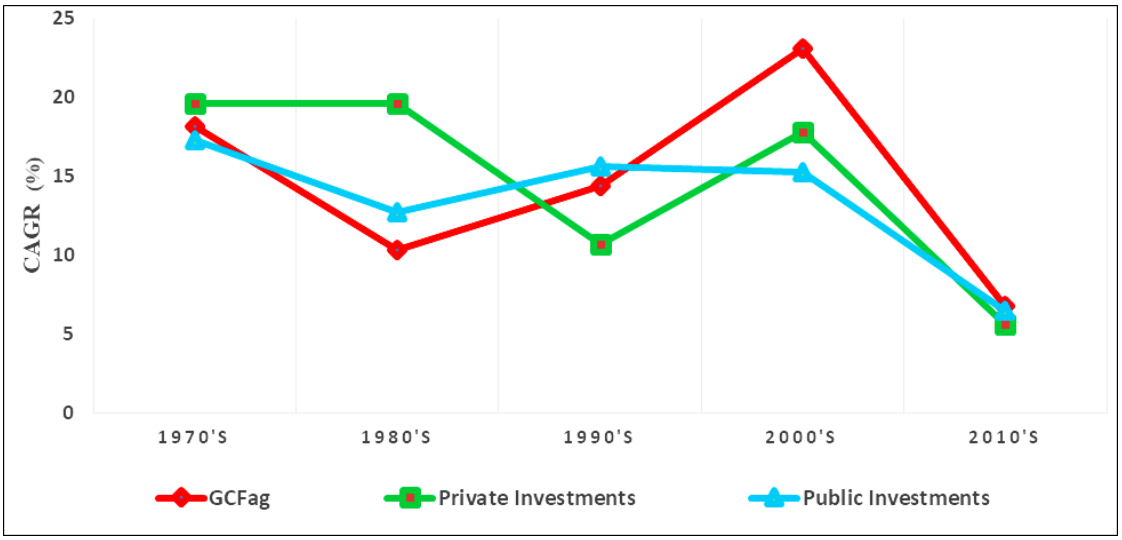

Fig 3: Trends of decadal compound annual growth rates (CAGR) of capital formation in agriculture sector

Trend line of growth rates of private investments was also shown the decreasing trend as CAGR of private investments are estimated as 19.6%, 19.6%, 10.7%, 17.8% and 5.6% in the periods of 1970's, 1980's, 1990's, 2000's and 2010's respectively. The CAGR for the private investments during the entire study period is 5.6%. in same periods as above the CAGR of public investments were estimated at 17.3%, 12.7%, 15.6%, 15.3% and 6.5% respectively. CAGR for public investments during entire study period was estimated at 7.9%.

Fig.3. clearly indicated that the growth rates of capital formation in the agriculture sector decreased in the first three decades of the study period i.e., 1970's, 1980's and 1990's and after post economic reforms period i.e., in the decade 2000's the growth rate revived and shown the increasing trend indicating that economic reforms positively impacted the capital formation in the agriculture sector. However, growth rate of capital formation in the agriculture sector again showed the decreasing trend in the period of 2010's.

3.2 Problems Related to Farm Subsidies and Capital Formation in Agriculture Sector

Based on the extensive review of literature and expert views, following issues were identified which were prioritized or ranked by using Garrett ranking technique as given below.

3.2.1 The Problems or Issues Related to Farm Subsidies

The four point continuum for all the statements of the problems of farm subsidies are given the percentage position and Garrett score in the Table 1. The problem or issue related to the farm subsidies prioritized or ranked by the subject exports are presented in the Table 2.

The over or mis use of subsidies leading to the depletion of natural resources was given the 1st rank with the Garrett score of 62.4. So the over use or mis use of subsidies was found to be most relevant constraint to the farm subsidies (Bisaliah, 2010) [6]. The 2nd most relevant constraint of farm subsidies was 'long-term use of agricultural subsidies is associated with heavy hidden costs that leave the economy with fiscal deficit' with the Garrett score of 56.95 (Madhur, 2015) [13]. Input subsidies have serious environmental effects by the excessive application of chemical fertilizers was given the 3rd rank (Ritika and Sah, 2020) [16]. Over time a rapid increase in input subsidies has squeezed public investments in agriculture which caused large scale inefficiencies in the agri-system was given the 4th rank (Madhur, 2015) [13]. Expenditure made on investments in agriculture is more powerful in alleviating poverty than the expenditure made on subsidies as marginal returns on subsidies are way below those from investments was given the 5th most relevant constraint to the farm subsidies. In the long run the agricultural subsidies are inefficient in promoting the growth of total productivity and ineffective when compared to the public spending on capital investments was given the 6th rank (Madhur, 2015) [13].

Table 1: Percentage position and Garrett score in four point continuum

Rank	Percentage Position $\frac{100(Rij - 0.5)}{Nj}$	Garrett Score
Extremely Relevant (1)	12.5	73
Mostly Relevant (2)	37.5	57
Considerably Relevant (3)	62.5	44
Irrelevant (4)	87.5	28

Agricultural subsidies have adverse effects on the cropping pattern by shifting the focus towards the water intensive crops was given the 7th rank. Agricultural subsidies distort trade by raising net exports of input-intensive commodities while lowering net exports of relatively low input using commodities was given the 8th rank. 'Farmers are accustomed to receiving government aid (subsidies) and as a result of this the farmers become sedentary and always depend on government (Ritika and Sah, 2020) [16]' and 'Increase in subsidies leads poor address of issues like market reforms and innovation in agriculture' were found to be less relevant constraints or the problems or issues related to farm subsidies.

Table 2: Prioritizing the constraints related to farm subsidies

Constraint	Average Garrett Mean Score				Total Average Score	Rank
	Extremely relevant (1)	Mostly relevant (2)	Considerably relevant (3)	Irrelevant (4)		
The over or misuse of subsidies are found to be problematic and depletion of natural resources	40.1	14.2	6.6	1.4	62.4	1
Long-term use of agricultural subsidies is associated with heavy hidden costs that leave the economy with fiscal deficit	18.2	28.5	8.8	1.4	56.9	2
Input subsidies have serious environmental effects by the excessive application of chemical fertilizers	29.2	5.7	19.8	1.4	56.1	3
Over time a rapid increase in input subsidies has squeezed public investments in agriculture which caused large scale inefficiencies in the agri-system.	18.2	19.9	15.4	1.4	55.0	4
Expenditure made on investments in agriculture is more powerful in alleviating poverty than the expenditure made on subsidies as marginal returns on subsidies are way below those from investments	25.5	14.2	11	4.2	55.0	5
In the long run the agricultural subsidies are inefficient in promoting the growth of total productivity and ineffective when compared to the public spending on capital investments	21.9	14.25	13.2	4.2	53.5	6
Agricultural subsidies have adverse effects on the cropping pattern by shifting the focus towards the water intensive crops	21.9	11.4	15.	4.2	52.9	7
Agricultural subsidies distort trade by raising net exports of input-intensive commodities while lowering net exports of relatively low input using commodities	14.6	22.8	11	4.2	52.6	8
Farmers are accustomed to receiving government aid (subsidies) and as a result of this the farmers become sedentary and always depend on government.	25.5	11.4	6.6	8.4	51.9	9
Increase in subsidies leads poor address of issues like market reforms and innovation in agriculture	14.6	8.55	17.6	7	47.7	10

3.2.2 The Problems Related to Capital Formation in Indian Agriculture

The prioritization or ranking of the problems or issues that are related to capital formation in agriculture sector of India were presented in the Table 3. Abnormal weather aberrations and output price fluctuations are effecting the Indian agriculture was found to be the most relevant problem of the capital formation in agriculture sector of India and was given the 1st rank with the total average Garrett score of 62.55 (Golait and Lokare, 2008) [10]. Inadequate risk mitigation mechanism was found to be the 2nd most relevant constraint of capital formation in agriculture and was given with the 2nd rank as its total average Garrett score is 57.9 (Golait and Lokare, 2008) [10]. The government's continuous deficit financing policy in agriculture sector was also found to be one of the relevant constraint of the capital formation in the agriculture sector as it was prioritized as the 3rd most relevant constraint of the capital formation. Backwardness and traditional farming practices leading to low productivity was given the 4th rank. Public sector investments on the basic infrastructure is declining as resources are being transferred from capital account to current account was prioritized as the 5th most relevant constraint to the capital formation in agriculture sector (Golait and Lokare, 2008) [10]. Lower marginal propensity to save of the people of India especially in rural area leading to lower capital formation in agriculture sector was given the 6th rank. Ineffective technology transfer mechanisms and inadequate extension services in the agriculture leading to low capital formation was given the 7th rank. Lack of financial institutions in the rural areas to mobilize savings and Meagre growth in the major sub sectors of the agriculture like irrigation and farm mechanization leading to poor growth of capital formation in agriculture (Golait and Lokare, 2008) [10] were ranked as the least relevant constraints of the capital formation in the agriculture sector as they were given with the ranks 8th and 9th respectively.

Table 3: Prioritizing or ranking of the constraints related to capital formation in agriculture

Constraint	Average Garrett Mean Score				Total Average Score	Rank
	Extremely relevant (1)	Mostly relevant (2)	Considerably relevant (3)	Irrelevant (4)		
Indian agriculture is effected by abnormal weather aberrations and output price fluctuation	43.8	8.55	8.8	1.4	62.5	**1**
Inadequate risk mitigation mechanism	29.2	17.1	8.8	2.8	57.9	**2**
The government's continuous deficit financing policy in agriculture sector has caused price inflation, which has deterred investments agriculture sector	29.2	11.4	15.4	1.4	57.4	**3**
Low agricultural productivity due to traditional farming practices and backwardness is constraining investment in this sector.	21.9	25.65	6.6	2.8	56.9	**4**
Public sector investments on the basic infrastructure is declining as resources are being transferred from capital account to current account	14.6	28.5	11	1.4	55.5	**5**

Lower marginal propensity to save of the people of India especially in rural area leading to lower capital formation in agriculture sector	25.5	11.4	13.2	4.2	54.3	**6**
Ineffective technology transfer mechanisms and inadequate extension services in the agriculture leading to low capital formation	14.6	22.8	15.4	1.4	54.2	**7**
Lack of financial institutions in the rural areas to mobilize savings	25.5	11.4	11	5.6	53.5	**8**
Meagre growth in the major sub sectors of the agriculture like irrigation and farm mechanization leading to poor growth of capital formation in agriculture	21.9	14.25	11	5.6	52.7	**9**

4. Conclusion and Policy Implications

By the decadal compound annual growth rate analysis of agricultural subsidies and capital formation in the agriculture sector of India, this paper concludes that the economic reforms of 1991 had contrasting impacts on subsidies and capital formation. While agricultural subsidies growth rate decreased more rapidly during post reforms period as compared to the pre economic reforms, as contrasting to subsidies, the economic reforms helped the capital formation growth rate to revive during post reforms period. Policy implications of this study includes in order to reduce the ill effects of input subsidies, rationalization of subsidy should be done across all the critical inputs, which can encourage balanced use of fertilizers, optimum & equitable groundwater exploitation, etc. for enhancing the agricultural productivity. Some input subsidies such as fertilizer and power subsidies which are inefficient should be withdrawn without causing any harm to farmers and these subsidies should be tapered off in phased manner. To improve the growth rates capital formation in agriculture, arrest of the declining trend of public investments and increase the public as well as private investments into the education, research and development projects of the agriculture sector and enhancing the public investments into research and development at least to the global average.

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