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SUBSIDIES AND INVESTMENTS IN INDIAN AGRICULTURE

Issues and Perspectives

S. MAHENDRA DEV

RAJIV GANDHI INSTITUTE FOR CONTEMPORARY STUDIES

Dr. S. Mahendra Dev is an economist who has made significant contributions in the field of development economics. He has written extensively on agricultural development, poverty and public policy, food security, employment guarantee schemes, social security, farm and non-farm employment. He did his Ph.D from the Delhi School of Economics and his Post-doctoral research at the Economic Growth Centre, Yale University and has been teaching at the Indira Gandhi Institute for Development Research, Mumbai for the last nine years. He has been a consultant to many international organizations like the UNDP, World Bank, International Food Policy Research Institute, ESCAP and has also worked as a member in committees set up by the Government of India. He is presently a Resident Fellow at the Rajiv Gandhi Institute for Contemporary Studies, New Delhi.

The views expressed in this paper are those of the author and are not necessarily those of the Institute.

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S. Mahendra Dev

1. The Problem

Unsustainability of farm subsidies has emerged as an important issue in recent policy debates. Since the mid-70s, central and state governments have followed a policy of supplying inputs at prices which do not fully cover costs. There has been an enormous increase in the amount of agricultural subsidies over the last two decades[1]. The problems due to subsidies can be divided into the following three categories:

a) Substantial contribution to fiscal problems at both central and state levels;
b) 'Crowding out' public investment in agriculture[2].
c) Negative implication for sustainability of land and water resources or capital—both natural and man-made capital.

It is very likely that increasing or maintaining the trend rate of growth of agricultural output in the future would require large agricultural investment, particularly public investment[3]. There are at least three reasons for this. First, major irrigation is likely to be more costly in the future, partly because the relatively less expensive potential sites have already been exploited and partly because the governments have to take care of the environmental costs of major dams. Secondly, there has been no significant new developments in plant breeding for a long time. We need more investments in agricultural research to achieve breakthroughs in plant breeding which can raise agricultural growth. Thirdly, more public and private investments are needed for developing and sustaining our land and water resources. It is also important to note that the growth in net sown area is negligible and the entire growth will have to come from increase in cropping intensity and productivity growth.

The problem of decline in public investment was aggravated during the Eighth Five Year Plan. On this, the Approach Paper to the Ninth Plan says that "the country has been blessed with good agricultural seasons during the Eighth Plan, but its agricultural potential has not been nurtured. Investments in the agricultural sector, particularly towards creation of irrigation potential have fallen short of targets. The strain on the agricultural economy is now beginning to show... *The percentage of short fall in irrigation capacity expansion during the Eighth Plan will be one of the highest during any Five Year Plan*" (emphasis added). On agricultural growth in the '90s, *the Economic Survey, 1996/97* (GOI, 1997) says "The annual compound growth of foodgrains for the past six years between 1990/91 to 1996/97 at 1.7 per cent is

[1] 'The trend of increasing farm subsidies started when the pro-farm lobby came to power in 1977.

[2] In the above categories, (a) and (b) are interrelated in the sense that the decline or stagnant public investment could be due to the fiscal problems created by the suhiidies at both central and state levels.

[3] The incremental capital ouput ratio (ICOR) was lower in the 1980s as compared to the earlier decades. It is not, however, clear whether lower ICOR indicates increase in efficiency of investment in the 1980s.

lower than the annual population growth of 1.9 per cent for the nineties and therefore, *a matter of serious concern"* (emphasis added) (see Table 1). The overall growth of agriculture during this period was less than 2 per cent. But, if we look at the average annual growth rate for agriculture during the Eighth Plan (1992-97), the growth rate has been around 3.5 per cent per annum. This discrepancy in growth rates could be due to the low base for the Eighth Plan period. However, whichever growth rate one accepts, the stagnant/declining public investment is a matter of concern for increasing or sustaining agricultural growth in the country. A report prepared for the U.S. Department of Agriculture indicates trouble on the food front (particularly wheat) in India. According to this report, the food situation in India is marked by "high, wheat prices, dwindling government wheat stocks, record wheat consumption, stagnant production of rice and coarse grains, and limited wheat procurement boosting policy options". The report further adds that India may have to import at least 3 to 5 million tonnes of wheat to augment the government stocks[4].

Table 1. Annual Growth in Foodgrains Production (Compound Growth Rates in percentages)

Years	Rice	Wheat	Pulses	Foodgrains
1967-68 to 1995-96	2.90	4.72	0.93	2.67
1980-81 to 1995-96	3.35	3.62	1.21	2.86
1990-91 to 1996-97	1.52	3.62	1.07	1.70

Source: *Economic Survey, 1996-97*

Turning to subsidies, the agricultural subsidies are 'crowding out' the public investment and they are not sustainable at any level of governance. The unsustainability of agricultural subsidies at the state level can be highlighted by 1ooking at the experience of Andhra Pradesh. A White Paper published by the Andhra Pradesh Government provides dimensions of different subsidies in the state for the year 1995/96. The food subsidy accounts for Rs. 1,300 crores while the subsidy in irrigation sector is estimated to be around Rs. 4,366 crores based on current costs. The power subsidy was estimated at Rs. 1,530 crores for the year 1995-96. The experience of Andhra Pradesh is true of many other states in the case of power and irrigation subsidies. Obviously, this enormous magnitude of subsidies will be unsustainable in future.

The other serious problem due to subsidies is the degradation of land and water resources and its impact on the sustainability of agricultural growth. It is known that increased subsidy in urea has led to indiscriminate use of this fertilizer. The present NPK (Nitrogen: Phosphate: Potash) ratio is 8.5:2.5:1 (the ideal ratio being 4:2:1) which is destroying soil quality. It is also known that in the case of surface and ground water, the subsidies have led to over-exploitation. Inappropriate pricing of water and poor maintenance of canal networks have led to soil degradation and deterioration in water quality. The over exploitation of groundwater resources has been mainly due to the power subsidy (in the form of flat rates) to private tubewells.

[4] See a report in *Economic Times*. March 27, 1997.

Against this background, the paper discusses some issues relating to subsidies and Investments in Indian agriculture based on the following questions.

a) What are the magnitudes of the subsidies? Who gets these agricultural subsidies?
b) What would be the impact on production and incomes of the farmers if subsidies are eliminated?
c) Can we remove subsidies without removing inefficiencies in the irrigation and power system?
d) What are the trends in public and private investments? Should we widen the definition of public investment?
e) Is there a complementarity between public and private investment?
f) How do we increase public investment? Can we shift subsidies to investment? What are the determinants of private investment?
g) What are the issues related to sustainable land and water resources?

The paper is divided into five sections. Section 2 deals with issues in the field of subsidies, while Section 3 concentrates on agricultural investment. Section 4 examines existing land and water policies and suggests improvements. The last section provides a summary of the paper and concluding remarks.

2. Subsidies —The Leading Issues

2.1 Quantitative Dimensions of Farm Subsidies

The major categories of agricultural subsidies are food, fertilizer, irrigation, power and credit (see Box 1). Food and fertilizers are borne entirely by the central government. Budgetary allocation for food and fertilizer subsidies are part of the non-plan expenditure of the central government. Apart from interest on the national debt, subsidies occupy a substantial part of the non-plan budget. Food and fertilizer subsidy has accounted for more than 70% of the total subsidy-part of the non- plan budget in the ‘80s, and it has shot up to 85.5% and 87% in two of the most recent budgets. The fiscal burden of the subsidies cannot be overstated.

There was pressure on the government during the early years of economic reforms to reduce these subsidies. However, that restraint has given way to much more increased levels of spending in recent times. For example, the budgeted figures for 1997/98 for fertilizer[5] and food subsidies[6] are Rs.8, 693 crores and Rs. 7.500 crores respectively. The food subsidy, however, may have to be distinguished from input subsidies because the subsidies on food are not limited to farmers and beneficial to both rural and urban population. The problem, however, with food subsidies in recent years is that the proportion of the subsidy financing food distribution and income transfers declined from 70 per cent to less than 40 per cent. There are also other problems of targeting, leakages, etc[7].

In this paper, we concentrate on input subsidies. Estimating the input subsidies is complicated. Two ways of measuring subsidies would be (a) the difference between

[5] Fertilizer subsidies include subsidy on the sale of decontrolled fertilizers.
[6] The Government has recently hiked the minimum support price for wheat to Rs. 475 per quintal by giving a bonus of Rs. 60 per quintal. This would raise the food subsidy by about Rs. 700 crores.
[7] See Mahendra Dev (1996) for details on problems relating to PDS.

farmer's willingness to pay and what they actually pay, and (b) the difference between suppliers' costs and the revenues they receive from farmers. Gulati and Sharma (1995)

Box 1. Farm Subsidies

Food Subsidy: Difference between the price at which the Food Corporation of India (FCI) procures foodgrains from farmers, and the price at which FCI sells (issue price) either to traders or to the Public Distribution System (PDS), with the added cost borne by FCI for storage and distribution of foodgrains. This subsidy ensures a reasonable high price to farmers (procurement price) and a reasonably low price to consumers (issue price) and food supply through PDS.

Fertilizer Subsidy: Difference between price paid to manufacturers of fertilizer (domestic or foreign) and price received by farmers. This subsidy ensures cheap inputs to farmers, reasonable returns to manufacturers, and stability in availability and price of fertilizers to farmers.

Power Subsidy: Difference between the cost of generating and distributing electricity to farmers by state electricity boards (SEBs) and the price paid by farmers to the SEBs. This acts as an incentive to farmers to invest in pumpsets, borewells etc.

Irrigation Subsidy: Difference between operating and maintenance cost of irrigation infrastructure in the state and irrigation charges recovered from farmers.

Credit Subsidy: Difference between interest charged to farmers, and actual cost of credit to banks, plus other costs such as write-offs on bad loans.

The food and fertilizer subsidies are centrally financed whereas irrigation and power subsidies are primarily state financed.

Sources: Ranade and Mahendra Dev (1997), World Bank (1996).

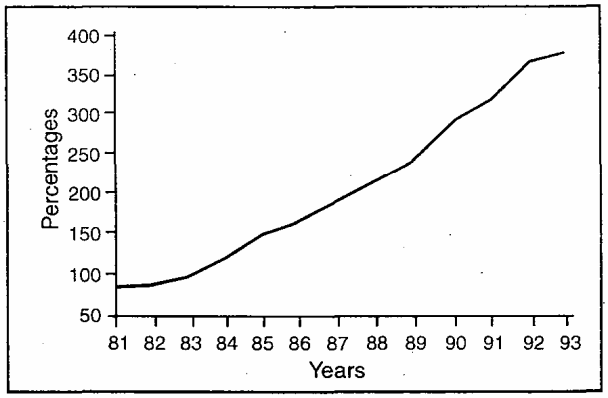
have estimated input subsidies (fertilizer, irrigation, power and credit) for the period 1980/81 to 1992/93 using the method of difference between suppliers' costs and revenues. Of these four components, they estimated irrigation subsidy in two different ways. One way is simply to take the difference between the operating budget of irrigation schemes and the revenues (charge recovery). The other way is also to include the cost of capital (interest charges on sunk capital). Expressed as a percentage of total (centre pIus states) plan expenditure on agriculture, there has been an increase in subsidies of approximately 53% in the early-eighties to 131% in the early-nineties. Similarly, as shown in Table 2, subsidies as a ratio of public investment increased from 84 per cent in 1980/81 to a whopping 377 per cent in 1992/93 (see Fig.!). In other words, the amount of subsidies is four times to the public investment in agriculture in the early-nineties. As discussed below, if

Table 2. Input Subsidies as a Percentage of Public Investment and GDP in Agriculture

Years	Total Input Subsidies	Public Investment in Agri.	GDP in Agri.	Subsidies as % of Public Investment in Agri.	Subsidies as % of Agri. GDP
	Rs. Crores in Current Prices				
1	2	3	4	5	6
1980/81	1515	1796	46649	84	3.25
1981/82	1678	1934	52685	87	3.18
1982/83	2083	2109	56151	99	3.71
1983/84	2706	2246	67498	121	4.00
1984/85	3654	2463	71994	148	5.08
1985/86	4288	2621	69964	164	6.13
1986/87	5077	2667	74405	190	6.82
1987/88	6571	3057	83515	215	7.87
1988/89	7591	3162	104103	240	7.29
1989/90	8634	2989	115447	289	7.48
1990/91	10162	3193	135162	318	7.52
1991/92	11867	3230	159299	367	7.45
1992/93	14128	3750	177910	377	7.94

Sources: Col. 2: Gulati and Sharma (1995)
Col. 3 and 4: *National Accounts Statistics*

Figure1. Subsidies as a Percentage of Public Investment in Agriculture



some of the input subsidy expenditures had gone as investments into agriculture, the implication for agricultural growth would have been tremendous.

2.2 Who Gets the Input Subsidies?

We examine here the inter-regional and inter-personal disparities in getting the input subsidies. Another issue of interest is whether the agriculture sector is getting the entire amount of the so-called 'agricultural subsidies'.

2.2.1 Fertilizer Subsidies

According to some calculations, cultivators received only 52 per cent of the central government budgeted fertilizer subsidy (average figure from 1980/81 to 1992/93). The rest of the fertilizer subsidy (48 per cent) may be going to the fertilizer industry

or its feed stock agencies (Gulati and Sharma, 1995). Therefore, a significant payment of the subsidy appears to be a transfer payment to inefficient fertilizer manufacturers[8]. Also, part of the subsidy payment going to manufacturers is in turn transferred to the petroleum industry since feed stock prices are controlled by the government.

It is true that farmers have benefitted from the fertilizer pricing policies of the government. However, most of the benefits went to the producers of irrigated paddy, wheat and sugarcane, Also, developed states like Punjab and Haryana got much higher share of subsidies than other states. There are considerable regional disparities in the use of fertilizers. In 1994/95, the fertilizers consumption per hectare varied from 175 kg. in Punjab to 9 kg. in Assam. Within the states also, developed districts corner much of the fertilizers. For example, in Maharashtra, fertilizer use in Kolhapur division is much higher than other regions because of sugarcane cultivation.

Fertilizer use by farm size reveals that per hectare fertilizer consumption is not lower for marginal and small farmers as compared to large farmers. However, some small and marginal farmers may not be using it because of credit constraints. A study by Kumar and Desai (1994) provides a detailed, realistic data on the use of fertilizer, in the mid-1980s, by 3,165 farmers located in 54 districts of 14 major states. The data show the following characteristics of the small and marginal farmers as compared to medium and large farmers.

a) Fertilizer adoption[9] is positively related to farm size: it ranged from 72 per cent for the marginal group of farms to 89 per cent for large farms.
b) Discontinuous use of fertilizers is more common among marginal and small farmers.
c) Proportion of farmers using fertilizers is also lower among marginal and small as compared to the rest of the farmers.
d) However, the proportion of area fertilized does not vary much across farm-size classes.
e) Moreover, the quantity used per hectare of fertilized area is inversely related to farm size on the irrigated and the partially irrigated farms, while on the fully irrigated farms—variation across farm size shows no pattern.

2.2.2 Irrigation and Power Subsidies

In the 1 980s, five states, Uttar Pradesh, Andhra Pradesh, Bihar, Rajasthan and Punjab constituted around half of India's irrigation subsidy. The high subsidy to irrigation water provides incentives for high water intensive crops. For example, in Maharashtra, sugarcane with less than 3 per cent of the cultivated area, consumes around 60 per cent of the total irrigation water in the state.

The estimated power subsidy for agriculture for the years 1994/95 and 1995/96 was around Rs. 10,000 crores and Rs. 15,000 crores respectively. If we add the domestic sector, 'the effective subsidy' in 1994/95 was Rs. 13,070 (GOI, 1995). However, the cross subsidy from commercial and .industrial sector covered around 45 per cent of the 'effective subsidy' to agriculture and domestic sectors in 1994/95.

[8] The share of fertilizer subsidy going to the farmers may partly depend on the international prices. International prices are very volatile and sometimes the prices vary from $60 per tonne to more than $200 per tonne. This was pointed out by Mukesh Srivasatva, CACP (personal communication).

[9] Adoption is defined as fertilizer being used by. a farmer at one time or the other.

Thus, cross subsidization takes care of some of the losses incurred by the agriculture sector.

The electricity subsidies have increased significantly over time. For example, in Maharashtra, the power subsidy to agriculture (in current prices) increased from Rs. 419 crores in 1986/87 to Rs. 1600 crores in 1992/93. This subsidy as a per cent of total revenue expenditure of the Maharashtra Government increased from 8.4% in 1986/87 to 13.9% in 1992/93. According to the Rajadhyaksha Committee Report[10], the agricultural subsidy in Maharashtra in 1996/97 was a whopping Rs. 2,845 crores (Table 3). The cost of producing energy is 241 paise per kwh while the recovery from agriculture is around 24 paise.

A study by the National Development Council shows that 80 per cent

Table 3. Power Subsidies in Maharashtra: 1996/97

Consumers	Cost of Energy (paise/ unit)	Average rate (paise/ unit)	Gap in rates (paise/ unit)	Recovery (%)	Subsidies (Rs. crores)
Agriculture	241	24.42	216.58	10.13	2,845
Domestic	241	135.83	105.17	56.36	472
Low tension industry	241	184.42	56.58	76.52	86
Rural water supply	241	25.00	216.00	10.37	83
Powerlooms	241	66.02	174.98	27.37	62
Street lights	241	86.74	154.26	35.99	46
Public water supply	241	167.45	73.55	69.84	4

Source: *Rajadhyaksha Committee Report*

of the farmers do not benefit from the agricultural power subsidy. The main beneficiaries are 2 per cent of farmers who are members of large lift irrigation schemes. The present system provides higher subsidies for farmers with larger capacity pumps rather than small needy farmers.

Over estimation of power subsidy to agriculture: The Effective Subsidy is the amount actually lost by the SEB on account of selling at less than average cost to a sector, i.e., average cost minus average tariff times the number of units sold to a given sector. These are overestimates because we do not have meters in many states to estimate the power consumption by agriculture. The unmetered supply of electricity to the agricultural sector is being misused to cover very high transmission and distribution (T&D) losses and pilferage. Due to heavy load sheddings and low growth rate of electricity production. The farmers have been facing several problems. Moreover. T&D losses are fast increasing in the absence of adequate system improvements. Thus, farm power subsidies are overestimates and the farmers may be getting only part of this subsidy[11].

[10] This Committee was appointed to look at the problems in the power sector of Maharashtra

[11] It may, however, he noted that the distribution costs are much higher for rural areas as compared to urban areas. In that way power subsidies are underestimates to the extent of excess costs of distribution.

Use by size of farm: Irrigation and use of power seem to be as high under small farms as compared to large farms. However, these are cornered by the farmers in irrigated areas and those in unirrigated areas do not get these subsidies. Most of the fertilizer subsidy also goes to the farmers under irrigated area.

2.2.3 Credit Subsidies

According to estimates by Katula and Gulati (1992), credit subsidies in. the 1980s were higher in states like Punjab, Haryana, Maharashtra, Andhra Pradesh, Tamil Nadu as compared to the poorer states of Orissa and Madhya Pradesh. A look at credit by size of the farm shows that the large farmers have been the major beneficiaries of the long term loans advanced at a concessional rate of interest. The share of large farmers in total institutional credit is significantly higher than their share in total operated area.

To sum up, during the initial stages of the adoption of new technology in agriculture some of these subsidies may be justified as 'front-up costs'[12] However, over time it was found that the richer states and irrigated areas, certain crops, and sometimes rich farmers, captured a disproportionately high share of the major input subsidy programmes for fertilizer, power, irrigation and credit[13].

2.3 What would be the Impact of 'Getting Input Prices Right' on Production and Incomes?

Those who support the subsidy regime argue that farmers would be adversely affected in terms of loss of production and incomes due to withdrawal of subsidies. For example, it is being argued that since the initiation of economic reforms in 1991, the growth of fertilizer consumption has declined. In fact, the consumption of chemical fertilizer during the period 1990-91 to 1993-94 has been stagnant around 12.5 million tonnes (see Table 4). Fertilizer consumption seems to have gone down in many states during the initial years of the reform period due to increase in fertilizer prices. The decline or stagnancy in fertilizer consumption is given as one of the reasons for the poor performance in agriculture in the 1990s. It is generally true that non-price factors are more important determinants of fertilizer consumption than price factors. However, it has been found that increase in fertilizer prices led to the decline in consumption. Therefore, the dilemma here is how

[12] According to Alagh (1997), Ignacy Sachs has used the word 'front-up costs' which means giving temporary subsidies because of market failures and withdrawing as you go on.

[13] Part of the Punjab's success in agriculture could be due to the input subsidies to farmers. The studies have shown that Punjab has cornered larger share of total subsidies.

Table 4. Consumption of Chemical Fertilizers in the 1990s (Million tonnes)

Year	Nitrogen(N)	Phosphate(P)	Potash(K)	Total
1990/91	8.0	3.2	1.3	12.5
1991/92	8.0	3.3	1.4	12.7
1992/93	8.4	2.9	0.9	12.2
1993/94	8.8	2.7	0.9	12.4
1994/95	9.5	2.9	1.1	13.5
1995/96	9.8	2.9	1.2	13.9
1996/97*	11.2	3.7	1.5	16.4

*Estimated
Source: *Economic Survey, 1996/97*

to reduce the fertilizer subsidy without reducing the crop production.

On withdrawal of subsidy on irrigation, one study shows that if full financial costs of water were charged, the cost of water input alone would absorb the total gross value. If water were charged at its full cost, farmers simply could not afford to grow wheat, rice or maize on the irrigated lands (Hanan, 1993). Therefore, what is being suggested is that at least we should seek full recovery of operation and maintenance (O&M) costs and treating capital costs for irrigation as a public expenditure rather than subsidy.

Part of the ongoing reforms involve removal of these subsidies with a view to reduce fiscal imbalance and also to remove the distortions in farm input prices to promote efficient use of these inputs[14]. While these are laudable medium to long term benefits, in the short run, subsidy removal can have adverse consequences on production and incomes. These adverse welfare effects in the short run may make subsidy removal politically difficult. However, as discussed below, the overall impact need not be so bleak if we remember that subsidy removal results in resources being released for more productive use elsewhere. Also, a gradual phasing out of irrigation and power subsidies is needed to give some time to the farmers and power sector for adjustment.

Another issue is the impact of withdrawal of subsidy on small and marginal farmers. The policy of 'getting the prices right' would lead to increase in input and output prices. This policy would benefit only those farmers who have marketable surplus. The small and marginal farmers who do not have marketable surplus could be worse- off with high input and output price policy. This is because now these farmers have to pay higher prices for inputs without getting any benefits from the higher output prices. Therefore, the small and marginal farmers have to be compensated by the Government in some other form while withdrawing input subsidies.

2.3.1 Inefficiencies, Farmers 'Protests and Withdrawal of Subsidies

The many inefficiencies in the power and irrigation systems of India are adversely affecting the farmers. For example, erratic power supply in Medak district of Andhra Pradesh led to demonstrations by farmers and we may see more 'power riots' in future. One frustrated farmer committed suicide because his parched fields could not get water which was due to power problems. The obsolete distribution lines and inadequate transmission capacities led to erratic power supply and the farmers were

[14] See Bhalla (ed., 1994) for several issues on liberalization in Indian agriculture.

not able to irrigate even a portion of their fields during the scheduled power supply. Apparently, the irrigation systems have also been neglected in the district.

An issue regarding subsidies is whether they should be withdrawn without improving the efficiency in supplying inputs. While withdrawing subsidies, care should be taken to remove inefficiencies in production and distribution of inputs and services e.g., in the production and distribution of fertilizers and electricity, and creation and distribution of irrigation facilities. For example, a farmer may not be willing to pay the full cost for intermittent power supply. The distribution system is characterized with inefficient transmission and widespread pilferage. This is a very serious problem and has to be averted by a comprehensive time bound action plan for a systemic improvement. Otherwise the nation will move towards a catastrophic situation on the power front. The irrigation system is characterized by inflated costs on account of bad design, inferior quality of services and inefficiencies in management, delays and leakages in construction. With the increase in population and food production, there is a greater demand on the canal system and in some areas these systems have been the same for the past 90 to 100 years. Canals which were designed for providing water for one crop now provide water for two or more crops.

In the case of fertilizers, it is felt that removal of Retention Pricing Scheme (RPS)[15] would improve the efficiency of fertilizer industry. Also, in the new environment, the emphasis has to be shifted from indiscriminate increase in the rate of application to improving the efficiency of fertilizer use. According to Vaidyanathan and Desai (1994), this shift requires "serious attention to a more balanced application of nutrients, identification and correction of micronutrient deficiencies, and various deficiencies in water management systems that lower efficiency of fertilizer use. This again underscores the importance of improving the research and extension support services, and also viewing problems related to the use of inputs like fertilizers in the context of prudent management of land and water resources.' They claim that these measures could also help to counter the political resistance to withdrawal of fertilizer subsidies.

Due to the above mentioned inefficiencies, the actual subsidy going to the farmers for use of these inputs is far less than what is projected. Subsidies should be withdrawn and the amount should be used for correcting the inefficiencies in the input use delivery systems. The efficiency of input use in the country is very poor. Research and extension efforts should also be directed to ensure efficient use of inputs.

2.3.2 Subsidy as a Political Weapon

Since the early 1980s, farm subsidy has become a political weapon to become popular and to win elections. Some examples are: NTR's two rupee kilo scheme,, free power to farmers by the Tamil Nadu Government under Jayalalitha, *'loan-melas'* of late 1980s. The latest to join the club are the governments of Punjab, Kerala and Bihar

[15] The fertilizer producers are given a price called the retention price that is fixed on a plant by plant basis and this price varies across plants. The retention price is fixed on an ex-factory basis to ensure a 12 per cent rate of return on net worth using normative costs.

which have decided to provide free electricity to .farmers[16]. The danger is, politicians in other states may also use this weapon now, and that could prove disastrous for the country.

The experience of Andhra Pradesh in agricultural subsidies (food, power, irrigation) shows that such subsidies make not only bad economics but bad politics as well. As food subsidies became unsustainable, the Chandrababu Naidu government had to increase the price of subsidized rice from Rs. 2 to Rs. 3.50. Thanks to the populist policies, the Andhra Pradesh government has totally neglected infrastructure. Sometimes the government does not have money to pay salaries. The weapon of agricultural subsidy may give short term political gains but it would not give sustainable political gain. In other words, bad economics may become good politics in the very short run but it would become bad politics in the medium term (it is a different matter if politicians are interested only in short term gains!).

In any case, the policy of giving free power and irrigation has to be stopped. One way of stopping these populist measures could be done through electoral reforms. Power and irrigation subsidies account for more than half of the subsidy in agriculture, both of which are supported by state governments. The Election Commission may have to give an Order saying that those who announce free power, free irrigation water and loan melas will not be eligible for contesting in future elections.

3. Issues in Agricultural Investments

3.1 Trends

Higher investment in agriculture and rural infrastructure is a necessary condition for increasing agriculture growth. The government's role seems. to be much more important for not only raising public investment but also for inducing private investment. The worrying aspect regarding investment is that its growth rate in agriculture rose only for a decade following the Green Revolution and later it declined significantly for both public and private sectors. The following points may be noted regarding the trends in agricultural investment (public and private) in India[17]

1) There has been a decline in public investment in agriculture over the last decade (see Fig. 2). The growth rate of public sector investment in agriculture increased from 3.54 per cent during the period 1960/61 to 1975/76 to 7.9 per cent during 1972/73 to 1982/83 and showed a decline at the rate of 4.25 per cent per annum during 1980/81 to 1990/91 (Mishra, 1996). There has been an absolute decline in public capital formation during the 1980s. It further declined in the early 1990s (Table 5). Canal and tank irrigation, which is largely the preserve of the public sector, has shown very little growth since 1980.
2) The rate of growth in private sector investment in agriculture declined from 4.89 per cent during 1960/61 to 1975/76 to 3.20 per cent during 1972/73 to

[16] National Development Council (NDC) has set up a committee of Chief Ministers which said that sooner or later all state governments must take on themselves the responsibility of levying at least a certain minimum rate, at least 50 paise per unit even for agriculture.

[17] There are several problems with the NAS (National Account Statistics) data on agricultural investments, particularly private investments. For details see Mishra (1996) and Kumar (1996).

1982/83 and to .2.80 per cent per annum during 1980/81 to 1990/91. Well (tubewell and other wells) irrigation which is mainly under private initiative has shown rapid growth over the same period (Ganesh Kumar, 1992).

3) The data also show that although real gross capital formation in agriculture by the private sector has increased since 1987/88, the total investment is still lower than that achieved in the early, 1980s because of the decline in public investment (Fig. 2). The total agricultural investments were higher since 1992/93 mainly due to higher private investments.
4) The share of fixed capital formation in agriculture GDP, however, increased from 5 per cent in the 1950s to around 9 per cent in the I980s. In the late I980s, it declined to below 8 per cent (Table 5) and it was around 8.5 per cent in the mid-nineties[18] (Fig. 3).
5) At the state level, capital investments in power and irrigation declined in poorer states like Orissa, Bihar and Uttar Pradesh during 1990/91 to 1994/95 (Table 6).

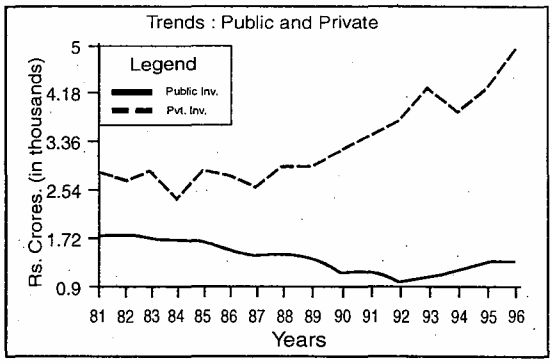
Table 5. Agricultural Investment (Rs. Crores, 1980/81, Constant Prices)

Year	Total GCF in Agri.	Public (GCF)	Private (GCF)	GFCF in Agri.	% of Agri. GFCF in Agri GDP
1980-81	4636	1796	2840	4537	10.68
1981-82	4499	1779	2720	4346	10.34
1982-83	4575	1725	2850	4409	10.53
1983-84	4097	1707	2390	3957	7.95
1984-85	4551	1673	2878	4287	8.63
1985-86	4322	1516	2806	4068	8.16
1986-87	4015	1428	2587	3798	7.75
1987-88	4418	1461	2957	4219	8.57
1988-89	4349	1364	2985	4260	7.35
1989-90	4355	1157	3198	4191	7.16
1990-91	4594	1154	3440	4460	7.31
1991-92	4729	1002	3727	4434	7.46
1992-93	5372	1061	4311	5259	8.30
1993-94	5038	1153	3885	5550	8.47
1994-95	5678	1329	4349	5886	8.55
1995-96(Q)	6301	1310	4991	------	------

Q: Quick estimates: GCF: Gross Capital Formation' GFCF: Gross Fixed Capital formation.
Sources: *1. CSO, National Accounts Statistics,* various issues;
2. Economic Survey, 1996/97; 3. Approach Paper to the Ninth Plan

[18] The share of gross capital formation in agriculture in total investment has declined from 17 per cent in 1980/81 to around 9 per cent in the early 1990s. However, it was pointed out that the decline in total investment in agriculture is to be expected in light of the declining share of agriculture in GDP (Alagh, 1997, Mishra and Chand, 1995). It is an experience shared by many developing countries. But, agriculture has to support more than 65 per cent of the workers in the country and we may need more capital for this sector.

Figure 2. Agricultural Investment



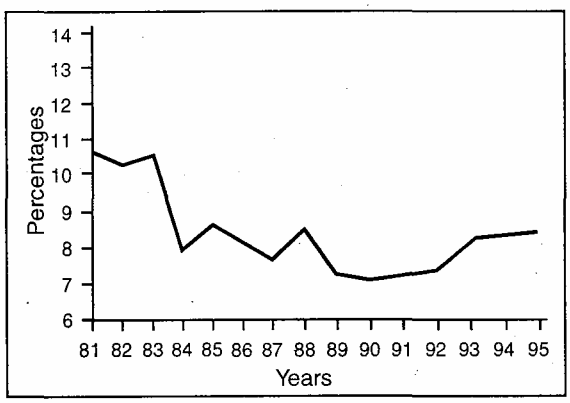
Regarding trends in agricultural investment, it has been argued that one has to look at gross fixed capital formation (GFCF) rather than gross capital formation (GCF) because of the fluctuations in stocks (Alagh, 1991, Mishra and Chand, 1995). The numbers for total GFCF shows that it increased in the last few years[19] (Table 5). Unfortunately, we do not have GFCF by public and private sectors. However, the trends in public sector GFCF would have been similar to those of GCF with minor differences.

Table 6. Capital Investments on Power and Irrigation: 1990/91 to 1994/95

Improved	Unchanged	Worsened
Maharashtra	Tamil Nadu	Karnataka
Rajasthan	Andhra Pradesh	Orissa
	West Bengal	Gujarat
		Bihar
		Uttar Pradesh

Note: The indicator used here is the ratio of capital investments on power and irrigation to state domestic product.
Source: Based on World Bank (1996)

Figure 3. Percentage of Agriculture GFCF in Agriculture GDP



[19] AIagh (1997) says that the GFCF has not declined but showed fluctuations over time.

3.1.1 Should We Widen the Definition of Public Investment?

According to the Central Statistical Organisation's (CSO) estimates, public sector investment is mainly in irrigation projects. Some researchers feel that this is an underestimate and point out a need for widening the definition of public investment by including infrastructural expenditures on rural roads and electrification. In other words, we have to include investments of both in and outside the agricultural sector[20]. As discussed below, the Government allocates large funds on anti-poverty programmes in the form of 'revenue expenditure' under the category of 'Rural Development'. For example, around Rs. 40,000 Crores were spent during the Eighth Five Year Plan. Part of this so-called 'revenue expenditure' helps in capital formation. As shown by Kurian (1987), nearly 55 per cent of the expenditure on IRDP results in capital formation. Similarly, some of the activities under JRY may be increasing the capital formation for agriculture although there are problems, like the construction of 'roads that get washed away in the next monsoon'. Thus, there is a need for systematic studies on trends in public investment by widening the definition to include the expenditure which can be considered as investment.

3.2 Complementarity between Public and Private Investment

There has been a debate on the complementarity between public and private investment in agriculture. Earlier studies on public investment have shown that it induces private investment[21]. "Availability of irrigation through public canals induces private investment in tractors and other implements. Availability of power induces private investment in pumpsets. Thus, it appears that, other things remaining equal, a rupee of public investment in agriculture induces private investment in this sector to an extent substantially higher than a rupee" (Krishnamurty, 1985).

In recent studies, the complementarity between public and private investment has been questioned. Mishra and Chand (1995) argue that the relationship between public and private investment depends on the nature of technology and the relation might well be of substitution, instead of the two having a complementary nature. Using a regression between public and private investments for the period 1980/81 to 1989/ 90, Mishra and Hazell (1996) have shown that "the role of public investment in influencing the private investment turned out to be quite weak, as it is significant at 15% level .... The complementarity relationship between public and private investment had also been broken during the 1980s". Alagh (1997), however, has questioned the validity of their finding and argued that it is too early to make "a strong case for substitution (or even a weaker case of non-complementarity) between public and private investment in Indian agriculture".

By testing the effect of canal irrigation on farmers' investment, Dhawan (1996) examines the question of public investment inducing private investment. This is done at both macro and micro levels. The analysis done using Debt and Investment Survey Data (RBI) shows that the elasticity of fixed capital formation in agriculture on private account with respect to canal irrigation ratio is 0.25 in a multiple regression

[20] See Dhawan (1996a). Dhawan is not in favour of disturbing the existing NAS (National Accounts Statistics) classification of capital formation by sectors.

[21] See Chakravarty (1987), Patnaik (1987), Rath (1989), and Shetty (1990).

equation. The micro-level data on Punjab and Karnataka also show that canal irrigation induced private investment in well irrigation.

An important issue which is not stressed in most discussions is the impact of government's input subsidies on private investment[22].

We have already seen above that the estimated subsidies at both central and state levels have been very large since the late 1970s. The most notable subsidies are in power, irrigation and diesel. What would be the impact on private investment in agriculture if these subsidies are withdrawn? It is true that the entire portions of input subsidies are not accruing to farmers and there are inefficiencies in the system. One can argue that instead of giving input subsidies, the government should concentrate on rectifying the inefficiencies and this may induce more private investment.

3.3 How to Increase Agricultural Investments?

As discussed above, India needs higher agricultural investments for increasing agricultural growth. The low rate of growth of agricultural investments is a matter of serious concern as it would have an adverse impact on long-term agricultural growth prospects. Given the importance of agriculture in India, the repercussions of a fall in agricultural growth would be felt in all sectors of the economy. Particularly, the incomes and welfare of the poor who depend on agriculture would be severely affected. Shortages in the supply of foodgrains could arise in the long-run forcing the country to depend on volatile foreign imports to meet its foodgrain needs.

The fixed capital formation was around 10 per cent of GDP in the early l980s but was only 8.55 per cent in 1994/95 at 80/81 prices. The incremental capital output ratio (ICOR) has declined from around 4.37 during 1978/79 to 1986/87 to 3.32 during 1987/ 88 to 199 1/92. As mentioned by Alagh (1997), even if the agricultural ICOR is around three, the ratio of fixed capital formation to GDP should be around 12 per cent to achieve 4 per cent rate of growth.

3.3.1 Options for Increasing Public Investment

Subsidies and Investment: The decline in public investment is attributed to diversion of resources from investment to current expenditure in the form of subsidies[23]. The rise in current expenditure was also due to larger expenditure on maintenance of existing projects. As noted earlier, the current subsidies on farm inputs and credit is a major strain on the government's resources. Reducing these subsidies suggests itself as a source of finance for public investments in agriculture. However, in the short run, it may be difficult to remove all the subsidies. The process of reduction of subsidy will have to be gradual. In the short run, therefore, public investment for agriculture

[22] Dhawan (1 996a) and Alagh (1997) mention this hut the relationship is not elaborated. For example, Dhawan says "Since rural electric power for irrigation pumpsets is highly subsidized in India, the inducement effect of rural electrification programme on the farmer's own investment in lift irrigation (from groundwater as well as surface water bodies) has been possibly heightened by the subsidy factor which has made unit cost of watering with an electric motor to be typically half as much from that on oil-driven pumpset". Alagh (1997) mentions that the complementarity of public and private investment can be seen more strongly in project level data.

[23] See Shetty (1990)

has to come from other sources in the central and state budgets. Much of the agricultural investment, particularly on irrigation is the responsibility of the states. Therefore, financing options have to be examined at the state level. Increase in public savings by reducing current expenditures is one option. In the medium to long term, increase in public investment is possible by removing subsidies. Such a transfer of funds from subsidies to investment, is desirable for growth and improving the welfare of the poor[24].For example, according to a World Bank estimate, during the, '80s agricultural subsidies increased three times faster than expenditure which promote productivity growth, and the former now dominate public spending. Thus, by 1994/95, around 40 per cent of total spending on agriculture was absorbed by subsidies. The share of productivity enhancing expenditure in the total agricultural expenditure declined from 60 per cent in 8 1/82 to 38 per cent in 94/95 (World Bank, 1996). With the transfer of subsidies to investment, two benefits can be achieved. One is that distortions in input subsidies can be eliminated and input prices would be brought in line with real costs. Secondly, it would encourage agricultural growth through higher public investment.

Expenditure on 'Rural Development' and Investment: The Government has been allocating larger amount of funds to anti-poverty programmes under the category of 'Rural Development'. These are basically funds given to employment programmes like IRDP and JRY. As shown in Table 7. around Rs.40, 000 crores were spent on these programmes during Eighth Plan. The table also shows that there has been a shift from irrigation expenditure towards anti-poverty programmes. The share of expenditure on rural development increased from 26.8 in the Sixth Plan to 38.7 per cent in the Eighth plan. During the same period, the share of irrigation sector declined from 41.8 per cent to 28.1 per cent.

It is known that the programmes like IRDP and JRY are found to suffer from leakages and only a part of. the funds are reaching the poor. Therefore, some people feel that the funds under these programmes could be shifted to productivity enhancing activities, like power and irrigation. This is a valid suggestion. It may, however, be noted that inspite of leakages, there has been capital formation under IRDP and JRY. Moreover, these programmes also have the social objective of equity in terms of helping the poor. It is a different matter whether the equity objective is being achieved from these programmes! One option is to improve the effectiveness of these programmes through Panchayati Raj. Otherwise, we have to transfer these funds to irrigation and other productive investments.

State Finances: The states have the major responsibility in raising agricultural investments, particularly in irrigation. One concern is that there has been a 20 per cent shortfall in state plan outlays in the Eighth Plan. One of the reasons could be the

[24] Parikh et al (1995), through simulations, conclude that "it is better to subsidise investment in irrigation rather than use of current inputs" and that a policy package involving trade liberalization, input subsidy removal, extra investments in irrigation and enhanced and targeted rationing (perhaps through programmes like EGS, JRY, etc.) promotes growth (through improvements in efficiency) and improves welfare of the poor in rural and urban areas, without posing any additional burden on the government's resource position.
This transfer of subsidies to investments is of course, not easy. For example, even if credit subsidies are removed, the saved amount would not be directly transferable to public investment. But, reduction of fertilizer, water and, power subsidies can be directed towards investment in agriculture (see Ahluwalia, 1996).

decline in Central transfers to states. In the '90s, the net transfer of resources from the Centre as per cent of GDP declined from around 6.0 per cent in 1990/91 to 4.3 per cent in 1997/98. However, states themselves are to he blamed for the erosion of their plan outlays. It may be noted that only a fifth of the resources of the states went into the plan account during the Eighth Plan. The remaining was spent on unproductive activities. Over the years, the states have depended on centrally sponsored programmes for investments and diverted their funds for populist programmes. The funds for social sector are also getting reduced because of the subsidies. Now with possibility of decline in central transfers and centrally sponsored programmes, the states have to increase investments for creating productive assets by reducing funds for unproductive activities.

3.3.2 Determinants of Private Investment

The fixed investments by the farmers are generally made in well irrigation, other irrigation sources, agricultural implements, machines and transport equipments, reclamation of land, farm houses, orchards and plantations, bunding and other improvements.

Table 7. Plan Expenditure on Agriculture Sector: Centre and States

Components[25]	Expenditure (in Rs. billion)			In Percentage		
	6th Plan (1980/85)	7th Plan (1985/90)	8th Plan (1992/97)	6th Plan	7th Plan	8th Plan
Agriculture & Allied	66.24	127.93	269.53	25.4	26.6	25.9
Rural Development	69.97	152.47	402.91	26.8	31.7	38.7
Special Area Programmes	15.80	34.70	77.32	6.1	7.2	7.4
Irrigation & Food Control	109.30	165.90	292.34	41.8	34.5	28.1
Total Agriculture Sector	261.31	480.99	1042.11	100.0	100.0	100.0

Source: Estimates by the author based on the information given in various plan documents.

One of the major factors determining private investment is public expenditure including investment. Private investments can be expected to grow given the complementary effects of public investments mentioned earlier. Further, investments in public works programmes that create infrastructure generate employment and

[25] Details of the major heads of Agriculture Sector

1. .Agriculture & Allied sector

Crop husbandry, soil and water conservation, animal husbandry, dairy development, fisheries, forestry and wild life, plantation, food, storage & warehousing, agricultural research and education, agriculture financial institutions, marketing and quality control and cooperation.

2. Rural Development

Special Programmes for Rural Development: Integrated Rural Development Programme (IRDP) and Allied Programmes, drought prone area programme (DPAP), Integrated Rural Energy Programme (IREP).

3. Backward Area Programme

4. Irrigation and Flood Control

Major and Medium Irrigation, minor Irrigation, Command Area Development, Flood Control.

incomes and poverty alleviation programmes that improve the asset base of the poor would also act as a catalyst in. increasing private investments in agriculture[26]. The Government's subsidies are also responsible for private investments like tubewell irrigation.

Regarding other factors, a study by Gandhi (1996) shows that rural savings and cooperative credit, followed by the extent of use of high-yielding varieties (HYVs), level of agricultural wages and commercial bank credit positively influenced private capital formation. The institutional credit seems to be one of the crucial variables in determining private investment. In recent years however, the credit availability has been stagnant (see Table 8). Efforts have to be made to increase the availability of credit which can increase private investment[27]. In a credit constrained economy, credit policy should play a vital role in determining private investment and agricultural performance.

Table 8. Credit to Agriculture (Rs. Crores at 80-81 Prices)

	1989-90	1992-93	1993-94	1994-95
Credit	4390	4915	4998	5890
(a) Short-Term	2684	3270	3415	3964
(b) Medium and Long Term	1706	1645	1583	1926

Source: Approach paper to the Ninth Plan

4. Issues Related to Sustainable Land and Water Resources

It is a well know fact that there is little scope for further expansion of net sown area and that land scarcity will become an acute feature of the rural economy. Water is a precious national asset and there are several concerns regarding water resources in the country. Therefore, a judicious use of land and water resources well have to be the central concern of agricultural growth policies[28]. In this context, this section briefly discusses the emerging problems regarding sustainability of land and water resources. It may be noted that the input subsidies and investments in agriculture have negative and positive impacts respectively in raising the sustainability of land and water resources.

4.1 Land Degradation

The official estimates show that around 130 million hectares of land (45 per cent of total geographical area) is estimated to be affected by serious soil erosion through

[26] See Mahendra Dev (1996) on the direct and indirect benefits of public works programmes.

[27] In recent years, the Central Government has taken some initiatives to expand the irrigation sector. Rural Infrastructure Development Fund (RIDF-**I**) was launched in 1995/96 with a corpus of Rs. 2000 crores to attend to the needs of rural infrastructure with aims at accelerating completion of on-going irrigation project. During 1996/97 also, an amount of Rs. 2,500 crores has been provided under RIDF-II**.** In additional loan assistance of Rs. 900 crores has been provided to the states under Accelerated Irrigation Benefit Programme for the year 1996/97. A new scheme called Ganga Kalyan Yojana was started and Rs. 200 crores were allocated in the recent budget

[28] See Alagh (1997), Rao (1994) and Vyas (1994) for issues on land and water resources**.**

ravine and gully, cultivated waste lands, waterlogging, shifting cultivation etc. The main reason for soil erosion is poor agricultural practices which leave no vegetative cover and thus no protection against flowing water and winds. Around 28 per cent of the degraded land belongs to forest area (Table 9). Within the non-forest area, 78 per cent of the degraded land is due to water erosion. The water erosion could be due to problems in the agricultural land or due to deforestation. India has a forest of around 64 mha. Which constitutes only 19.5 per cent of the total land area as against the target of 33 per cent envisaged by the National Forest Policy of 1988? A large part of these forests is degraded and has very low productivity. The assessment is much lower than official statistics. The closed type of forest having forest cover density of 40 per cent or more is approximately only 11 per cent of the country's total land area. Anyhow, the depletion of forest cover is assuming alarming proportions. The magnitude of land degradation in both forest and non-forest areas is large and the problem is serious.

Watershed Development Programmes through afforestation and other soil controlling measures in the catchments of reservoirs can partially check land degradation. However, the efforts so far are minuscule in relation to the magnitude of the area needing treatment.

Another important area where afforestation can be done is through the development of common property resources (CPRs) by communities. There have been several government programmes in India to manage village commons, like forests, pastures, wastelands, ponds, tanks etc. Most of these government programmes have not succeeded because of lack of people's involvement. The official programmes also made villagers dependent on the government for everything. The natural resource base of a village can only if there is an effective village level institution to involve them in controlling and managing their environment and to resolve any disputes that may arise amongst them[29]. This does not negative the government's role in the management of CPRs. In some cases, the government has played a crucial role in seeking local people's participation in the management of a CPR. The government officials have begun to realize that they could not hope to protect forests and other CPRs without the help and involvement of local communities.

[29] Village panchayat can be one of the institutions for protecting the village resources. Agarwal and Narain (1989), however, indicated that the panchayatas were creating more problem than solving them. According to this study, panchayats, as they function today have two major problem: a) they are the products of village factionalism and b) for removed from the 'grassroots' to be effective agents for good natural resource management. However, the effectiveness of panchayats in protecting the resources may differ across regions.

Table 9. Estimates of Wasteland in India, All India figures

	Million ha.
1.Non-forest Degraded Area	93.70
(a) Saline/Alkaline lands	7.17
(b) Wind eroded area	12.93
(c) Water eroded area	73.60
II. Forest Degraded Area	35.89
Total (I+II)	129.59

Source: Government of India (1989)

The contribution of CPRs to the income of poor households varied from 17 to23 per cent in the semi-arid regions of India. The CPRs contribution to the poor is estimated to be higher than those of the government's anti-poverty programmes. The major economic benefits are employment, fodder and fuel wood. Apart from these advantages, CPRs provide many minor products for the poor.

An important benefit of the village institutions relates to protection of the natural resources from degradation. They created awareness of ecological balances which resulted in better soil and moisture conservation practices. In many places, positive changes in bio-diversity (in both flora and fauna) have been observed. This change has been dramatic in a few cases.

4.2 Chemicalization of Agriculture

The new technology (popularly called Green Revolution) in the form of high yielding varieties (HYV) and its associated bio-chemical package of practices was introduced in the mid-sixties. At that time it was justified because there was no good alternative to increase foodgrains to feed the growing population[30]. The new bio-chemical technology in agriculture, however, has many negative impacts on environment. There has been significant increase in the use of chemicals, like fertilizers and pesticides since the 1960s. There is enough cause for worry on the impact of these chemicals on the environment.

India is the fourth largest consumer of fertilizers in the world although its per hectare fertilizer consumption is relatively low. There are, however, considerable regional variations in fertilizer use. Punjab, Tamil Nadu, Andhra Pradesh and Haryana showed more than 100 kg. per hectare of fertilizer consumption while other states, such as Madhya Pradesh Rajasthan, Orissa and Assam consumed less than 40 kg. per hectare in 1995/96.

Determination of optimum level of fertilizer use is difficult at macro level. It varies with type of soil, its nitrogen retention and release properties and so on. To be on the safer side farmers resort to fertilizer application above optimum levels.

[30] See Dantwala (1987)

Subsidized fertilizer prices and lack of information on optimum level lead to excessive use of fertilizers. The nitrogen lost from agricultural fields through run-offs and leaching contaminate surface and ground water. The harmful effects of excessive use of fertilizer have been found in Punjab and in some other districts.

Also, nearly half of the districts in India have been classified as low in availability of phosphorus. These deficiencies were due to the unbalanced application of fertilizers. Soil testing facilities and information through extension services and removal of subsidies are some of the measures needed for optimum use of fertilizers.

Chemical pollution due to intensive use of pesticides is also a growing environmental problem. Although per hectare pesticide consumption is low in India, it is concentrated in few states and crops. Punjab, Gujarat, Andhra Pradesh, Tamil Nadu and Maharashtra account for 90 per cent of the pesticide consumption in the country. In terms of crops, cotton consumes 55 per cent, rice 22 per cent, chillies 12 per cent, vegetables 8 per cent and crops 3 per cent of all pesticide consumed on India farms are banned or severely restricted in Western countries and identified by the WHO as excessively toxic or hazardous"[31] (CSE, 1985). Like fertilizers, pesticides also tend to be overused. In some cases, this is related to subsidized prices, while in others the higher pesticide use could be due to the new HYV package. Mono-cropping and resistance developed by pests over time have also increased susceptibility of crops to pests and disease. Therefore, higher doses of pesticides are used. The new pesticides introduced over the past 20 years have adversely affected the health of agricultural labourers. While spraying pesticides, these labourers do not cover their faces, have no footwear and are scantily clothed. Agricultural workers in rice fields are exposed to health hazards from both acute and chronic poisoning.

It is clear from the above findings that the present methods of fertilizer and pesticide use and growth are not sustainable. There are several possible technologies and alternatives to reduce the adverse impact of these chemicals on environment. Particularly in the 1980s, it was realized that for sustainable agricultural development, alternative farming practices are needed to reduce or remove environmental consequences of the bio-chemical technology. Some of these are: biological control of pests, integrated pest resistant varieties of crops, sound agricultural practices, such as crop rotation and growing nitrogen fixing crops, reduction in subsidies, vermiculture, natural and indigenous faming, etc[32]. These alternatives are not perfect substitutes to the chemical farming but adoption of these can substantially reduce the adverse impact on the environment.

[31]In Gujarat, cotton farmers spray their fields 20 to 30 times more often than before with more toxic and expensive pesticides, which today account for over half of cotton cultivation costs. In the Vidarbha region of Maharashtra, expenditure on chemicals has increased 340 per cent since the mid-seventies without any increase in the average yield. In Andhra Pradesh, the state with the highest consumption of pesticides at a staggering 15,000 tonnes a year, at least 15 species of pests have become resistant to all commonly-used agrochemicals (CSE, 1985)

[32] For more details, see Painuly and Mahendra Dev (1995). See also Desarda (1997) for similar issues.

4.3 Problems with Irrigation

4.3.1 Surface Irrigation

The issue that invites wide and heated discussion is the one related to the question of large vs. small dams or minor irrigation. The concerns regarding large irrigation projects are: high cost, low utilization, submergence of land and displacement of people, and degradation of land due to indiscriminate irrigation. To put it differently, the minor irrigation works are advocated on grounds that they are cheaper, construction and management are easier and ecologically safe. The empirical evidence shows that the choice between large vs. minor irrigation is not as simple as these arguments would suggest.

In terms of costs, minor irrigation may be large irrigation works in some cases. But this argument is not sufficient to establish the superiority of minor over major irrigation. One has to take into account many factors, like the quantum of additional water made available by them during the year, reliability and its seasonal distribution. In the case of wells, the costs per unit area should involve funds on digging in search of ground water and the cost of providing electricity, etc. Also, there is no conclusive evidence that the loss of agricultural or forest land due to submergence by large reservoirs relative to the area benifitted is always less in the case of small dams or other minor irrigation works. Thus, the argument that large dams are necessarily inferior in terms of costs and ecological safety is not true. The large dams are important for higher agricultural growth and food security. With proper government action, the damage to the environment and to the people can be minimized.

Canal irrigation too is facing several problems. Irrigation and drainage schemes are in poor condition and badly managed. This is partly due to the little importance given to O&M (operation and maintenance) because farmers' contributions (water charges) are low as compared to the public expenditure on irrigation. Farmers are dissatisfied with the service and believe that the provision and management of irrigation is government's responsibility. It is known that the subsidies to canal irrigation led to indiscriminate irrigation which in turn resulted in water logging and salinity in canal irrigation.

For increasing the efficiency of irrigation project, there is a need for institutional reforms. One suggestion is to transfer the responsibilities from irrigation departments to farmer's organizations. The Committee on Pricing of Irrigation Water (GOI, 1992) also says that "the effective involvement of farmers in management is essential for improving the operational efficiency and financial viability of public irrigation system. The country must move over progressively from a management wholly through the government bureaucracy to a management by farmers. As a first step, we suggest a substantial reduction in the sphere of responsibility of the government and the encouragement of user groups to take over maintenance, management of water allocation, and collection of water rates for a group of outlets serving at least a village." This would ensure efficiency in water management and reduce government interference. It will also strengthen the sense of effective participation in management of community resources among the people.

4.3.2 Ground water

The lowering of water table is one of the main concerns regarding ground water irrigation. Almost all the districts of Haryana and Punjab have extracted more ground water than the estimated usable discharge. A study on Tamil Nadu districts shows that the water table depth everywhere had fallen by as much as 60-65 per cent in some categories (see Vaidyanathan, 1994). In most of the states, water level has fallen by more than 2 to 4 meters. Power and other subsidies are responsible for the lowering of water table in many areas. Removal of subsidies on power, diesel oil and credit would create strong disincentives against over-exploitation (Vaidyanathan, 1996).[33]

It is being increasingly recongnised that regulation of ground water is needed for sustainability of water resources. We need institutions for water use efficiency and conservation[34]. Regulation by local communities would have more impact on resource conservation and would be more economical and equitable.

Thus, both the surface and ground water has to be used more efficiently for sustainability. We have water users' associations and water markets as institutions for sharing of water. To improve the efficiency, the water-quota-based water rights system is also being advocated[35]. We already have some water use associations which are doing well in some parts of the country. For example, the Pani Panchayat in Pune district of Maharashtra succeeded in making available limited water in an equitable and optimum manner.

4.3.3 *Rainfed Areas*

While irrigation is an important source of agricultural growth, the fact remains that even today, nearly 70 per cent of the cultivated area is rainfed and contributes to 40 per cent of the output. It may also be noted that even after the potential is fully exploited, half the land will remain dependent only on rainfall. A major part of the irrigation potential is unexploited in the eastern region. Regarding these high rainfall states, we need investments for flood protection and expansion of irrigation.

The problem of moisture stress is more seven in 'dry land' states. It is no accident that five 'dry land' states (Madhya Pradesh, Maharashtra, Rajasthan, Gujarat and Karnataka) account for the overwhelming majority of the low productivity districts in India. For, in each of these five states over 65 per cent of their respective net sown area is both unirrigated and located in districts with low to medium rainfall

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[33] As Vaidyanathan says, removal of subsidies is only a necessary but not sufficient condition for reducing the over-exploitation. It needs to be supplemented by several other measures.

[34] More on institutional factors for raising agricultural, see Mahendra Dev (1997)

[35] For example, saleth (1996) says, "What we need actually is a legally-centered and locally managed 'water-quota' – based water rights system to set quantitative limits (i.e., water quotas) for water availability both at the individual and group levels. Although it is a more durable solution to our water problem, the establishment and enforcement of the water rights system is a real administrative as well as political challenge"

Vaidyanathan (1996) also says, "Regulation, monitoring and enforcement of use to prevent over-exploitation entirely through the bureaucracy will be impossible. Some form of collective rights with the responsibility for regulation to be devolved on local communities seems essential".

Also see Bhatia (1992).

not unirrigated and located in districts with low to medium rainfall not exceeding 1100 millimetres. No doubt such a high proportion of unirrigated area may partly reflect the low level of capital use in general and in particular, the non-exploitation of the available irrigation potential. However, the fact of the matter is that in each of these five states, eve on full utilization of the currently known irrigation potential, about 50 per cent or more of the current net sown area would remain dependent on rain which itself is low and uncertain[36].

In a policy context, the development and full utilization of the available irrigation potential is the most obvious example of a solution for countering the constraints imposed by inadequate and uncertain rainfall. Less obvious but nonetheless important as means of raising land productivity are: capital expenditure on bunding, terracing and shaping fields, and creation of drainage facilities apart from direct programmes of soil treatment. It must be stressed that programmes involve collective efforts at the village level and the absence of this could act as a constraint even when capital per se is available. We have already mentioned about the importance of watershed development for soil and water conservation in these areas. Finally, in the regions where moisture stress is a near permanent problem, there is a need for promoting a more diversified portfolio of economic activities by creating assets in non-crop activities such as animal husbandry, fisheries, manufacturing and services.

To sum up, our discussion on land and water resources shows that there are problems regarding sustainability of these resources. We need to remove input subsidies and invest massive resources for land and water development to increase or sustain agricultural growth. Community approach and action are very important for achieving this goal of sustainability.

5. Summary and Conclusions

This paper examines some of the leading issues on subsidies and investments in India agriculture. The conclusions of the paper are summarized as follows.

1) ***Quantitative dimensions:*** There has been an enormous increase in the amount of agricultural subsidies over the last two decades. The input subsidies as a ratio of public investment increased form 84 per cent in 1980/81 to a whopping 377 per cent in 1992/93. In other words, the amount of subsidies is four times to that of public investment in agriculture. If some of the input subsidy expenditures had gone as investments into agriculture, the implication for agricultural growth would have been tremendous.
2) ***Who gets the input subsidies?*** During the initial stages of the adoption of new technology in agriculture some of these subsidies may be justified as 'front-up costs'. Over time it was found, that the richer state and well-irrigated areas certain crops, and sometimes rich farmers captured a disproportionately high share of the major input subsidy progammes of fertilizer, power, irrigation and credit. Besides, the farmers are not getting the entire amount of the so called 'agricultural subsidies'. Some estimates show that cultivators receive only 50 per cent of the budgeted fertilizer subsidy. Similarly; official and independent

[36] For more details on constraints on agricultural productivity, see Mahendra Dev (1991).

estimates show that large amount of power subsidy is given to agriculture. First, it may be noted that cross subsidization take care of some of the losses due to agricultural sector. Secondly, the power subsidies are overestimates because we do not have meters in many states to indicate the power consumed by agriculture. The unmated supply of electricity to the agricultural sector is being misused to cover very high transmission increasing in the absence of adequate systemic improvements. Thus, farm power subsidies are overestimates and the farmers may be getting only a part of this subsidy.

3) ***Impact of withdrawal of subsidy on production:*** Withdrawal of fertilizer subsidy may have adverse consequences on agricultural production in the short run. However, it should be remembered if the subsidy is converted into investment, these adverse consequences can be minimized. Also, a gradual phasing out of power and irrigation subsidies is needed to give time to farmers and the power sector for making necessary adjustment. Improvement in the efficiency of supplying inputs is important while withdrawing subsidies.
4) ***Trends in Agricultural Investment:*** There has been an absolute decline in public investment during the 1980s. It further declined in early 1990s before picking up in 1994/95. The real gross capital formation in agriculture by the private sector has increased since 1987/88. The total agricultural investments were higher since 1992/93 mainly due to higher private investment. It is argued that one should look at gross fixed capital formation (GFCF) rather than gross capital formation. The trends in GFCF show that it increased in recent years. Unfortunately, we do not have a break up of GFCF by public and private sectors. The share of GFCF in agricultural GDP increased from 5 percent in the 1950s to around 9 percent in the 1980s. In the late eighties, it declined to below 8percent and it was around 8.5percent in the mid-nineties.
5) ***Should we widen the definition of public investment***? The estimates of CSO's public sector investment comprise mainly of investment in irrigation projects. Some researchers feel that this is an underestimate and there is a need for widening the definition of public investment by including investment in infrastructure, like rural roads and electrification. Government allocates large funds to anti-poverty programmes like IRDP and JRY. Some of these expenditures can be included under public investment in agriculture.
6) ***Complementarity between public and private investments***: In recent studies, the complementarity between public and private investment has been questioned. We feel that there is complementarily between the two as shown by the analysis on Debt and Investment Survey and other project related data. Also, one issue which is not stressed in the debate is the impact of government's input subsidies on private investment. The most notable subsidies are in power, irrigation and diesel. One can argue that without these subsidies, private investment would have been lower. It is true that the entire input subsidies are not accruing to farmers and there are inefficiencies in the systems. Therefore, instead of providing input subsidies, the government should concentrate on rectifying the inefficiencies in the provision of input and this may induce more private investment.
7) ***How to Increase Agricultural Investment?*** The decline in public investment is attributed to diversion of resources from of subsidies. Reducing the subsidies suggests itself as a source of finance for public investments in agriculture. Some analysts that fund under programmes like IRDP and JRY should be shifted to productivity enhancing activities, like power and

irrigation. Although this is a valid suggestion, it is not conclusively provide that the anti-poverty programmers have not been creating assets. One option is to improve the effectiveness of to transfer these funds to irrigation and other productive investments. The states have the major responsibility in raising agricultural investments, for creating productive assets by reducing funds for populist and unproductive activities. One of the factors determining private investment is public investment because of the complementarity between the two. The institutional credit seems to be another crucial variable in determining private investment. In a credit constrained economy, credit policy should play a vital roe in determining private investment and agricultural performance.

8) ***Issues related to sustainable land and water resources:*** It is known that there is very little scope for further expansion of net sown area and land scarcity will become an acute feature of the rural economy. Water is a precious national asset and there are several concerns regarding water resources in the country. Therefore, a judicious use of land and water resources will have to be the central concern of agricultural growth policies. Our discussion on land and water resources shows that there are problems (land degradation, chemicalization of agriculture, water logging, ground water depletion) regarding sustainability of these resources. We need to remove input subsidies and invest massive resources for land and water development to increase or sustain agricultural growth. Community approach and social action are very important for achieving this goal of sustainability.

To sum up, subsidization has become the crudest personification of politics in the electoral arena. The unwholesome experience of Andhra Pradesh bears out the deleterious consequences of such strategies as well as their unsustainability. These schemes not only 'crowd out' public investment in agriculture but also block the much needed enhancement in expenditure on health and education sectors. This is not to say that any realistic prognostication does not pre-empt certain short term disturbances in economic and social spheres. But a determined and rational commitment to national good warrants a gradual, steady and judicious phasing out of subsidies. And render the subsequent focus on productive and creative investment, realistic and feasible. There is general consensus that excessive subsidy causes more negative impact which more than neutralizes any incidental beneficent effects, which in turn are hardly sustainable. As Keynes said, it is better to be 'roughly right than precisely wrong'.

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