

**IMPACT OF INVESTMENT ON AGRICULTURAL GROWTH
AND RURAL DEVELOPMENT IN HIMACHAL PRADESH**

THESIS

By

SAJAD HASSAN BABA

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DEDICATED TO MY PARENTS

"Fountain of Inspirations"

Dr. A. S. Saini
(Professor)

Department of Agricultural Economics
CSK HP Krishi Vishvavidyalaya,
Palampur-176 062 (H.P.), India

CERTIFICATE- I

This is to certify that the thesis entitled "**Impact of Investment on Agricultural Growth and Rural Development in Himachal Pradesh**" submitted in partial fulfillment of the requirements for the award of the degree of **Doctor of Philosophy (Agriculture)** in the subject of **Agricultural Economics** of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur is a bonafide research work carried out by **Mr. Sajad Hassan Baba** son of **Shri Ghulam Hassan Baba** under my supervision and that no part of this thesis has been submitted for any other degree or diploma.


The assistance and help received during the course of this investigation have been fully acknowledged.

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(A.S. Saini)
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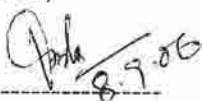
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Dr. A.S. Saini 8/9/06
(Chairman)
(Advisory Committee)




Dr. K.D. Sharma
(Member)



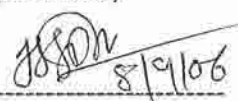
Dr. Kamlesh Singh
(Member)



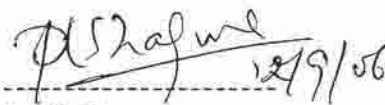
(J.L. Sharma)
(External Examiner)




Dr. D.R. Thakur
(Member)



Dr. J.S. Sohi
(Dean's nominee)



Dr. R.K. Sharma
(Head of the Department)



Dr. H.N. Verma
(Dean Postgraduate Studies)

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(Sajad Hassan Baba)

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INTRODUCTION

INTRODUCTION

1.1 PROLOGUE

Majority of economies in the world are either developing or underdeveloped nations. These economies have low productivity in agriculture for want of sufficient production technology and capital formation. Agricultural sector still occupies a key place in such economies, despite of poor resources and low capital investment capacity of farmers. Capital formation is the outcome of investment. As a matter of fact, investment refers to the flow of expenditure diverted to increase or maintain capital stock. In economic theory, it is the periodic addition to the capital stock in an economy, industry or firm that takes place in response to a gap between the actual level of capital stock and its desired level (Gandhi, 1996). More specifically, agricultural investment refers to changes in the level of all inputs that augment physical capital, enhance agricultural production capacity and the conservation of natural resources, knowledge and human capital development, rural infrastructure net-work and post-production equipments.

The growth and development of any enterprise as well as that of an economy are determined essentially by the level of technology and the efficiency of the market mechanism. But, it is the use of capital that makes the above two factors operational. Hence, capital is the most vital input required for achieving the much desired goal of growth both in the micro and macro units of the economy. Capital is one of the most crucial factors, which sets the pace and pattern of economic growth in any country. The importance of capital in economic progress has been recognized by development economists long back (Cairncross, 1955, Lewis, 1955, Rostow,

1960). Economists have assigned a key role to investment in the process of economic growth due to two reasons: firstly, it creates income and secondly, it augments productive capacity of the economy by increasing capital stock (Kulshrestha, 2000). The vicious circle of poverty in underdeveloped countries can be broken through investment led capital formation. It leads to increase in the dimension of national output, income and employment, thereby, solving problems of inflation and balance of payments (Nurkse, 1962). It creates infrastructure and adds to the capacities of production units and leads to the development of all the sectors of the economy like manufacturing, agriculture, etc.

1.2 INVESTMENT AND AGRICULTURAL GROWTH

Since, majority of the people in developing countries like India are engaged in agriculture or related activities, therefore, for the development of Indian economy, agricultural sector has been assigned a major role. Its development has remained the major concern of government and policy makers in different plan periods. The policy makers claimed agricultural development in two ways, one, developing agriculture as a source of raw materials and food for industries and people, respectively (Government of India, 1959, Anderson and Lorch, 1994) and two, agricultural development as a means to achieve goals of employment led economic growth, poverty alleviation and self-reliance (Johnston, 1997, Desai, 1997, Desai and Namboodri, 1998).

In this context, Government of India (1998) observed that while the private investment has been the principal source of agricultural growth, particularly in the recent past, and will continue to be so in future, the public investment is essential to correct existing infirmities and to impart added dynamism to this sector. The new technology responsible for substantial increase in production is by and large capital

embodied, implying thereby, that the growth of agricultural sector depends substantially on the rate of investment and capital formation. Investment has been identified among various factors to affect adoption of improved package of practices in India (Dwivedi, 1972). The purpose of investment in agricultural sector is to generate capital in the form of infrastructure, improvement in quality of natural resources and creation of productive assets. Capital investment along with land resource account for the drastic improvement in agricultural output over time and it makes the difference in performance of economies across countries (FAO, 1999). The modernization of agriculture along with technical advances, therefore, necessitate a consistent and significant growth in the capital investment per unit of land, man and livestock.

In case of developing nations, the top most priority for agricultural development is likely to include the reform of policies and laws to improve poor people's access to land, markets and services by creating an environment that encourages investment in agriculture and agricultural services by the private sector.

1.3 AGRICULTURAL GROWTH AND RURAL DEVELOPMENT

Process of development in the third world countries, in fact, is the process of rural development. In developing countries like India, rural development has been a theme of growing importance due to the fact that still a very large percentage of total population and those living below poverty line dwell in the rural areas and a large proportion of national income is generated in these areas (Gangwar and Pandey, 1998). Rural development is a comprehensive and multidimensional concept that encompasses the development of agriculture, poverty alleviation and employment generation. Agriculture is the bed rock of the India's economic activity. Development of agriculture seems to hold the key to the progress of our economy in view of its

predominantly agrarian character as it continues to be the single largest contributor to the GDP of Indian economy. Agricultural development seems to have a definite influence on poverty reduction in rural areas (Ravallion and Dutta, 1996, Singh and Baleka, 1999). Being a dominant sector, the impact of its performance (good or bad) is not only confined to agriculture but is manifested in all the sectors of the economy.

Indian agriculture is now in the threshold of second phase of Green Revolution. The natural resource base of land, water, bio-diversity and other resources are under severe pressure of high population growth. In view of this, Indian agriculture is now poised for greater diversified technical transformation for (i) ensuring food security (ii) export earnings, and (iii) a decentralized development to reduce rural poverty. A diversified production plan in agriculture in order to meet these urgent needs is the first priority (RBI, 1989). Sustained agricultural growth, therefore, has been a central theme of our developmental planning since Independence, for simultaneously meeting both availability of and access to food. It required a consistent enhancement in public and private investment for sustained growth of agricultural sector of the country.

1.4 BEHAVIOUR OF AGRICULTURAL INVESTMENT

One of the remarkable achievements of the global food and agricultural system is that the huge investment experienced in the past three decades has been accompanied by progress in food security for many countries of the world. On an average, food available for human consumption has increased to the tune of 19 per cent in the developing countries (FAO, 1999).

In India, prior to the introduction of new farm technology (during 1950's), Indian agriculture was trapped in the vicious circle of low productivity, low income, low savings and low investment (Sharma, 1987). Nurkse (1962) opined that in

developing countries, the incentives and ability to invest were weak because the domestic market mechanism was narrow and domestic savings were meagre. In this context, Lewis (1957) attributed lower investment in developing nations to the lower savings. Lack of investment opportunities was another reason, which inhibits the people's desire to invest (Hanssing, 1964). In general, the farm sector because of its peculiar characteristics of high degree of risk, low productivity, seasonal nature that coupled with fluctuations in input-output prices lacks incentives to allure the investors, resulted in lower investment rate in agriculture as compared to other sectors of the economy (Singh *et al.*, 1996).

However, a substantial investment in agricultural sector during early sixties ushered in the Green Revolution, which in turn gave fillip to the farmers to make investment on irrigation structures, farm machinery and equipments. Since then, it has sustained the tempo of agricultural growth. The agricultural development strategies followed in the country since late 1960's have paid-off handsomely. The trend growth rate of food production was maintained well above the population growth rate. The country was able to achieve self-sufficiency in food and sustain it too. It continued to employ two-thirds of the country's labour force, even though its share in the real GDP has come down to below one-third (Mishra, 1997). Investment in Indian agriculture in real terms (at 1980-81 prices) went up from Rs 13 billion in 1950-51 to Rs 68 billion in 1998-99 (Central Statistical Organisation – CSO various issues). But, it has been observed that there was a deceleration of public investment in agriculture during 1980's (Bhagwati and Srinivasan, 1993, Gulati and Bhidi, 1993). Thus, it is often argued that agriculture did not receive due attention as much as it deserved in terms of allocation of public resources (Shetty, 1990, Kumar, 1992, Alagh, 1997, Gulati and Bathla, 2001). Consequently, the growth of agriculture has

also tended to slacken during 1990's. Moreover, the declining public investment in post-WTO era and inadequate incentives for the private investment may not be compatible with required growth rate for meeting demand of food for our growing population and alleviating poverty (Government of India, 1998).

The declining trend of public investment in Indian agriculture, its relationship with the private investment and the possible factors that affect agricultural productivity has generated considerable interest among researchers in recent years (Gandhi, 1990, Misra and Hazell, 1997, Gulati and Sharma, 1997, Karmarkar, 1998, Chand, 2000). These estimates, however, are subjected to debate for their limited scope and narrow coverage of public sector agricultural investment as well as for ignoring the two way causation between investment, productivity and other macro-variables (Rao, 1994, Kurain, 1987, Dev, 1997, Gulati and Bathia, 2001, Chand, 2001).

Almost all the studies on investment have used Central Statistical Organization (CSO) series on public investment in agriculture, which is narrow in its coverage as CSO series report that about 90 per cent of public agricultural investment is on major and minor irrigation (Rao, 1997). Since, infrastructure has important forward and backward linkages, it extends the horizon of market economy and monetization and thus, breaks the vicious circle of backwardness (Banerjee, 1996). The CSO series have completely left investment on several items of infrastructure. Thus, the trend of the investment revealed by the CSO series cannot be used as an adequate indicator of behaviour of public sector investment in agriculture. In the light of large number of factors influencing investment, an investigation needs to be conducted through a comprehensive framework.

1.5 RATIONALE OF THE STUDY

The process of investment in agriculture has not been a one-time phenomenon but, a continuous process and the public investment aimed at increasing agricultural productivity in country will have differential impact across regions, favouring some areas more than other. Therefore, the results of behaviour of agricultural investment at the country level is of little utility to hill state like Himachal Pradesh, as the hill agriculture is entirely different from that of plains due to several mountain specificities like undulating topography, inaccessibility and marginality, steep slopes, climatic and other edaphic factors, etc. and the sustainability of profitable mountain agriculture is highly dependent on the so termed specificities (Jodha, 1992).

Himachal Pradesh underwent many territorial changes after Independence and emerged as a full-fledged state in year 1971. Soon after it received statehood, government directed its efforts to the overall development of the state. The importance of agricultural sector and rural poverty alleviation has led the state government to pursue the strategies focused on reducing chronic food insecurity and poverty alleviation through increasing productivity. Himachal Pradesh is predominantly a rural state. About 90 per cent of the total population of the state (around 6 million) live in rural areas and are predominantly engaged in agriculture and related activities (Anonymous, 2004). Development of agriculture is essential for the development of state in general and rural masses in particular. Therefore, agricultural investment, a catalyst of agricultural growth, is more critical for development of rural masses.

So far, much work on agricultural investment have been done at the country level but, scanty work on this aspect have been conducted in Himachal Pradesh.

Therefore, it requires a separate and in depth analysis of the investment in relation to agricultural growth, poverty alleviation and rural development *per se*.

In the back drop of these facts, the present study is a humble endeavour to investigate the behaviour of investment in agriculture and its impact on agricultural growth and poverty alleviation in Himachal Pradesh.

1.6 OBJECTIVES

Specifically, the main objectives of the present study are:

- i. To analyze the trends and composition of investment in agriculture and study its determinants.
- ii. To examine the impact of investment on agricultural growth and rural development.
- iii. To study the problems and constraints thwarting investment in agriculture and rural development and suggest policy options.

1.7 ORGANIZATION OF STUDY

The entire study has been systematically planned in six chapters. Chapter I (Introduction) elaborates the concept, importance and objectives of the study. Chapter II contemplates the critical review of work done in India and abroad, which is relevant to the present topic of investigation. The systematic methodology adopted for the selection of sample, collection and analysis of data has been described in Chapter III. The results of the study described under different sections have been presented in Chapter IV. Chapter V is devoted to elaborate discussion with logical conclusions and inferences drawn on the basis of the results. Finally, based on the findings of the study, the pertinent policy options have been summarized in Chapter VI. The illustrations, tables and figures have been extensively used to elucidate the results while, additional information has been given

under different appendices for further clarification, understanding and future use of the interested readers.

1.8 LIMITATIONS OF THE STUDY

The precision of the study depends upon the accuracy and reliability of data and their sources and methodological approach followed. All the scientific inquiries are subjected to few limitations, although these may differ with respect to magnitude of limitations. In the present study, few limitations were also observed particularly related with data. Though, due care was taken while collecting the data to minimize the bias on estimates, yet the findings of the present study are subjected to following limitations:

- I. There were notable inconsistencies in the published data across the years and sources. However, efforts were made to collect data from original sources or nodal agencies. Again, since the expression in constant prices is a better measure, the available data were analysed at 1970-71 prices.
- II. Multicollinearity was another problem, which resulted in dropping some important variables from the model. But, efforts were made to capture the effect of left-out variables in alternative way.
- III. It was assumed that secondary information collected for the study is free from biases and errors. It was also assumed that scientific methodology has been adopted by the state agencies for collection of data at the state level.
- IV. The study was constrained by non-availability of time series data on agricultural investment for the state. However, in this direction the study made an attempt to use alternative data sources such as, All India Debt and Investment Survey Reports of the survey conducted by Reserved Bank of India in collaboration with National Sample Survey Organization (RBI-NSSO), Financial Accounts of

State Government and other published/unpublished sources of Planning Department, Shimla (H.P.). Since, RBI-NSSO survey report is published after every ten years, the figures in the intervening years were appropriated by using interpolation.

- V. A portion of the study was based upon the sample observations collected from 180 households of the selected villages due to limited time and other resources at the disposal of a researcher. However, random selection was done from different categories in different farming systems to get representative sample for the study.
- VI. As no farm records were being maintained by the sample farmers, therefore, the data were collected by survey method based on their memory and past experiences. Though, due care was taken to extract accurate information, yet the possibility of few slips from the memory of the respondents could not, however, be ruled out.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The outcome of research inquires, accomplished through systematic thinking, factual observations and past experiences, becomes a sound base of knowledge for the future research to be undertaken, because such inquires are always undertaken on the basis of past acquired and accumulated knowledge in the concerned field. As such, before initiating any study, an insight into the related studies is of utmost importance, because the primary function of review of literature is to reveal the nature and ascertain the level of theoretical and empirical framework already applied in related studies for setting the guidelines in developing scientific methodology and new dimensions for future research. To accomplish this task, therefore, the research work already conducted relating to agricultural investment have been critically reviewed in the ensuing section.

Agricultural investment is an expenditure to generate capital, which consists of both tangible goods (like tools and implements, irrigation structures, etc.) and intangible goods (like research and education, skill development, etc.). Investment in agriculture comes from two sources i.e. public sector and private sector. The public investment comes from government sector while, the private investment comes from farm households and corporate sector.

Plethora of the studies on micro-level analysis of agricultural investment are available in literature where in many studies revealed that farmers invested higher proportion of total farm investment on purchase of land and its improvement as this investment was considered to be a gainful expenditure (Waghmare and Marali, 1971, Goswami and Saikia, 1972, Sinha and Kumar, 1996). While few other

researchers found that livestock and farm buildings form the major items of household investment (Kalla, 1978, Sharma, 1987). It was also found by researchers that comparatively higher investment on progressive farms was made on irrigation structures and modern farm equipments while, in back ward areas the investment was mainly on livestock and traditional farm assets (Desai, 1969, Shah, 1972, Singh and patel, 1972, Garg *et al.*, 1996, Bhuvaneshwari and Alagumani, 1996). Since the major emphasis of the present study is to analyse the behaviour of agricultural investment at macro-level, therefore, the studies that examined the behaviour and determinants of agricultural investment and its impact on agricultural growth and development within and outside the country, have been reviewed and presented in the ensuing sections under the following four sub-headings:

- Trend, composition and magnitude of agricultural investment
- Impact of investment on agricultural growth and rural development
- Relationship between public and private investment
- Problems and constraints in agricultural investment

2.1 TREND, COMPOSITION AND MAGNITUDE OF AGRICULTURAL INVESTMENT

Gonzalez (1987) found that whilst agriculture contributed 22 per cent to gross domestic product in 1983 to 1986, its share of investment was 7.5 per cent to 10 per cent, indicating low priority given to the sector. Agricultural investment runs at 1.3 per cent to 2 per cent of agricultural gross domestic product, whilst in the economy as a whole it reached 3.2 per cent to 4.8 per cent over the same period. The rate of increase of the investment budget also showed discrimination against agriculture, with 28.3 per cent annual growth rate in agricultural investment, as compared with 40 per cent for the whole economy.

Shetty (1990) analysed the time series data of agricultural investment in India

and found that since 1960-61 to 1987-88 gross capital formation in agriculture at 1980-81 prices, which was steadily rising during the decade of the 1960's became relatively subdued during the first half of the 1970's, thereafter it got momentum during the second half of the decade till 1979-80. Since then, it has been persistently declining in absolute terms. Thus, over the decade of 1960's, gross capital formation in agriculture (at 1980-81 prices) rose at compound rate of 6.3 per cent per annum and over the next decade of 1970's, it rose at the rate of 5.9 per cent per annum. But, during subsequent seven years (1981-88), it declined at an annual growth rate of 2.6 per cent.

Kumar (1992) in a study on falling agricultural investment in Indian agriculture and its consequences revealed that neglect of agriculture, an important sector was likely to have an adverse impact on economy of India. Such neglect had been observed as a result of fall in agricultural investment during eighties. The study pinpointed that if the present trends of investment policy were continued in the country, then large-scale imports to meet the domestic demand may become imperative despite high imports food prices that would adversely hit the poor most of the country.

Mallik (1993) analysed the trends in capital formation in Indian agriculture and factors underlying these trends using time series data from 1950-51 to 1989-90. He observed that there has been a noticeable deceleration in gross capital formation in the 1980's. To large extent, public and private investments were complementary, rather than substitutes for each other and thus, falling public investment may be affecting private capital formation. He stated that there is considerable scope for improving the impact of public expenditure in the sector by reducing subsidies, by focusing expenditure on smaller array of programmes and services, urgent priority

areas, increase cost recovery, control recurrent expenditure and strengthen sectoral management and budgeting.

Dolgiev (1995) in a study of investment in agriculture in Russia, observed that annual investment in agriculture needs to be increased from 11 million roubles in 1994 to 110 million roubles by the year 2000 (1991 price basis) in order to establish necessary infrastructures for storage and processing of agricultural produce, livestock production, agricultural services and rural development.

Gandhi (1996) examined the behaviour of aggregate private investment in agriculture over the period 1952-53 to 1992-93. The results indicated substantial changes in investment in the post 1980's period. Government investment which was almost continuously rising until the early 1980's showed a decline which continued even beyond the mid-eighties to 1992-93. Between 1980-81 to 1986-87, private investment has fluctuated and also showed some decline. However, after 1986 private investment increased and continued to rise quite sharply to 1992-93 and compensated for the decline in government investment thus, making the growth of total investment positive.

Misra and Hazell (1996) examined the time series agricultural investment in India. They observed that in 30 years series, during the first 20 years (i.e. 1960's to 1970's), public and private investment both have shown increasing trend but, in the later 10 years (i.e. 1980's), the public investment declined while as, private investment increased persistently. The correlation between public investment and terms of trade and technology were also not high enough to influence the coefficient of each other in the multi-variate regression analysis of private investment.

Khatkar and Singh (1996) while studying the pattern of capital formation in Indian agriculture from period-I (1965-66 to 1979-80) to period-II (1980-81 to 1992-

93), observed that the declining growth rate of public sector investment (-4.36%) was higher than the positive growth rate in private sector investment (3.25%) in period-II. The priority areas of private sector investment in a majority of the states were agricultural implements (about 46%), irrigation (about 30%) and land improvement (about 15%). They further observed that there was an urgent need to increase more investment in agriculture both in public and private sector to earn more foreign exchange owing to globalization of agriculture and to sustain the pace of agricultural growth for feeding the ever increasing population.

Singh *et al.* (1996) in a spatio-temporal analysis of capital formation on Punjab farms found that investment on fixed farm assets (except on draft animals) has continuously grown on almost all farm situations in the state both at current and constant prices over the period from 1971-72 through 1991-92. They pointed out that the relatively low increase in investment on farm machinery and equipments on the large farms indicates the saturation stage of mechanization, which led to decline in investment on draft animals on all the farm size categories.

Banerjee (1996) attempted to explore a new strategy of capital formation in Indian agriculture. He observed that there has been substantial public investment in agriculture in the seventies but, this has declined in the eighties and consequently private investment also showed some decline. He suggested that public investment in agriculture, long confined largely to high-tech irrigation projects have now to be diversified in high value short gestation projects. Infrastructure, technology, energy, marketing and communication sub-system are important areas, which call for extensive public investment for diversified agricultural production.

Tripathi (1996) while studying capital formation in different subsistence hill farming systems of Uttar Pradesh, observed that the investment on farm buildings

increased at an annual rate of 14.4 per cent in high-hills, 14.2 per cent in mid-hills and 10.3 per cent in valley farming systems from 1984-85 to 1994-95. The capital investment on irrigation structures increased at an annual rate of 30.5 per cent in mid-hills and 15.3 per cent in valley situation during same period. Investment on livestock increased at 8.7, 15.5 and 19 per cent per year during corresponding period in high-hills, mid-hills and valley farming situations, respectively. The regression analysis indicated sufficient scope to increase fixed capital investment in the mountain farming system of Uttar Pradesh.

Pal *et al.* (1996) studied capital formation in Indian agriculture and found that capital formation in Indian agriculture has been declining since 1980. The retrogression in the public investment was mainly responsible for such decline. Though, public investment has been declining, private investment has not followed such pattern. They further observed that public initiatives was not always a determining factor of private investment as it takes place in alternative farms.

Janaiah (1996) analyzed the trend in capital formation in Indian agriculture. He observed that ratio of capital formation in public sector to private sector widened from 1:1.9 (1965-66) to 1: 3.75 (1994-95), implying a declining trend in the share of public investment in agriculture. On the whole, the growth in public investment declined at a faster rate than in private investment over the period. He further pointed out that the existence of complementary relationship between investment flow and output level was a warning signal to increase investment in agriculture on one hand and to generate more agricultural output by using peasant resources efficiently and judiciously on the other hand.

Dinger (1996) examined the trend and determinants of capital formation in Indian agriculture. It was observed that the trend in public sector investment

declined after 1980-81 while, the trend in private investment showed an increase for the whole period. The percentage share of public sector in total investment declined from 38.73 per cent in 1980-81 to 26.98 per cent in 1990-91, whereas, the percentage share of private investment increased from 61.27 per cent to 73.02 per cent during the same periods. It was concluded that without adequate investment on capital, agriculture cannot make substantial contribution to economic development of the country.

Namboodiri (1996) in his study on the magnitude of investment in Indian agriculture, observed that there has been a significant decline in the share of investment in agriculture to gross capital formation. It declined from 26 per cent during early 1950's to roughly 10 per cent during the early 1990's. The ratio of capital formation in agriculture to agricultural gross domestic product has also set a declining trend since the early 1980's. Government expenditure in agriculture has dropped from over 43 per cent until the early eighties to 25 per cent during early nineties and this decline in public capital formation in real terms could be attributed to both declined government expenditure in agriculture and the expenditures in favour of special programmes.

Mukharjee (1996) found that investment in agriculture at constant prices revealed 3 distinct types of trend i.e. a rising trend between 1960-61 and 1978-79, falling trend between 1979-80 and 1986-87 and finally an upward trend, which lasts upto 1993-94. Since, 1986-87 till early nineties capital formation in agriculture follows the rising trend whereas aggregate investment reflects a declining tendency. The relative share of agricultural investment declined from 16 per cent during 1960-61 to 7.50 per cent during 1990-91, which later showed slight improvement up to 9.27 per cent in 1993-94.

Dhawan and Yadav (1997) studied the trends and determinants of public investment in Indian agriculture and observed that though nominal public investment in agriculture has tended to rise year after year but in real terms, it has tended to diminish in absolute magnitude since the beginning of the 1980's. Thus between 1980-81 and 1991-92, the value of net fixed capital formation on government accounts in agriculture (at 1980-81 prices) fell from Rs 1528 crores to Rs 581 crores, indicating a reduction of the order of 62 per cent as compared to 3 per cent reduction realized by gross fixed capital formation on government accounts in agriculture in the same period.

Singh (1997) in his rapporteur's report stated that both the public and private investments in agriculture in real terms have been increasing up to 1980-81 and the complementarity between the two was confirmed. But later during 1980-92, public investment declined in real terms and the private investment, though fluctuating some what up to 1986, increased rather quite sharply thereafter.

Pal and Singh (1997) developed and analyzed a data base of investment on agricultural research, extension and education, containing state wise data since 1960-61 in India. They observed that India was spending 0.42 per cent and 0.20 per cent of agriculture gross domestic product on research (excluding education) and extension, respectively. These intensities are very low in comparison to those in developed nations. Most of the investments were made by government; the share of private investment was only 15 per cent in research and 8 per cent in extension. There was positive association between research and extension investments. Rural literacy and demand for agricultural commodities has significant positive effect on research and extension investment.

Pardey and Beintema (2001) stated that globally public expenditure for

agricultural R&D almost doubled from 1976 and 1996 (at 1993 international prices), and developing countries now contributed the greater share (56% of total). The intensity of public spending on R&D was much higher in developed countries than poor and developing countries. Private sector spent an estimated 11.5 billion dollars on agricultural R&D in 1995, which covers only a small subset of the needs of poor and mostly complements, rather than substitute for continued public and other non-profit research.

Chand (2001) in a state level analysis of trends and issues of public and private investment in Indian agriculture observed that there was a widespread decline in public sector capital expenditure in agriculture in all the states. The decline was not confined to investment in irrigation projects only but, it was rather sharper in other heads related to agricultural development. The author suggested that the declining trend in public sector agricultural investment should be reversed by increasing allocation in all the major states to check the adverse impact on agricultural output. There was also a need to improve the efficiency of public investment in agriculture so that they serve the intended purpose.

Anonymous (2001) examined the investment gap in African agriculture. It was concluded that aid and public investment in agriculture have generally declined. It has remained stagnant in absolute terms, fallen sharply in per capita terms since 1980's. The declining trend in public investment also affects private investment. Improving the environment for private investment was of critical importance through a combination of regulatory reforms. Improving public spending on infrastructure may pay in terms of boosting agricultural growth and rural development.

Anonymous (2003) in the "Indian Agricultural Policy: Vision 2020", stated that the public investment in agriculture has been declining and was the main reason

behind the declining agricultural productivity and low capital formation in agricultural sector. Private investment in agriculture has also been slow and must be stimulated through appropriate policies. Accelerated investment is needed to facilitate agricultural growth and rural development.

Chadha and Sharma (2005) in their study, "Liberalizing Indian agriculture", observed that broad trends in agricultural investment revealed a decline in the gross capital formation (GCF) in agriculture since the 1980's. They attributed the decline in overall investment in the sector to a decline in the rate of public investment vis-à-vis that of private investment in agriculture. However, growth in the rate of private gross capital formation has been inadequate to stem the fall in aggregate gross capital formation in Indian agriculture. The share of agriculture in total gross capital formation fell from 14.3 per cent in 1970-71 to 7.5 per cent in 1999-2000 and further to 5.6 per cent in 2002-03. They concluded that several measures are required to improve growth outcome including increase in the level of investment in agricultural sector.

Braun *et al.* (2005) in a strategic paper, stated that since early 1980's public investment in Indian agriculture has experienced a secular decline. With shrinking public investment the growth impetus for agriculture has also been declining. Private investment in agriculture has been rising, yet it has not fully compensated for the loss from the falling public investment. The first among various strategic decisions must be to raise the level of public investment in agriculture and rural infrastructure. This move would also help unleash private sector investment, which complements public investment.

2.2 IMPACT OF INVESTMENT ON AGRICULTURAL GROWTH AND RURAL DEVELOPMENT

Rao (1977) explored the relationship between agricultural growth and rural poverty in India. He observed that there was a strong complementary relationship between agricultural growth and employment generation in Indian agriculture because of the existence of large under-utilized resources. He further suggested that the public investment should be increased in the rural sector in projects which can be directly undertaken by the government and which exploit complementarity between public and private investment.

Rao and Stern (1978) in the world development report stated that unless economic growth in the developing countries can be substantially accelerated, the non inevitable increase in population will mean that the numbers of the absolute poor will remain high even at the end of the century. Poverty alleviation depends overwhelmingly on increasing agricultural productivity, particularly among small farmers, and the output in parts of Asia can be increased rapidly by stepping up irrigation investment.

Srinivasan (1978) pointed out that the present comfortable position in food and foreign exchange in India would permit initiation of policy changes in the agricultural sector, which would help to realize a vigorous and faster growth in other sector. Attempts to raise agricultural growth as well as employment generation would have substantial impact on poverty abatement and public investment in agricultural has a major role to play.

Kim *et. al.* (1988) studied the investment direction on agricultural development in Korea. They observed that investment on research and development for agriculture would create new technologies and it would raise the

productivity of agriculture. Hence, in this way investment in agriculture has much importance in the growth of individual farms and national economy.

Pardey and Craig (1989) examined casual relationship between public sector agricultural research expenditure and output. The results indicated significant correlation between research expenditure and output and the impact of research expenditure on agricultural output may persist for as long as thirty years. Further it was suggested that simultaneity issues should not be ignored while modeling research and expenditure-output relationship.

Cavassa *et. al.* (1995) analyzed the impact of new technologies on a number of variables like soil productivity, resource allocation and family income in Ponacanchi-cusco basin in Peru. They found a clear relationship between the investments made and the higher income realized. Researchers concluded that with investment programmes oriented towards rural development, it was possible to facilitate the growth of farm economy.

Cleaver and Donovan (1995) examined the agricultural scenario in sub-saharan Africa over the past five years. They found that most of Africa's poor live in rural areas and depend on agriculture for survival. Consequently, growth of agriculture and agricultural income helps the rural poor and hence alleviate poverty. However, the major problems were poor economic conditions, agricultural policy and inadequate public investment on infrastructure, rural education, agricultural research and education and rural health. It was also found that poor public investment has led to a lack of private investment in farming, input supply and processing.

Heidhues (1996) conducted a study on "Food security in developing countries" and observed that while the production potential of industrial countries was probably able to meet food demand of the growing world population, it was

imperative for political, economic and social reasons that developing country should provide for their own food security. This was only achievable if investment in agricultural research and the development of innovations was considerably increased.

Rai *et al.* (1996) analysed the impact of public sector investment on revenue account in agriculture and suggested that fall in the agricultural investment need to be arrested not only to meet the food requirement of growing millions but, specially in our present efforts to make Indian agriculture globally competitive. The shift in investment resources away from agriculture to non-agriculture may not result in a faster growth in total gross domestic product on account of the higher ratio of gross domestic product from agriculture and its investment as compared to the economy as a whole.

Singh (1996) examined the relationship between investment in agricultural research and agricultural output. The study revealed that the investment in agricultural research in Gujarat state has grown at an annual growth rate of about 12 per cent and yielded a maximum return after a time lag of four years. Researcher found that the average estimated return to each rupee of investment on research ranged from Rs. 12 to Rs. 56 in different aggregate production functions with different forms of equations and combinations of explanatory variables. The higher return to farm research suggest that the investment on agricultural research was remunerative and should be increased from existing level of 0.37 per cent of agricultural state gross domestic product to about one per cent.

Alagh (1997) in his inaugural address at the 56th annual conference of the Indian society of agricultural economics raised issues concerning agricultural growth in India and explored problems of investment in the Ninth Plan. He emphasized that

private and public investment need to be increased for having sustainable growth of Indian agriculture.

Reardon *et al.* (1997) while exploring the factors for promoting sustainable intensification and productivity growth in Indian agriculture after macroeconomic policy reform, observed that while partial intensification was already achieved, too little investment was occurring in land improvement and inputs. They concluded that the implementation of macroeconomic policy reforms along with substantial public and private investment on agricultural research, human capital, production and marketing are means for full intensification in agriculture.

Evenson *et al.* (1999) observed that private sector in India were also engaged in extensive research and development relevant to agriculture and has increased its investment rapidly overtime. Several type of investment has been found associated with and contributed to the growth of total factor productivity (TFP) in agriculture. Public agricultural research investment accounts for nearly 40 per cent of TFP growth between 1956 and 1987. Investment on agricultural extension programme and improved rural market has also contributed to the growth of TFP. Irrigation investment generated TFP growth over and above the contribution to output growth that irrigation makes as conventional input. The return to public research investment increased substantially because the output from the research investment was realized more rapidly. They suggested that investment in these productivity enhancing activities should be increased substantially.

Kalaitzandonakes (1999) studied the role and interaction of the public and private sector in U.S. It was observed that the estimated average return on public investment for agricultural research and technology transfer in the U.S. was over 30 per cent, which was high by any standard of investment efficiency. Benefits for

consumer have come in various forms including low priced, high quality and safe food. Government should invest much as private sector got less benefit out of it. He concluded that the structure of private-public interaction and the relevant institutional environment in which such interaction occurred have meaningful effects on their efficiency and effectiveness.

Fan *et al.* (2000a) used a simultaneous model for time series and cross sectional data to analyse the differential impact of different types of public investment on growth and poverty reduction in rural China. The results revealed that expenditure on education has by far the largest impact on poverty reduction and the second largest impact on production growth. Government spending on agricultural research and extension has the largest impact on agricultural growth and third largest impact on poverty reduction. The next best investment was rural telecommunication with second and third largest impact on poverty alleviation and agricultural growth, respectively. The results also showed that there exist an opposite relation between agricultural growth and poverty.

Fan *et al.* (2000b) developed a simultaneous equation model to estimate the direct and indirect effect of different types of government expenditure on rural poverty and productivity growth in India. The results showed that in order to reduce rural poverty, the Indian government should give highest priority to additional investments on rural roads and agricultural research and education. These types of investment not only have much larger impact on poverty than any other government investment but, also generate higher productivity growth. Other investments (including irrigation, soil and water conservation, health, rural and community development) have only modest impact on growth and poverty per additional rupee spent.

Fan and Hazell (2000) analyzed the impact of investment in irrigated and high and low-potential rainfed areas in India. The researchers observed that in order to promote economic growth and to redress poverty, policy-makers in developing countries (like India) will need to promote agricultural intensification for high and low-potential regions. This dual strategy will be particularly challenging if government budgets for investment in agriculture and rural areas continue to remain tight and striking the right investment balance between irrigated and rainfed regions and between high and low-potential rainfed areas will be particularly important. It was further suggested that investment on rural infrastructure, agricultural technology and human capital were at least as productive in many rainfed areas as in irrigated areas and they have much large impact on poverty. Greater public investment in some low-potential areas could actually offer a "win-a-win" strategy for addressing productivity and poverty problems.

Fan *et al.* (2000c) developed and empirically estimated a model that quantifies the impact of government investment on productivity growth and poverty reduction for different types of agro-ecological zones in India. Results showed that improved technology and rural infrastructure have made important contribution to agricultural growth and poverty alleviation in recent decade. However, the marginal impact of investment on these items has varied widely between irrigated and rainfed areas and across different types of rainfed zones. They observed that as investment in irrigated area continue to increase, their marginal returns diminish, and it is now in many of the rainfed areas, including some of lower agriculture potential areas, where marginal return to additional government investment on infrastructure and technology were largest. They further highlighted the importance of selecting the right type of investment as well as the right regional priority if the government has to

made best use of its scarce resources in achieving growth and poverty alleviation goals.

Anderson and Lorch (1999) observed that most of the world's poor were rural-based, engaged directly or indirectly in agricultural activities. Agricultural growth is a catalyst for broad based economic growth and development in most low-income countries. Accelerated public investments are needed to facilitate agricultural growth and poverty alleviation. Investment on agricultural research is particularly urgent for low-income developing countries, partly to increase agricultural productivity through efficient use of resources and partly to undertake further research.

Murgai *et al.* (2001) examined the critical issues in the long term productivity and sustainability of irrigated agriculture in the Indian and Pakistan Punjab by measuring trends in the total factor productivity (TFP) for production system in both states, since the advent of Green Revolution. The study confirmed that India has experienced much higher growth of yield of food-grains. However, the results revealed that most of India's higher growth was due to the more rapid growth of input use while, investment (both public and private) played a central role in productivity growth. The researchers found that there was a considerable lag between investment on infrastructure and the realization of production growth in both Punjab. The findings revealed the need for policies that promote agricultural productivity and sustainability through public investments (in education, roads and research and extension) that reduces resource degradation by decreasing or eliminating subsidies that encourage more input use.

Roy and Pal (2002) conducted a study in India to analyse the impact of agricultural investment on agricultural productivity and rural poverty. They observed

that agricultural productivity growth is central to alleviating poverty and infrastructural and technological changes are, in turn central to this process. This requires not only change in institutional policies but, also enhancement of public and private investment in agricultural research, rural infrastructure including roads, marketing, storage and irrigation. They pointed out that investment is a better instrument than subsidies in agriculture and whatever subsidies to be provided it should be targeted to the poor and backward regions. The role of human capital and agrarian reforms are critical, as these have direct and indirect effect on agricultural productivity and rural poverty. They further suggested that in view of financial austerities of government, incentives to farmers should be improved to enhance private investment in agricultural sector.

Anonymous (2002a) stated in the consultation issue paper that agriculture has performed well in the past and agricultural growth can and does reduce poverty and inequality, making specific contribution as measured by progress towards achieving the millennium development goals (MDGs). He pointed out that policies should be directed to create climate that encourage private sector investment in agriculture and agricultural services, which are of crucial importance, through a combination of regulatory reforms, institutional development and complementary physical investment.

Kydd (2002) in the study, "Agriculture and rural livelihood: Is globalization opening or blocking path out of rural poverty", highlighted that continued investment in public sector agricultural research was required as it pave the way for agricultural growth and rural upliftment. While, the private sector investment was found to address many of needs of smaller-holders.

Anonymous (2002b) examined the declining rural poverty in India and China and revealed that to achieve further rounds of poverty reduction and agricultural growth, India and China should increase investment on rural infrastructure, roads, education and agricultural research and development. It was also pointed out that investment in less-favoured lands in India and China made a stronger contribution to poverty reduction than spending in developed areas.

Zhang and Fan (2004) developed a method for decomposing the contribution of various types of public investment to remove regional inequality and applied the method to rural China. Public investment was found to have contributed to production growth in both the agricultural and non-agricultural sector. They found that all type of investment in the least developed western region reduce regional inequality, which may have great role in reducing poverty. They concluded that additional investment on rural education and agricultural research and development in the western regions has the largest impact in reducing regional inequality.

Zhu (2004) examined the effect of public investment in irrigation and agricultural research on the agriculture output in China in crop specific manner, by taking agricultural research and irrigation as proxy. The analysis revealed that increasing public investment on agricultural research will bring about higher output. He suggested that increasing public investment on agricultural research and development, etc. should be considered with high priority in future, so that it could be utilized as a policy tools to enhance long term food security.

Fan *et al.* (2004a) studied the impact of different types of government expenditure on agricultural growth and rural poverty in Thailand. The results showed that despite Thailand's middle-income status, public investment in agricultural research and development, irrigation, rural education, and infrastructure still have

positive marginal impact on agricultural productivity growth and poverty reduction. The poverty reducing impact of infrastructure was high than irrigation investment. They suggested that the future irrigation investment should be geared towards improving the efficiency of existing irrigation system through reforming pricing incentives and through the institutions that manage irrigation water.

Fan *et al.* (2004b) estimated the effect of different type of government expenditure on agricultural growth and rural poverty in Uganda. They observed that government spending on agricultural research and extension improved agriculture production significantly and has larger assessed impact on poverty reduction. Government spending on rural roads, education has substantial marginal impact on rural poverty. Additional investment in northern region (a poor region) contribute the most to reduce poverty, however, in the western region, most type of investment have highest return in terms of increasing agricultural productivity.

Kumar (2005) studied the constraints facing Indian agriculture and the path ahead in reorienting both agricultural policy and practice to the changing circumstances. He highlight the following major areas for the development of Indian agriculture: land market and agricultural labour, rural unemployment and poverty; capital formation and investment; farm input supply and availability; access to agricultural credit; and agricultural extension network.

2.3 RELATIONSHIP BETWEEN PUBLIC AND PRIVATE INVESTMENT

Wagle (1994) estimated function for private investment in Indian agriculture. The analysis revealed that with regards to investment in agricultural sector 1 per cent rise in the relative price of agricultural product strengthens investments in agriculture by 0.94 per cent in short run and 1.93 per cent in long run. Public investment also strengthens private investment. During 1961-62 to 1979-80,

government investment in agriculture as percentage of gross domestic product increased, thereby strengthening private investment. The share of government investment however, declined during the 1980's thus, explaining the slow down in private investment.

Dhawan and Yadav (1995) studied the private fixed capital formation in agriculture and observed that Indian farmers allocated a rather small proportion of their total capital funds (owned and borrowed) towards fixed capital formation in agriculture. They found that private fixed capital formation was positively associated with public investment in canal irrigation. In view of this fact the absolute decline in real public investments in irrigation in practically all the Indian states during the 1980's might have *ceteris paribus* diminished fixed capital formation in agriculture on private accounts, which affirms the thesis of complementarity between public and private investment as bulk of total investment was on irrigation.

Jairath and Purohit (1996) established the link between public and private sector capital formation in Rajasthan and assessed their relative importance in agricultural growth. The higher degree of complementarity between public and private investment suggested that there was an urgent need to enhance public investment in the agriculture sector, which in turn will influence private capital investment in the agriculture sector. Further the improvement of private farm investment calls for change in the incentives to farmers.

Pendse *et al.* (1996) studied the relationship between public and private capital formation and observed that there exists a high degree of complementarity between public and private capital formation in agriculture. This would mean that if the declining trend of public sector capital formation will not be reversed, the prospects of agriculture growth in the country were dim.

Rai *et al.* (1996) examined the trends and growth in the level and composition of investment, overall and separately by public and private sectors. The study revealed that both public and private sector investment in agriculture after a modest start in 1960's increased steadily during the 1970's but declined thereafter, leading to an absolute fall in investment. However, the private sector investment remained stagnant during 1980-81 to 1991-92, due to the complementarity between public and private sector investment.

Misra and Hazell (1997) while analyzing the determinants of private investment in Indian agriculture observed that in phase 1960-67 to 1980-81, public investment was an important factor in explaining the variations in private investment. But, in modernized phase (1981-82 to 1993-94), the reversal has taken place in the sense that other factors like terms of trade and technology became important factors in explaining variations in private investment and it lacks complementarity with public investment.

Dhawan (1996) while studying the trends and determinants of capital investment in agriculture pointed out that public investment in major irrigation works could stimulate private investment in agriculture through the price route. This mechanism of inducing private farm investments applied to all public expenditures and the duration of such inducement effect would obviously be more for public investment with higher gestation period.

Karmakar (1998) discussed the growth trends in capital formation in agriculture in both the public and private sector in India. He pointed out that as public investment in agriculture has been declining, the private sector has also showed declining trend. Private investment in agriculture was determined by three factors *viz.* complementarity between public and private investment, technology and

terms of trade. The falling role of public investment in agriculture was due to the falling sectoral allocation in the National Plans, increasing in recurring expenditure, and partly due to under utilization of irrigation potential created mainly through medium and major irrigation projects. He suggested that the decline in capital formation in agriculture could partly be off-set through increased flow of institutional credit.

Gulati and Bathla (2002) studied the temporal behaviour and structure of public and private gross capital formation in agriculture (GCFA) in India. They observed that the public sector investments remained important for their inducement effect on private gross capital formation in agriculture (GCFA) and, therefore, a gross domestic product in agriculture.

2.4 PROBLEMS AND CONSTRAINTS IN AGRICULTURAL INVESTMENT

Baltas (1983) formulated a simultaneous model to describe demand for credit and investment by Greek farmers. The level of credit was shown to have strong influence on investment particularly on farm buildings. He further observed that availability of credit may enhance investment while its unavailability constraints investment in agriculture.

Pilati (1986) formulated a demand function for investment (which takes into account a sub-division of financial resources into two groups i.e. self-financing of internal liquidity and external liquidity) to define the financial bottlenecks in the process of private fixed capital formation in agriculture in four main geographical areas of Italy. From the econometric analysis, it appeared that private investment demand was strongly influenced by financial constraints, though not in uniform manner over the whole country.

Kivistik and Sallinen (1993) in their study in Estonia observed that 98 per cent

of the respondents considered the problem of lack of machinery and mechanization as major constraint on the capital formation and development of farm families. They suggested that priority should be given first to investment on tractor and machinery and then farm buildings for development of farm families.

Dhawan (1996) while studying the complexities of investment behaviour in Indian agriculture found that profitability of investment, uncertainties about expected returns, risk associated with these and investor's risk taking capacity rendered investment decision-making a truly complex process in agriculture. He suggested that the process of investment in agriculture need to be carried out in a multivariate framework.

Mani *et al.* (1996) studied capital formation in Indian agriculture and observed that the public investment in agriculture which accounted for about one-third of the total investment has been declining in the last four years and it was the private investment which was playing a major role. The long term finance was not found sufficient and proportional to growth in short-term and medium-term finance, which constraints the agricultural capital formation adversely.

Prema and Thomas (1996) studied the constraints to the capital formation in farm households of Thrissur district, Kerala. They identified high consumption expenditure, non-availability of labour, high wage rate, low product price, high input price and lack of irrigation as the major constraints to capital formation in descending order of important.

Zheng (1996) while establishing a mechanism to safe guard agricultural development and ensure a steady rate of development of Chinese economy, observed that the factors that prevented steady agricultural development were the lack of sufficient investment in agriculture and lack of government policies to

encourage and support such investment. Lack of foresight shown in seeking large profit, insufficient funds for research and development and national credit policies were other factors limiting investment in agriculture. He suggested that the ways in which these factors can be controlled to provide a basis for consistent development need to be explored.

Bastine and Palanisami (1996) estimated the cost of private investment in agriculture in the northern agro-climatic zone of Kerala and found that private investments in irrigation in small sized holdings are costly. Full utilization of water and pump capacity was constrained by smaller size of the farm. It was suggested that group investments should be encouraged to bring down the farm investment cost. Institutional credit has to be provided to motivate the farmers to go for irrigation investment.

Varadarajan and Sankari (1996) while studying the determinants of private capital formation in agriculture in Tamil Nadu found that the past saving, asset holding, area irrigated, productivity of land and priorities among investment opportunities are farm specific constraints of private fixed capital formation in agriculture.

Prakash and Srivastava (1996) studied the constraints and prospects of investment in agriculture and observed that the vicious circle of poverty, unfavourable environment, economic and technological backwardness, inequality in income distribution, demographic constraints, discriminatory government policies such as external trade restrictions, domestic price interventions, large subsidies, power consumed by the farmers and irrigation were some of the constraints responsible for low investment in agriculture. They suggested that the policy support for institutional credit, marketing and pricing of farm inputs and outputs were effective

instruments to promote capital formation in agriculture.

Dinar and Keck (1997) attempted to identify the effect of several variables on public investment on irrigation in Columbia. They identified several variables as significantly affecting investment in general and irrigation investment in particular. Variables such as, government prices and credit policies affected the private investment in irrigation across regions and overtime. Violence negatively affects private investment. Climate affects the investment such that in region with unfavourable climatic conditions, investment in irrigation is less attractive. They suggested that appropriate crop price and credit policies promote investment in irrigation.

Pender and Kerr (1998) investigated the constraints of farmer's indigenous soil and water conservation investment in semi-arid tropics of India. They found that conservation investment was significantly lower on leased land and plots that were subjected to sale restrictions. Farmer's education, caste, characteristics of plot and the presence of existing land investment were other factors that significantly effects investment on soil and water conservation. They suggested that policies should be made to promote investment in soil and water conservation.

Petrick (2004) analysed the effects of government promoted credit access on investment behaviour of credit-rationed farmers in Poland. The estimates revealed that access to subsidized credit has constrained investment behaviour of farmers. Furthermore, the magnitude of investment was negatively related to farm size. He suggested that a government policy which aimed to promote productive investment should emphasize lending in large amount without discrimination of small farmers.

It is amply clear from the review of literature that there has been a deceleration of public investment in agriculture while, the private investment has

been increasing at increasing rate over the years. At the farm level, purchase of land, farm buildings, livestock and irrigation structures, etc. were the major items of private investment. The literature revealed that the agricultural investment bears direct relation with agricultural growth and rural development. It also improves the conditions of rural masses and shift the people from below the poverty line both directly through various development schemes and indirectly through enhancing productivity of agriculture. Public investment in agriculture was found to hold complementary relation with private investment. Moreover, various problems and constraints thwarting investment in agriculture have been highlighted in different studies. Although, much work related to the present study have been carried out at national and international levels, yet scanty research of such kind pertains to Himachal Pradesh. The impact of agricultural investment on agricultural growth and rural development is very complex phenomenon as investment in agriculture affected agricultural productivity and rural poverty in multiple ways. Instead, much of the work on agricultural investment at the national level have ignored simultaneity between investments (public and private) and agricultural productivity. Moreover, previous studies were also criticized for their limited coverage of agricultural investment as these studies have completely left-out the investment on important heads of infrastructure. In the light of large number of factors influencing investment, an investigation needs to be conducted through a comprehensive framework to capture both direct and indirect impact of agricultural investment. Therefore, the present study, "Impact of investment on agricultural growth and rural development in Himachal Pradesh" has been planned to remove the above said loopholes of studies already conducted by constructing new broad series of investment in agriculture including investment on all possible heads.

MATERIALS AND METHODS

MATERIALS AND METHODS

The scientific enquiries need to be built on the sound and systematic methodology that acts as a foundation stone of a study. Moreover, the reliability, precision and validity of the scientific findings of any investigation heavily depend on the selection of appropriate techniques. Therefore, this chapter has been incorporated to lucidly elaborate the methodology (materials and methods) that includes the selection of study area, sampling plan, data collection and analytical framework which is given as under:

3.1 SELECTION OF STUDY AREA

The present study pertains to Himachal Pradesh as it is regarded as a model state among the hill states of the country for agricultural as well as all round development. The study intends to investigate the behaviour of investment in agriculture, using both primary and secondary data. The state has got varied types of agro-climatic conditions ranging from sub-tropical to temperate. The state, therefore, has potential for growing large variety of crops like food-grains, vegetables, fruits and industrial crops like medicinal and aromatic crops. Considering this diversity, the state's agriculture has been divided into the following three farming systems and dairying was considered as an allied activity to each of these systems:

- i. Food-grain based farming system (FFS)
- ii. Vegetable based farming system (VFS)
- iii. Fruit based farming system (FTFS)

Each farming system was first divided into two sub-farming systems. Consequently, FFS was divided into maize based and rice based sub-farming

systems, VFS into main and off-season vegetable based sub-farming systems and FTFS into temperate and sub-tropical fruit based sub-farming systems.

3.2 SAMPLING PLAN

Three stage stratified random sampling technique was used for the selection of blocks, villages and cultivators as under:

3.2.1 Selection of Blocks

In first stage of sampling, two blocks representing each sub-farming system were randomly identified on the basis of dominant cropping pattern. Kangra and Poanta blocks have been selected to represent rice based sub-farming system. Similarly, Sadar and Jhanduta blocks representing maize based, Kullu and Solan blocks representing off-season vegetable based, Una and Nagrota Baghwan blocks representing main-season vegetable based, Mashobra and Kalpa block representing temperate fruit based and Nurpur and Indora blocks representing sub-tropical fruit based sub-farming systems have been selected for the present investigation thus, making a total sample of twelve blocks (Fig. 3.1).

3.2.2 Selection of Villages

In the second stage of sampling, one village from each selected block was randomly selected on the basis of dominant cropping pattern thus, making a total sample size of twelve villages.

3.2.3 Selection of Cultivators

In the third stage of sampling, a complete list of all the cultivators was prepared in consultation with the revenue officials. Keeping the time and financial constraints at the disposal of the researcher in view, a manageable sample of sixty farmers from selected villages of each farming system representing small (≤ 2 ha) and large (> 2 ha) farmers were chosen randomly through proportion allocation method



Figure 3.1: Map of Himachal Pradesh showing selected blocks under different sub-farming systems

thus, making a total sample size of 180 farmers (Table 3.1). However, the household investment on different farm categories did not show much variation, therefore, information obtained from two farm categories were pooled for comparative study of investment pattern in three different farming systems.

3.3 DATA COLLECTION

The study is based upon both primary as well as secondary data.

3.3.1 Primary Data

The primary data consisted of the following information:

- Size and structure of family
- Education
- Inventory of land
- Farm implements and machinery
- Livestock
- Cropping pattern and yield levels
- Costs and returns
- Farm level (private) investment
- Problems and constraints

The primary data were collected from sample farmers on well designed and pre-tested household schedule (Appendix-I), through personal contact method for an agricultural year (2004-05).

3.3.2 Secondary Data

The secondary data consisted of the following information:

- State level public investment in agriculture
- State level private investment in agriculture
- Village level public investment in agriculture

Table 3.1: Sampling plan for the selection of blocks, villages and farmers

Farming system	Sub-farming system	Selected blocks	Selected villages	Total farm households (No.)		Selected farm families (No.)			
				≤2 ha	>2ha	≤2ha	>2ha		
Food-grain based Farming System (FFS)	• Rice based	▪ Kangra	• Thanpuri	999	219	49	11		
		▪ Poanta	• Majra						
		▪ Sadar	• Mehar						
		▪ Jhanduta	• Barthin						
Vegetable based Farming System (VFS)	• Off-season vegetable based	▪ Kullu	• Kelhali	1172	322	47	13		
		▪ Solan	• Anun						
		▪ Una	• Arniala						
		▪ Nagrota	• Mundla						
		Baghwan							
Fruit based Farming System (FTFS)	• Temperate fruit based	▪ Mashobra	• Dhagogi	693	335	40	20		
		▪ Kalpa	• Kothi						
		▪ Nurpur	• Basa Bazira						
		▪ Indora	• Indpur						
Total	6	12	12	2464	876	136	44		

- Literacy rate
- Proportion of area under marginal farms
- Area under HYVs
- Population living below poverty line
- State gross domestic product
- Fertilizer subsidy
- Cropping intensity
- Road density
- Per capita income
- Institutional credit to agricultural sector
- Agricultural labour wages
- Rainfall
- Grants from Central Government
- Irrigated area
- Net sown area

The secondary data were collected from various published and unpublished sources like Financial Accounts of State Government, Annual Plan Drafts, All India Debt and Investment Survey Reports, Statistical Outline of Himachal Pradesh, Economic Review of Himachal Pradesh, Economic Survey of Himachal Pradesh, State Statistical Abstract of Himachal Pradesh, Fertilizer Statistics of India, UCO Bank Agenda Papers and unpublished records of village level officials, ADO circles, Patwar circles and various offices at Tehsil and Block level.

Considering the loopholes of previous studies, an attempt was made in this study to construct a broad series of public and private investment in agriculture by taking into account all important heads of investment for a period from 1969-70 to 2001-02.

New broad series of state level public investment in agriculture was constructed that includes investment on items like crop husbandry, irrigation and flood control, soil and water conservation, rural development, rural infrastructure, agricultural research and education, animal husbandry, dairy development, market development, fishery, forestry, agricultural financial institutions and rural electrification. The secondary information on these items was obtained from Financial Accounts of the State Government. However, government accounts revealed expenditure in three forms:

- i. Anticipated expenditure
- ii. Revised expenditure, and
- iii. Actual expenditure

The actual expenditure was considered for this study as other measures do not reflect correct picture of investment.

Data relating to state level private investment in agriculture have been obtained from different issues of "All India Debt and Investment Survey Reports". Since, this survey is conducted by Reserve Bank of India (RBI) in collaboration with National Sample Survey Organization (NSSO) periodically at decennial intervals, the figures in the intervening years were arrived at by interpolating each variable between two decades following the approach advocated by many past studies (Chand, 2001, Gulati and Bathla, 2001, EPW Research Foundation, 1997). The private investment series consists of investment on improvement/reclamation of land/buildings, irrigation structures, farm houses, agricultural implements and machinery, transport equipments, orchards and plantations and other items.

For clarity and comparative study of the behaviour of state level investment in agriculture, the entire period (1969-70 to 2001-02) was divided into the following three

sub-periods, which correspond to different phases of agricultural development:

- a) Period-I (1969-70 to 1979-80) corresponds to Green Revolution Phase.
- b) Period-II (1980-81 to 1990-91) corresponds to Post-Green Revolution Phase.
- c) Period-III (1991-92 to 2001-02) corresponds to Post-Reform Phase.

The secondary data pertaining to village level public investment in agriculture were collected on well designed and pre-tested village schedule (Appendix-II) from village level officials, ADO circles, Patwar circles and various offices at Tehsil and Block level. Village level public investment in agriculture includes investment on items like rural development, irrigation structures, rural infrastructure, crop husbandry and miscellaneous items like forestry and animal husbandry.

The data bases used in this study along with their sources have been given in Appendix-III.

3.4 ANALYTICAL FRAMEWORK

Commensurate with the set objectives and information (primary and secondary) available for the present study, following analytical tools were employed for analysis and interpretation of data:

3.4.1 Tabular Analysis

Tabular analysis was extensively employed to work out averages, ratios and percentages for the data relating to farm resources, farm level agricultural investment and intensities (investment as per cent of agricultural gross domestic product), share of agriculture in gross domestic product, incidence of poverty, socio-economic features of sample households and problems faced by the farmers in investment in agriculture.

The constant series of investment and other variables in monetary terms were worked out by deflating their current series at 1970-71 prices by state specific price

deflator (used for computing state gross domestic product at constant prices) by employing tabular analysis.

3.4.2 Statistical Tools

Following statistical methods were used in the study:

3.4.2.1 Compound growth rates (CGRs)

To examine the rate of change in agricultural investment and various components of state gross domestic product (SGDP) compound growth rates were estimated for three different periods by employing exponential function of following form:

$$Y_t = AB^t \quad \text{----- (I)}$$

Where,

Y_t = Agricultural investment/state gross domestic product in the year (t)

A = Constant indicating Y in the base period (t=0)

B = Regression coefficient indicating the extent to which investment/
state gross domestic product changes per unit time (t)

t = Time period (t= 1, 2, 3...)

Converting equation (I) into log form, we get

$$\text{Log } (Y_t) = \text{Log } (A) + t \text{ Log } (B) \quad \text{----- (II)}$$

The log linear equation of above form was then estimated separately for investment (Public & Private) and various components of state gross domestic product by using Ordinary Least Square (OLS) procedure. Ultimately the estimates of the compound growth rates (CGRs) were obtained by employing following formula:

$$\text{CGRs} = (\text{antiLog}B - 1) \times 100$$

The standard errors (SE) of CGRs were calculated by using the following formula:

$$SE = \frac{100B}{\text{Log } 10^e} \sqrt{\frac{\sum \text{Log } Y^2 - (\sum \text{Log } Y)^2/n - \text{Log } B (\sum t \text{Log } Y - \sum t \sum \text{Log } Y/n)}{(n-2) (\sum t^2 - (\sum t)^2/n)}}$$

Where, n = Number of observations

The calculated growth rates were tested for their significance by using following form of students t-test:

$$t_{cal} = \text{CGRs}/SE \sim t_{n-2}$$

where,

t_{cal} = Calculated t value

t_{n-2} = Table t value at degree of freedom (n-2)

3.4.2.2 Correlation

An attempt was also made to study the association between public and private investment, investment and other macro-variables like terms of trade, agricultural gross domestic product and institutional credit to agricultural sector by employing Pearson's Correlation Method. The calculated correlation coefficients were tested for their significance by employing Students-t test.

3.4.2.3 Incremental capital-output ratio (ICOR)

To examine the efficiency of the capital used in agriculture in different periods and to find out the amount of additional investment required to increase agricultural output by one unit, Incremental capital-output ratio (ICOR) was estimated. The ICOR was calculated by taking investment and output at constant prices (1970-71) by using following method (Rangarajan and Kannan, 1994).

$$\text{ICOR (with out lags)} = \frac{I_0(1 + rt)}{Y_0g}$$

$$\text{ICOR (with lags)} = \frac{I_0 (1 + (t-L) r)}{Y_0 g}$$

Where,

- ICOR = Incremental capital-output ratio
- I_0 = Initial investment (Rs. in lakhs)
- Y_0 = Initial output (Rs. in lakhs)
- r = Compound growth rate of investment (%)
- g = Compound growth rate of output (%)
- L = Lags (No.)
- T = Time period ($t = 1, 2, 3 \dots$)

The estimates of ICOR with lags were not in line with our expectations, therefore, for present study ICOR was estimated without considering lags in investment. Further, the estimates of ICOR calculated by employing the method without considering lags in investment gave consistent and expected results.

Marginal efficiency of capital (MEC) was estimated as:

$$\text{MEC} = 1/\text{ICOR}$$

3.4.2.4 Simultaneous equation model for macro-analysis

In this study an attempt was made to determine the impact of investment on rural development through affecting agricultural growth, generating non-farm employment and poverty alleviation in the state. The single equation approach to this complex phenomenon suffers from two major limitations. Firstly, there may be a two way causation between exogeneous and endogeneous variables. Secondly, variables may affect endogeneous variables through multiple channels. Therefore, it is difficult to capture these different effects within a single equation approach (Van De Walle, 1985, Bell and Rich, 1994). To overcome the limitations of simultaneous

bias of the single equation approach and to capture and quantify the direct as well as indirect effect of fiscal measures in agricultural growth and poverty reduction, a simultaneous equation model was developed in this study. Two Stage Least Square (2SLS) procedure was employed to estimate the model.

Hausman specification test

Hausman's specification test was used to test the endogeneity between different pairs of endogeneous variables of the model (Roy, 2001). To find out the endogeneity of agricultural productivity in public investment equation, the first step is to regress productivity (AGDP) model on all exogeneous variables included both in public investment and productivity equations to obtain residual productivity. In second step, we add this residual productivity as an additional explanatory variable in public investment equation and run regression for new public investment model by Ordinary Least Square (OLS). Now, if t-value is statistically significant for coefficient of residual productivity, endogeneity of agricultural productivity is detected in public investment model and under this condition Ordinary Least Square (OLS) is not applicable and the model is estimated using Two Stage Least Square (2SLS)) procedure.

Model specification

Investment incurred in agriculture and rural development at a point of time are determined by number of factors. Identification of these factors and a careful specification of all these variables as well as cause-effect relationship among investment, productivity and poverty in a system approach was essential for a meaningful analysis to reach at realistic conclusions. Already research scholars have used this approach in the recent years to study the determinants of agricultural growth and investment in agricultural research (Aron, 2000; Fox, 1987; Pal and

Singh, 1997). The model was modified by including few other important variables. Specific variables included in the model are categorized below:

a) Economic variables: These variables include:

- i. Per hectare public investment in agriculture
- ii. Per hectare private investment in agriculture
- iii. Per hectare agricultural gross domestic product
- iv. Per capita income
- v. Agricultural labour wages
- vi. Per hectare investment on soil and water conservation
- vii. Per hectare investment on irrigation and flood control, and
- viii. Per hectare investment on rural development

Agricultural investment has direct effect on upliftment of rural masses through employment generation and indirectly it affects poverty through growth in agriculture. Moreover, investment could itself be generated by increasing agricultural output with the more efficient use of presently available resources. Improvement of agricultural labour wages and in turn per capita income improves the financial position of rural masses and those living below poverty line. Construction of check dams, water harvesting structures, irrigation projects and rural handicrafts provide employment opportunities to rural masses. Hence, the investment on soil and water conservation, rural development and irrigation and flood control were specified separately in the model to capture their effect on non-farm employment.

b) Economic-political variables: These variables are:

- i. Per hectare grant from central government
- ii. Per hectare fertilizer subsidy
- iii. Per hectare state gross domestic product, and

iv. Terms of trade

The improvement in gross domestic product was expected to have positive influence on public investment while, increase in various subsidies possibly have negative effect on agricultural investment. Grants from the central government improve the access of state government to more resources, which was also expected to improve public investment in agriculture. An improvement of prices of agricultural commodities in relation to non-agricultural commodities may attract more private investment in agriculture. Therefore, terms of trade variable has been included in the model.

c) Political-institutional variables: Agricultural investment and productivity were also expected to be influenced by:

- i. Literacy rate
- ii. Per cent area under marginal holdings
- iii. Per hectare institutional credit to agriculture
- iv. Growth in population, and
- v. Per cent population living below poverty line

Literacy rate was included in this model to capture effects of human capital formation on agricultural productivity, their ability to find jobs in non-agricultural sector and their investment behaviour. Increase in per cent area under marginal holdings may hinder the use of machinery and big implements, which are the major items of private investment but from management point of view, it was expected to enhance the productivity by more intensive cultivation. Greater access to a piece of land was also expected to benefit the poor. Per hectare institution credit was expected to increase the private investment and agricultural productivity through pumping more purchasing power among rural poor. Population growth was expected to have both

negative and positive impact on productivity and investment. However, population growth is likely to accentuate the incidence of rural poverty (Roy, 2001).

d) Technological-infrastructural variables: These variables include:

- i. Cropping intensity
- ii. Area under HYVs
- iii. Per cent irrigated area, and
- iv. Road density

Agricultural productivity could be increased if agriculture is put on scientific lines, which requires the use of modern inputs and rural infrastructure, therefore, cropping intensity and area under HYVs were used in this model. Per cent of cropped area that is irrigated was included in this model to capture the impact of irrigation infrastructure on productivity. Road infrastructure was expected to improve the non-farm employment through increasing connectivity of villages to near by towns and cities.

e) Agro-ecological variable: Weather is an important determinant of agricultural production. Unfavourable weather either leads to crop failure or drastic fall in crop yields. Around 82 per cent of the cropped area in Himachal Pradesh is rainfed. Moreover, the pattern of rainfall varies considerably across districts within the state. Therefore, rainfall deviation index was included in the model as a proxy for agro-climatic variables. The rainfall deviation index was measured as under.

$$R_t = \sum_{i=1}^n (R_{it} \times W_{it}/W_t)$$

Where,

$$R_{it} = \left| \frac{(A_{it} - N_{it})}{N_{it}} \right| \times 100$$

- R_t = Rainfall deviation index in t-h year
 A_{it} = Actual rainfall in i-th district in t-th year
 N_{it} = Normal rainfall in i-th district in t-th year
 W_{it} = Net sown area of i-th district in t-th year
 W_t = Net sown area of the state in t-th year
 n = Number of districts in the state

Structural form of the model

A simultaneous equation model was formulated in which several economic variables are specified as endogeneous and their direct and indirect interactions were explicitly considered in the structure of the model. The model consists of five endogeneous variables, namely, per hectare public agricultural investment (PBINV), per hectare private agricultural investment (PRINV), per hectare agricultural gross domestic product (AGDP), per cent of rural population living below poverty line (POVT), and per cent of population engaged in non-farm employment. The structural form of the complete system is given in equation (I) to (V).

$$PBINV_t = f(AGDP_{t-1}, SUBS_t, SGDP_t, LIT_t, POP_{t-1}, GRNTS_t) \quad \text{-----}(I)$$

$$PRINV_t = f(PBINV_{t-n}, AGDP_{t-1}, TT_t, LIT_t, POVT_t, PCI_t, POP_{t-1}, MF_t, ROAD_t) \quad \text{-----}(II)$$

$$AGDP_t = f(PBINV_{t-n}, PRINV_{t-m}, LIT_t, MF_t, POP_{t-1}, CI_t, HYVs_t, RDI_t, IR_t) \quad \text{-----}(III)$$

$$POVT_t = f(AGDP_{t-1}, PBINV_{t-n}, PRINV_{t-m}, NEMP_t, MF_t, RUDI_{t-y}, ALW_t, LIT_t, CRD_t, TT_t, POP_{t-1}) \quad \text{-----}(IV)$$

$$NEMP_t = f(AGDP_{t-1}, SOIL_{t-x}, RUDI_{t-y}, LIT_t, ROAD_t, IRI_{t-z}) \quad \text{-----}(V)$$

The subscript 't' represents the t-th year and 'n' and 'm' are the length of lags for public and private investments, respectively. While, the lags of investment on soil and water conservation, rural development and irrigation and flood control are represented by 'x', 'y' and 'z', respectively. Long lead time is required in transforming investment into productive capital asset (Fan *et al*, 2000b). Therefore, lags of

investment were used (instead of current figure) to capture their lag lead time. Adjusted R^2 criterion was employed to find out the appropriate lags of investment. Lags, which gave the improved adjusted R^2 were used for the estimation of the model. A lag of six years for public investment and one year for private investment gave the best fit to our model. These lags of public and private investment are also consistent with some of the past studies (Rangarajan and Kannan, 1994). Further, six year lags of investment on soil and water conservation, five year lags of investment on rural development and one year lag of investment on irrigation and flood control was found appropriate in non-farm employment equation. The variables used in the model have been defined as under:

SUBS	=	Government fertilizer subsidy (Rs/ha)
TT	=	Terms of trade: ratio of agricultural and non-agricultural GDP deflator (%)
LIT	=	Literacy rate (%)
ROAD	=	Road density (Km/000sqkm)
GRNT	=	Grant from union Government (Rs/ha)
SGDP	=	State gross domestic product (Rs/ha)
PCI	=	Per capita income (Rs/annum)
POP	=	Population growth rate (%)
MF	=	Area under marginal holdings (%)
RDI	=	Rainfall deviation index (%)
CI	=	Cropping intensity (%)
HYVs	=	Area under high yielding varieties (ha)
IR	=	Percentage of cropped area that is irrigated (%)
ALW	=	Agricultural labour wages (Rs/day)

NEMP = Working population engaged in non-farm activities (%)

CDR = Institutional credit to agriculture (Rs/ha)

SOIL = Investment on soil and water conservation (Rs/ha)

RUDI = Investment on rural development (Rs/ha)

IRI = Investment on irrigation and flood control (Rs/ha)

Identification of model

After specifying the complete model, each equation was identified by using necessary order condition of identification as:

$$K - M \geq G - 1$$

Where,

K = Number of variables in the whole equation system

M = Number of variables in the equation

G = Number of equations in the model

The estimates of the order condition of identification revealed that all the equations of the macro-model are over-identified (Table 3.2). Hence, Two Stage Least Square (2SLS) procedure is better method of estimation.

Table 3.2: Identification of macro-model

Equation	Order condition			Identification
	K-M	≥	G-1	
PBINV _t	23 - 7	>	5 - 1	Over-identified
PRINV _t	23 - 10	>	5 - 1	Over-identified
AGDP _t	23 - 10	>	5 - 1	Over-identified
POVT _t	23 - 12	>	5 - 1	Over-identified
NEMP _t	23 - 7	>	5 - 1	Over-identified
Whole model over-identified				

3.4.2.5 Simultaneous equation model for micro-analysis

To study the determinants of agricultural investment at farm level and its impact on agricultural growth under different farming systems, a simultaneous equation model was developed and estimated by employing Two stage Least Square (2SLS) procedure. The model consists of two endogeneous variables i.e. per hectare total capital stock (TCS) and per hectare gross farm returns (GFR). The structural form of the model is given as under:

$$TCS_i = f(GFR_i, EVC_i, FMS_i, HOLD_i, LIT_i, OFINC_i) \quad \text{-----(I)}$$

$$GFR_i = f(TCS_i, EVC_i, IRA_i, CI_i, HOLD_i) \quad \text{-----(II)}$$

Where,

- i = i-th farming system
- TCS = Present value of total capital stock on farm (Rs/ha)
- GFR = Gross farm returns (Rs/ha)
- EVC = Expenditure on variable inputs (Rs/ha)
- HOLD = Size of operational holding (ha)
- LIT = Literacy rate (%)
- OFINC = Dummy for off-farm income (1 for presence of off-farm income and 0 for no such income)
- IRA = Operational area irrigated (%)
- CI = Cropping intensity (%)

As explained earlier, capital requires long lead time for coming into actual production process. Therefore, lags of investment are generally used to capture this lag lead time. But, lags of investment could not be obtained in cross sectional data. Moreover, the estimation of the micro-model with per hectare investment as one of the endogeneous variables gave inconsistent results, therefore, per hectare total

capital stock on farm (present value of total capital stock in agriculture) was specified as one of the endogeneous variables in the model.

The estimates of order condition of identification of micro-model revealed that whole model is over-identified (Table 3.3). Hence, Two Stage Least Square procedure was employed to estimate the model.

Table 3.3: Identification of micro-model

Equation	Order condition			Identification
	K - M	≥	G - 1	
TCS _f	9 - 7	>	2 - 1	Over-identified
GFR _f	9 - 6	>	2 - 1	Over-identified
Whole model over-identified				

3.4.2.6 Average Cumulative Response

To find out the extent and magnitude of different problems/constraints faced by the farmers that thwart investment in agriculture under different farming systems, average cumulative response method was employed.

3.4.2.7 Chi-Square test (χ^2)

In order to test the association between different problems/constraints faced by the farmers and different farming systems chi-square test was employed (Kothari, 2001).

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where,

χ^2 = Chi-Square value

O_{ij} = Observed frequency of respondents of different farming systems with respect to j-th component of ith problem

E_{ij} = Expected frequency of respondents of different farming systems with respect to j-th component of ith problem

$$\text{Expected frequency of (i,j)-th cell } (E_{ij}) = \frac{(\text{Total for i-th row}) \times (\text{Total for j-th column})}{\text{Grand total}}$$

The χ^2 value obtained as such was then compared with relevant table value of χ^2 at degree of freedom $df = (n - 1) (r - 1)$.

Where,

n = Number of components of j-th problem (corresponds to number of rows)

r = Number of farming systems (corresponds to number of columns)

If χ^2 calculated is greater than χ^2 tabulated, it is inferred that there is an association between different problems and different farming systems and the effects of problems on different farming systems differ significantly. The degree of association between problems/constraints and different farming systems was determined by using coefficient of mean square contingency (C) as:

$$C = \sqrt{\frac{\chi^2}{\chi^2 + N}}$$

Where, N = Total sample size.

The value of C ranges from 0 to 1, the value of C close to 1 means higher degree of association.

3.4.3 Graphical Method

Besides tabular and statistical analysis, graphical illustrations like pie and bar diagrams were also used to depict the results more clearly.

RESULTS

RESULTS

The presentation of findings in a systematic manner is imperative for arriving at the logical interpretations and to suggest policy options. The results obtained from the data pertaining to different aspects of farming and investment pattern in study area have been presented systematically in this chapter under seven broad sections. First of all, the existing resource structure of sample farmers in various farming systems has been ascertained. The second section encompasses the investment pattern on various farming systems. The third section unveils the structural behaviour of public and private sector investment in agriculture. The capital use efficiency in agricultural sector has been described in fourth section of this chapter. The structure of different economic sectors in state gross domestic product and the incidence of poverty in relation with agricultural gross domestic product have been depicted in fifth section. The sixth section speaks of empirical analysis of determinants of investment and its impact on agricultural growth and rural development. Finally, various problems/constraints that thwart investment in agriculture as perceived by the farmers have been highlighted in the seventh section of this chapter.

4.1 SOCIO-ECONOMIC PROFILE OF SAMPLE HOUSEHOLDS

Efficiency of farming is influenced more or less by the resource availability at the command of an individual farmer and socio-economic overheads. Farm management decisions made by the farmers are the resultant of *inter alia*, the interplay of social status and resource endowments. Formulation of various developmental programmes and their implementation necessitate a critical

examination of the existing resource structure. Further, an insight of general socio-economic features enables the understanding of problems and prospects of development of any region. It becomes, therefore, quite imperative to examine the socio-economic conditions of the farmers in the study area. In view of above, the present section throws light on the socio-economic status of the households in the study area.

4.1.1 General Information of the Study Area

An insight into the parameters like demographic features, land utilization pattern and classification of workers is pertinent to frame developmental strategies for any region. The general information of study area has been presented in Table 4.1. It can be visualized from the table that FTFS has higher geographical area (1978 ha), which is almost triple the geographical area under FFS and VFS. However, the proportion of net sown area was relatively higher under FFS (58.73%), in comparison to other farming systems. The area under forests and permanent pastures and wastelands was higher under FTFS in comparison to VFS and FFS. The area under pastures and wastelands under VFS and FFS were about 309 and 186 hectares, respectively.

According to 2001 Primary Census Abstract, the total population was 6227, 7733 and 4894 in sample villages of FFS, VFS and FTFS, respectively. In all the farming systems, male out numbered females as indicated by lower sex ratio. The sex ratio in the sample villages was much lower under FTFS (890 females/1000 males) and higher in case of VFS (967 females/1000males). Moreover, the population was found less dense under FTFS as a consequence of higher geographical area.

Looking across the comparative employment pattern under different farming

Table 4.1: General information of the study areas under different farming systems

Particulars	FFS	VFS	FTFS
Population			
• Male	3234	3932	2589
• Female	2993	3801	2305
Total	6227	7733	4894
Sex ratio (Females/1000males)	925	967	890
Total households (No.)	1218	1494	1028
Small farm households (% of total households)	82.01	78.45	67.41
Large farm households (% of total households)	17.98	21.55	32.59
Total workers (No.)	26 31	31 73	1999
	(42.25)	(41.03)	(40.85)
• Cultivators (% of total workers)	41.01	44.09	42.32
• Agricultural labours (% of total workers)	6.23	5.67	12.06
• Other workers (% of total workers)	52.80	50.20	45.60
Non-workers (No.)	3596	4558	2889
	(57.75)	(58.94)	(59.03)
Population density (persons/km ²)	982.56	1117.48	247.42
Total geographical area (ha)	633.75	692.00	1978.00
Net sown area (ha)	372.23	342.17	740.75
Net sown area as per cent of geographical area	58.73	49.45	37.45
Forests (ha)	75.23	41.04	903.15
Pastures and wastelands (ha)	186.29	308.79	334.10

Source: Primary Census Abstract, Census of India, 2001 and Patwar Circles.
 Figures in the parentheses indicate percentages of total population

systems, the non-workers under all the farming systems out numbered the working population as indicated by the percentage of non-workers, which was more than 50 per cent in all the situations. The occupational pattern of working persons showed that over 50 per cent of total working population was engaged in farm related activities in study areas of FTFS and VFS. However, it was interesting to note that non-agricultural workers were slightly higher than agricultural workers under FFS.

4.1.2 Land Holding and Utilization

Agriculture, by and large, is a land-based avocation and, as such, land resource is the most critical and constraining resource in farming, especially in those developing countries like India, which has abundant supply of labour. The size of holding of farm household determines his well being and capacity to produce food for consumption as well as farm earning. A cursory glance at the Table 4.2 revealed that the farmers under FTFS were having relatively larger land holdings as compared to VFS and FFS. The minimum size of the holdings was observed under FFS. However, the proportion of operation holding was found higher under FFS (66.67%) as compared to VFS and FTFS farms. It was observed that about 92 per cent of the operational holding under VFS was irrigated, which was higher in comparison to FFS (41.86%) and FTFS (36.36%).

Table 4.2: Land use pattern of sample households under different farming systems

Farming system	Total holding (ha)	Operational holding		Irrigated area	
		Area (ha)	% of total holding	Area (ha)	% of operational area
FFS	1.29	0.86	66.67	0.36	41.86
VFS	1.51	0.93	61.59	0.86	92.47
FTFS	2.01	0.99	49.25	0.36	36.36

4.1.3 Family Structure and Literacy Level

The family structure plays an important role in farming and investment decisions. Since farming is a labour intensive activity, therefore, number of family members available for farming pursuit determines the well being of farm households. Therefore, this parameter of the social status has been dealt with in this section. It can be observed from Table 4.3 that average size of the family was almost same on all the farming systems though, it was slightly higher on FTFS farms. On an average about 64 and 59 per cent of the families under FFS and VFS, respectively have nuclear structure where adult members live apart from their parents after marriage. It is interesting to note that about 49 per cent of the farm families under FTFS still have joint family system.

Table 4.3: Family structure and literacy rate of sample households under different farming systems

Farming system	Family Size (No.)	Structure of family		Literacy Rate (%)
		Nuclear (%)	Joint (%)	
FFS	5.20	63.55	36.45	82.25
VFS	5.70	59.41	40.59	86.50
FTFS	6.20	50.88	49.12	83.60

Literacy level plays a catalytic role in the scientific management of farming and more so in case of investment decision. Education plays a vital role in the betterment of socio-economic conditions and provides healthy as well as clear environment for a good standard of living through a change in social and cultural life of the people, living both in plains and hilly regions. However, in the hilly regions, education is the sole media to bring radical changes in the economic and social

status of the people. It was observed from Table 4.3 that higher percentage of the literacy was recorded on VFS farms (86.50%) followed by FTFS (83.60%) and lower on FFS farms (82.25%). It indicated that the farmers under VFS were more innovative and could utilize the available resources optimally.

4.1.4 Capital Formation in farm Implements and Machinery

The capital formation in the form of implements and machinery per farm in different farming systems has been presented in Table 4.4 which revealed higher capital formation in the form of transport equipments under all the farming system though only few farmers were found to possess tractor and other equipments in the study areas. The proportion of capital formation in terms of cutting/harvesting and digging/hoeing tools was relatively higher under FTFS in comparison to other farming systems. The capital formation in the form of thresher under VFS (Rs 2381/farm) was higher in comparison to other farming systems. The proportion of capital accumulation in terms of plough was higher under FTFS farms while that of planker was higher on VFS farms. However, the proportion of capital formation in miscellaneous items was meagre under all the farming systems. The total capital formation on farms of different farming systems was higher on VFS followed by FFS and FTFS.

4.1.5 Capital Formation in the form of Livestock

Livestock rearing is an integral part of farming and holds distinct association with crop production. There exists a symbiotic relationship between crops and livestock, therefore, rearing of livestock along with farming is essential to derive more income and to augment the benefits from their mutual association. The inclination towards one group or species of livestock speaks of peculiar attitude of farmers conditioned by agro-ecological and environmental forces. The capital



formation in the form of livestock per farm under different farming systems has been presented in Table 4.5. The proportion of total capital formation in the form of livestock was higher in case of cross-bred cows and buffaloes under all the farming systems. Further, in the absence of tractor/power tiller in the study areas, some farmers were found to keep bullocks for ploughing. The proportion of capital formation in the form of bullock was higher in case of VFS (25.79%) followed by FFS (21.38%) and FTFS (20.66%). Few sheep/goats were also found visible in the study area and their proportion in total capital formation in the form of livestock was found to be meagre under all the farming systems. Per farm capital formation in the form of livestock was higher in case of FTFS in comparison to other farming systems.

4.1.6 Production System and Economics

The type of production system patronized in the area depends upon the resource endowment, topography and agro-climatic conditions, etc. The pattern of crop production and their economics have been contemplated in this section.

4.1.6.1 Cropping pattern, yield levels and cropping intensity

The cropping pattern shows the spatial distribution of different crops with respect to area at a particular point of time and thus, indicates the relative importance of each crop in the total cropped area. It depends mainly on physical and environmental factors like the type of soil, climate, etc. It is also governed by the economic factors such as prices of the outputs, income, cost of inputs, farm size, availability of inputs, marketing outlet, etc. Of late, the development of improved farm technologies has resulted in drastic change in the cropping pattern. From economic point of view, the study of cropping pattern is important to know the combination of different crops that may be grown to fetch higher returns. Cropping pattern and yield levels under different farming systems have been presented in the

Table 4.4: Capital formation in farm implements and machinery under different farming systems (Rs/farm)

Particulars	FFS		VFS		FTFS	
	Amount	%	Amount	%	Amount	%
Plough	434 (2.07)	2.90	397 (1.87)	1.91	323 (1.65)	4.62
Planker	105 (0.65)	0.70	219 (0.68)	1.05	32 (0.07)	0.46
Cutting/harvesting tools (sickle, axe, chaff cutter, sessor, gandasa)	1602 (8.93)	10.71	2464 (11.45)	11.83	1825 (10.97)	26.10
Digging and hoeing tools (spade, balcha, ganti, khudali)	460 (10.13)	3.07	422 (9.43)	2.02	384 (8.81)	5.49
Transport equipments (tractor, tiller, harrow, seed drill)	9969 (0.20)	66.64	14831 (0.48)	71.20	2634 (0.05)	37.68
Sprayer	52 (0.17)	0.35	96 (0.57)	0.46	101 (0.57)	1.45
Thresher	2251 (0.18)	15.04	2381 (0.10)	11.43	1666 (0.10)	23.83
Miscellaneous*	89 (2.29)	0.59	21 (1.22)	0.10	26 (0.56)	0.37
Total	14962 (24.62)	100.00	20831 (25.80)	100.00	6991 (22.78)	100.00

* includes speller, sieves, baskets, etc.

Figures in the parentheses indicate physical inventory of implements and machinery per farm.

Table 4.5: Capital formation in the form of livestock under different farming systems (Rs/farm)

Particulars	FFS		VFS		FTFS	
	Amount	%	Amount	%	Amount	%
Cross-bred cow	4937 (0.52)	21.78	6053 (0.80)	26.94	6403 (1.20)	27.75
Local cow	630 (0.20)	2.78	750 (0.25)	3.34	2005 (0.59)	8.69
Buffalo	9608 (1.09)	42.38	8175 (0.90)	36.38	7550 (0.97)	32.72
Heifer and calf	1803 (1.22)	7.95	1247 (0.80)	5.55	859 (0.93)	3.72
Bullock	4848 (1.10)	21.38	5796 (1.18)	25.79	4767 (0.88)	20.66
Sheep/Goat	47 (0.10)	0.21	282 (0.42)	1.26	310 (0.63)	1.34
Horse /Mule	798 (0.12)	3.52	167 (0.03)	0.74	1180 (0.17)	5.12
Total	22671 (4.35)	100.00	22470 (4.38)	100.00	23074 (5.37)	100.00

Figures in parentheses indicate physical inventory of livestock per farm.

ensuing section (Table 4.6 to 4.8).

- **Food-grain based farming system (FFS)**

The common crops grown under this farming system were maize, wheat, paddy, mustard, potato cauliflower, ginger, etc. It was observed that under FFS about 78 per cent of the total cropped area was allocated to cereal crops (Table 4.6). The vegetables were mostly grown under irrigated conditions and occupied about 10 per cent of cropped area. Spice crops occupied about 3 per cent while, about 3 and 2 per cent of the cropped area were allocated to pulses and oilseeds, respectively. Fodder crops were grown over 3 per cent of the cropped area. Among

these crops, maize, wheat and paddy were found to be the most predominant crops grown by the farmers accounting for around 20, 35 and 23 per cent of cropped area, respectively. The cropping intensity of FFS farms was around 200 per cent indicating thereby that farmers were generally growing two crops in a year.

It can be visualized from the table that under this farming system, the yield of maize was higher than that of wheat and paddy. The average yield of potato (101 q/ha) was higher in comparison to other vegetable crops. Mustard and gram gave higher yield among oilseeds and pulses, respectively while, the yield of ginger (73.03q/ha) was higher among spice crops. The yield of berseem was found as high as 195 quintals per hectare.

- **Vegetable based farming system (VFS)**

The area under different crops under VFS along with corresponding average yields has been displayed in Table 4.7. The common crops grown under this farming system were cauliflower, cabbage, capsicum, pea, wheat, maize, etc. Obviously, under this farming system, vegetable crops were predominantly grown accounting around 65 per cent of total cropped area. Around 26 per cent of the cropped area was allocated to cereals. Spices and pulses were grown over 5 and 1 per cent of cropped area, respectively. Fodder crops were grown over 1 per cent of cropped area. Among vegetable crops maximum area was allocated to cauliflower followed by cabbage, capsicum and pea. Wheat was the major cereal crop during rabi season, paddy was mostly grown under irrigated while maize was grown under rainfed condition during kharif season. The cropping intensity of VFS farms was about 228 per cent.

Average yield of vegetable crops showed that cucumber leads all vegetable crops with the average yield of about 197 quintals per hectare followed by potato,

Table 4.6: Cropping pattern, yield levels and cropping intensity under FFS

Crop	Area (ha)	Per cent of cropped area	Yield (q/ha)
Cereals	1.35	78.03	-
• Maize	0.35	20.23	23.88
• Wheat	0.60	34.68	22.49
• Paddy	0.40	23.12	22.83
Vegetables	0.17	9.83	-
• Lady finger	0.02	1.16	66.42
• Cauliflower	0.03	1.73	50.45
• Cabbage	0.01	0.58	61.4
• Potato	0.03	1.73	10.1
• Onion	0.01	0.58	59.5
• Spung guard	0.02	1.16	54.25
• Others	0.05	2.89	60.56
Oilseeds	0.04	2.31	-
• Mustard	0.03	1.73	6.84
• Others	0.01	0.58	5.19
Pulses	0.05	2.89	-
• Mash	0.02	1.16	4.52
• Gram	0.02	1.16	8.2
• Others	0.01	0.58	6.58
Spices	0.05	2.89	-
• Chilli	0.01	0.58	0.88
• Ginger	0.02	1.15	73.03
• Garlic	0.02	1.16	55.31
Fodder	0.06	3.47	-
• Berseem	0.05	2.89	194.79
• Others	0.01	0.58	10.86
Sugarcane	0.01	0.58	398.00
Cropped area	1.73	100.00	-
Net sown area	0.86	-	-
Cropping intensity (%)	-	201.16	-

Table 4.7: Cropping pattern, yield levels and cropping intensity under VFS

Crop	Area (ha)	Per cent of cropped total	Yield (q/ha)
Cereals	0.56	26.42	-
• Maize	0.19	8.96	20.11
• Wheat	0.27	12.74	24.79
• Paddy	0.10	4.72	24.43
Vegetables	1.38	65.10	-
• Cauliflower	0.34	16.04	137.73
• Cabbage	0.21	9.91	176.44
• Potato	0.11	5.19	193.96
• Tomato	0.07	3.30	193.75
• Radish	0.09	4.25	106.48
• Spung guard	0.01	0.47	175
• Capsicum	0.14	6.60	121.12
• Cucumber	0.09	4.25	196.93
• Pea	0.13	6.13	78.44
• Brinjal	0.03	1.41	190.72
• Spinach	0.05	2.36	177.27
• Onion	0.04	1.89	138
• Lady finger	0.04	1.89	104.33
• Others	0.03	1.41	142.83
Pulses	0.03	1.41	-
• Gram	0.01	0.47	8.44
• Lentil	0.01	0.47	8.44
• Rajmash	0.01	0.47	14.06
Spices	0.10	4.72	-
• Ginger	0.03	1.42	115.33
• Garlic	0.05	2.36	135.48
• Dhaniya	0.02	0.94	109.72
Oilseeds	0.03	1.41	7.14
Fodder	0.02	0.94	297.06
Cropped area	2.12	100.00	-
Net sown area	0.93	-	-
Cropping intensity (%)	-	227.96	-

tomato, brinjal and spinach. The yield levels of lady finger and pea were around 104 and 78 quintals per hectare, respectively. Garlic yielded about 135 quintals per hectare which was higher than other spice crops. Among cereals, the yield of wheat was higher than that of paddy and maize.

- **Fruit based farming system (FTFS)**

Under FTFS higher proportion of cropped area (59.87%) was under orchards while, cereal crops were grown over 25 per cent of total cropped area (Table 4.8). Vegetables were mostly grown under irrigated conditions and occupied about 9 per cent of cropped area. Mango as main sub-tropical fruit and apple as main temperate fruit were planted over 14 and 16 per cent of cropped area, respectively. The other fruits including litchi, anola and papaya were grown in limited number. Maize among cereals and cauliflower among vegetables were other important crops predominantly grown under this farming system.

It can be seen from the table that the average yield of mango was higher than other fruit crops grown under this farming system. The yield of apple was higher among all temperate fruits. Among cereals, the yield of paddy was higher than wheat and maize. The average yield of tomato (180.6 q/ha) was much higher than other vegetable crops grown under this farming system. The cropping intensity under this farming system was around 153 per cent.

4.1.6.2 Financial overview of crops

The study of economics (costs and returns) of different crops gives an understanding of the comparative profitability of these crops. It helps in identifying the crops that could be taken up on commercial lines. The economics of different crops grown under different farming systems has been worked out and presented in Table 4.9 to 4.11.

Table 4.8: Cropping pattern, yield levels and cropping intensity under FTFS

Crops	Area (ha)	Per cent of cropped area	Yield (q/ha)
Cereals	0.38	25.00	-
• Maize	0.17	11.18	22.69
• Paddy	0.05	3.29	23.71
• Wheat	0.16	10.53	19.4
Vegetables	0.13	8.55	-
• Spung guard	0.02	1.31	54.64
• Potato	0.01	0.66	98.79
• Cauliflower	0.04	2.63	63.37
• Tomato	0.01	0.66	180.56
• Pea	0.04	2.63	54.35
• Others	0.01	0.66	61.72
Pulses	0.04	2.63	5.97
Oilseed	0.04	2.63	5.62
• Mustard	0.02	1.32	4.66
• Others	0.02	1.31	6.58
Spices	0.01	0.66	24.88
Fodder	0.01	0.66	178.13
Fruits	0.91	59.87	-
• Mango	0.22	14.47	133.62
• Orange	0.14	9.22	133.57
• Malta	0.03	1.97	103.11
• Kinnow	0.14	9.21	111.53
• Apple	0.25	16.46	118.33
• Peach	0.03	1.97	98.63
• Apricot	0.02	1.31	95.91
• Pear	0.04	2.63	132.77
• Dry fruits	0.03	1.97	104.49
• Others	0.01	0.66	118.47
Cropped area	1.52	100.00	-
Net sown area	0.99	-	-
Cropping intensity (%)	-	153.53	-

The gross as well as net farm returns from different crops grown under FFS as shown in the Table 4.9 revealed that ginger recorded higher gross returns (Rs 80329/ha) followed by garlic (Rs 49781/ha). Among cereals, gross returns from paddy were relatively higher than maize and wheat. Among vegetables, onion recorded higher gross returns followed by potato. Among pulses, gram recorded the higher gross returns than mash and other pulses while, mustard gave higher gross returns among oilseeds. The net returns over variable costs were also found maximum in case of ginger. The comparison across the cereal crops exhibited higher net returns from paddy. Likewise, net returns from onion were higher among vegetables followed by potato.

The gross returns and net returns from different crops on VFS farms have been presented in Table 4.10. It was found that gross returns were higher in case of garlic (Rs 143609/ha) followed by ginger (Rs 105417). Paddy gave higher gross returns among cereals while among vegetables, tomato gave higher gross returns followed by capsicum, cauliflower and potato. Among pulses, rajmash was found more paying. The net returns were also found to be higher in case of garlic. Paddy among cereals, capsicum among vegetables and rajmash among pulses were found to give better net returns.

It is clear from the Table 4.11 that under FTFS fruit crops relatively gave better gross returns than other field crops. Dry fruits recorded higher gross returns (Rs 193561/ha) followed by orange (Rs 121564/ha) and mango (Rs 111185/ha). It was observed that paddy recorded higher gross returns (Rs 20868) than other cereal crops while, tomato gave higher gross returns among vegetables followed by pea and cauliflower. The gross returns from mustard (Rs 10718/ha) were found to be lower among all the crops. With regards to net returns, dry fruits appeared at top

Table 4.9: Economics of different crops under FFS (Rs/ha)

Crop	Gross returns	Variable Costs	RFFR *
Cereals			
• Maize	12535	5637	6898
• Wheat	13494	7050	6444
• Paddy	19865	8171	11694
Vegetables			
• Lady finger	24574	10321	14253
• Cauliflower	23205	11751	11454
• Cabbage	23024	10501	12523
• Potato	30562	16199	14363
• Onion	32725	8678	24047
• Spung guard	27125	15511	11614
• Others	27422	13082	14340
Oilseeds			
• Mustard	17100	3881	13219
• Others	10380	2550	7830
• Pulses			
• Mash	9944	2486	7458
• Gram	16391	3681	12710
• Others	8071	1482	6589
Spices			
• Chilli	6160	2550	3610
• Ginger	80329	30890	49439
• Garlic	49781	28550	21231
Fodder			
• Berseem	17531	5142	12389
• Others	13031	4949	8082
Sugarcane	45500	31000	14500

* Returns to fixed farm resources

Table 4.10: Economics of different crops under VFS (Rs/ha)

Crop	Gross returns	Variable costs	RFER *
Cereals			
• Maize	12267	6564	5703
• Wheat	21317	9785	11532
• Paddy	35227	11317	23910
Vegetables			
• Cauliflower	82638	27401	55237
• Cabbage	61754	23770	37984
• Potato	81463	52503	28960
• Tomato	87187	21350	65837
• Radish	40995	14660	26335
• Spung guard	64750	16888	47862
• Capsicum	84784	17566	67218
• Cucumber	68925	18118	50807
• Pea	66672	17353	49319
• Brinjal	59129	20765	38364
• Spinach	46091	19144	26947
• Onion	57960	20280	37680
• Lady finger	68858	20732	48126
• Others	29809	9429	20380
Pulses			
• Gram	17724	9429	8295
• Lentil	19112	7477	11635
• Rajmash	28140	6602	21538
Spices			
• Ginger	105417	29330	76087
• Garlic	143609	28550	115059
• Dhaniya	49375	18221	31154
Oilseeds	17850	10212	7638
Fodder	23755	7142	16613

Returns to fixed farm resources

Table 4.11: Economics of different crops under FTFS (Rs/ha)

Crop	Gross returns	Variable Costs	RFFR *
Cereals			
• Maize	11798	5640	6159
• Paddy	20868	6951	13917
• Wheat	15134	5856	9278
Vegetable			
• Cucurbits	25953	14163	11790
• Potato	40504	15408	25096
• Cauliflower	34852	17038	17814
• Tomato	119167	34180	84987
• Pea	35871	9889	25982
• Others	28981	13741	15240
Pulses	12886	8477	4409
Oilseeds			
• Mustard	10718	3721	6997
• Others	16450	3949	12501
Spices	39472	28550	10922
Fodder	17813	4000	13813
Fruits			
• Mango	111185	30174	81011
• Orange	121564	32898	88666
• Malta	76834	29876	46958
• Kinnow	86992	33216	53776
• Apple	82831	34192	48639
• Peach	43131	27610	15521
• Apricot	81254	31573	49680
• Pear	63729	30066	33663
• Dry	193561	31574	161987
• Others	105281	30875	74406

* Returns to fixed farm resources

followed by orange, tomato and mango. The relatively lower net returns were found in case of pulses

4.1.7 Economics of Livestock

The total cost as well as gross and net returns per animal have been estimated and presented in Table 4.12. It was observed that on FFS farms maximum cost per animal was in case of cross-bred cow followed by buffalo. In case of sheep/goat the cost was estimated at Rs 609 per annum. Based upon the value of animal products (milk, wool, etc.) and by product (dung), the gross returns were estimated. In case of the cross-bred cow, the gross and net returns were estimated at Rs 19950 and Rs 5278 per animal, respectively, which was substantially higher than buffalo and local cow. In case of sheep/goats (which also included sale of wool and milk) the net returns were estimated at Rs 666.

Under VFS farms, higher cost was in case of milch cross-bred cow (Rs 14452) which was higher than milch buffalo (Rs 12321). In case of local cow the cost per animal per annum was estimated at Rs 9536. The cost of sheep/goat was Rs 703 per annum. The gross returns in case of cross-bred cows were estimated at Rs 21224 per animal, which were higher than other milch animals kept under this farming system. The net returns were also higher in case of cross-bred cow followed by buffalo.

Under FTFS, it was observed that maximum cost per animal was in case of cross-bred cow followed by buffalo and local cow. In case of sheep/goat the cost per animal was estimated at Rs 700 per annum. Per animal net returns in case of cross-bred milch cow were Rs 8601 per annum, which were higher than buffalo and local milch cow.

The comparison across different farming systems showed that the returns from

Table 4.12: Economics of livestock production under different farming systems (Rs/animal/annum)

Particulars	FFS						VFS						FTFS					
	Production (q)		GR	TC	NR	Production (q)	GR	TC	NR	Production (q)	GR	TC	NR	Production (q)		GR	TC	NR
	Main	By				Main	By			Main	By			Main	By			
Cross ^{-bred} milk cow	19.2	38.2	19950	14672	5278	20.1	37.0	21224	14452	6772	21.7	40.0	24212	15611	8601			
Local milk cow	8.9	29.1	9468	9267	201	9.2	24.5	9648	9536	112	9.1	29.8	9492	9411	81			
Milch buffalo	14.8	40.6	15356	11321	4035	15.0	40.8	16190	12321	3869	15.5	41.2	16597	11121	5476			
Sheep/goat	0.02	3.1	1275	609	666	0.02	3.5	1015	703	312	0.03	3.7	1319	700	619			

GR, TC and NR denote gross returns, total costs and net returns, respectively.

all the animals particularly in case of cross-bred milch cow and milch buffalo were higher in case of FTFS followed by VFS and FFS. The higher returns from cross-bred cow and milch buffalo under FTFS were as a result of higher yield of these animals under this farming system. However, net returns from local milch cow were higher under FFS due to higher yield in comparison to other farming systems.

4.2 PATTERN OF INVESTMENT IN DIFFERENT FARMING SYSTEMS

Farm investment is an important indicator of capital formation and economic progress in agriculture. The investment in agriculture is made by farm households as well as by government. An attempt has been made in this section to estimate the farm investment made by the public and private sectors.

4.2.1 Public Agricultural Investment

The public investment in agriculture in Himachal Pradesh is specifically in the form of investment on rural development (which includes investment that is directly spend for village development through developmental blocks (Stream-I) and the investment that is channelized to village through panchayat offices and village level officers (Stream-II)), investment on irrigation (which includes investment on lift irrigation, tube wells, kulhs and canals), investment on rural infrastructure (which includes investment on rural roads and rural electrification), investment on crop husbandry and investment on miscellaneous items (which includes investment on animal husbandry and forestry). The investment on account of public sector on all these components along with their relative contribution under different farming systems has been presented in Table 4.13.

Under FFS, it was the investment on rural development (56.12%) which constituted higher proportion of total public investment while, the share of rural infrastructure and irrigation was about 21 and 13 per cent, respectively. However, the

Table 4.13: Pattern of public investment in agriculture under different farming systems during 2004-05

Items	FFS		VFS		FTFS	
	Amount	%	Amount	%	Amount	%
Rural development	412558	56.13	715172	57.16	656322	57.61
• Stream-I	168008	22.86	586624	46.89	333304	29.26
• Stream-II	244550	33.27	128548	10.27	323018	28.35
Crop Husbandry	26569	3.62	38251	3.06	53421	4.69
• Agriculture	24311	3.31	37251	2.98	18171	1.60
• Horticulture	2258	0.31	1000	0.08	35250	3.08
Irrigation structures	93956	12.78	310612	24.83	65160	5.72
Rural infrastructure	151902	20.66	156153	12.48	331211	29.07
• Rural electricity	67472	9.18	64000	5.11	139000	12.20
• Rural road	84430	11.48	92153	7.37	192211	16.87
Miscellaneous	50101	6.81	30971	2.47	33205	2.91
• Forestry	8850	1.20	402	0.03	13705	1.20
• Animal Husbandry	41251	5.61	30569	2.44	19500	1.71
Total	735086	100.00	1251159	100.00	1139319	100.00
Total per hectare	1975	100.00	3656	100.00	1538	100.00
Total per farm	603	100.00	837	100.00	1108	100.00

Source: Panchayat offices, Patwar circles, ADO circles, and various offices at Tehsil and Block levels

proportion of public investment spent on miscellaneous items and crop husbandry was quite low under this farming system. Further, it was observed that higher proportion of the investment on rural development was spent through stream-II.

Under VFS, the public investment on rural development was found to be higher in comparison to other investment components and was contributing around 57 per cent of total public investment in agriculture. The investment on irrigation came next followed by investment on rural infrastructure. However, the investment allocated to crop husbandry and miscellaneous items accounted for about 3 and 2 per cent of total public investment, respectively. Bulk of investment on rural development was made through stream-I, which alone accounted for about 47 per cent of total public investment.

Under FTFS, rural development and rural infrastructure were the main components of public agricultural investment. Only 6 per cent of the total investment was allocated to irrigation under this farming system. Similarly, crop husbandry and miscellaneous components also have low share in public investment under this farming system.

Comparison of the pattern of public investment under different farming systems showed that relatively higher proportion of the investment was made on rural development under all the farming systems. The investment on irrigation was relatively higher under VFS and less in case of FTFS. The relative proportion of investment on rural infrastructure was higher under FTFS. The total public agricultural investment was observed to be Rs 1251159, 1139319 and 735086 under VFS, FTFS and FFS, respectively, which indicated higher public investment under VFS than under other farming systems. Per hectare public investment also showed the same pattern. However, per farm public investment showed higher

investment on FTFS farms followed by VFS and FFS.

4.2.2 Private Agricultural Investment

The pattern of agricultural investment made by farm households has been examined by grouping the items of investment into (i) land improvement (ii) farm buildings (iii) irrigation structures (iv) implements and machinery (v) livestock (vi) orchards and plantations (vii) transport equipments, and (viii) miscellaneous items including fencing of newly laid orchards and furniture and fixtures. The land has not been considered because it was mostly acquired as ancestral property. Private agricultural investment per farm and the relative contribution of various components in total private investment in the study area have been shown in Table 4.14 to 4.16.

Under FFS, the pattern of total capital stock indicated higher capital formation in case of farm buildings followed by livestock and transport equipments. However, there was lower capital accumulation in case of orchards and plantations under this farming system (Table 4.14). The behaviour of investment made during the year 2004-05 revealed that investment on livestock was found to be as high as 38 per cent of total farm investment. Investment on farm buildings came next and contributed about 23 per cent of total farm investment. Investment on implements and machinery and irrigation constituted about 16 and 19 per cent of total investment, respectively. Investment on miscellaneous items accounted for just 2 per cent of total private investment. Investment on transport equipments was found to be completely absent under this farming system.

Under VFS, the per farm capital stock revealed that there was higher capital stock in case of livestock followed by farm houses and transport equipments. The capital stock in form of irrigation structures was as high as Rs. 11966 per farm. The pattern of investment made during the year 2004-05 revealed that the investment on

livestock and farm houses accounted for fairly high proportion of total farm investment (Table 4.15). Livestock alone contributed about 46 per cent of the total per farm investment while, farm buildings accounted for about 21 per cent. The next important items of investment was found to be irrigation structure, which constituted 10 per cent, followed by implements and machinery which constituted for about 15 per cent of total farm investment. It was found that under this farming system tractor and power driven equipments were kept mainly for hiring out. In this way, transport equipments accounted for about 7 per cent of total farm investment. The investment on orchards and plantations and miscellaneous items was meagre. However, the investment on land improvement during 2004-05 was absent under this system.

Table 4.14: Total capital stock and pattern of private agricultural investment under FFS (Rs/farm)

Investment item	Total capital stock	Investment during 2004-05		Investment as % of capital stock
		Amount	%	
Land improvement	253	147	1.93	58.10
Farm building	25557	1760	23.06	6.89
Livestock	22671	2920	38.25	12.88
Implements and machinery	4993	1196	15.67	23.95
Irrigation structures	5619	1474	19.31	26.23
Orchards and plantations	4	4	0.05	100.00
Transport equipments	9969	0	0.00	0.00
Miscellaneous*	218	132	1.73	60.55
Total per farm**	69284	7633	100.00	11.02
Total per hectare	80563	8876	100.00	11.02

* Others include investment over fencing, furniture, grain bins, ropes, etc.

** This does not include investment over residential houses and store rooms being simultaneously used for residence.

Table 4.15: Total capital stock and pattern of private agricultural investment under VFS (Rs/farm)

Item	Total capital stock	Investment during 2004-05		Investment as % of capital stock
		Amount	%	
Land improvement	180	0.00	0.00	0.00
Farm building	19943	1942	21.46	9.74
Livestock	22470	4150	45.86	18.47
Implements and machinery	6000	1345	14.87	22.42
Irrigation structures	11966	908	10.03	7.59
Orchards and plantations	21	11	0.12	52.38
Transport equipments	14831	620	6.85	4.18
Miscellaneous*	611	73	0.81	11.95
Total per farm**	76022	9049	100.00	11.90
Total per hectare	81744	9730	100.00	11.90

* Others include investment over fencing, furniture, grain bins, ropes, etc.

** This does not include investment over residential houses and store rooms being simultaneously used for residence.

The per farm capital stock and investment under FTFS farms have been presented in Table 4.16. The perusal of the table revealed higher capital stock in case of farm buildings followed by livestock. The capital stock in terms of orchards and plantations was as high as Rs 6928 while, it was Rs 6099 per farm in case of irrigation. The capital stock in case of land improvement and transport equipments were Rs 3268 and Rs 2634 per farm, respectively. The scenario of investment during 2004-05 revealed that investment on livestock and farm houses accounted for 52 and 24 per cent of total farm investment, respectively. Investment on implements and machinery and transport equipments accounted for about 8 and 7 per cent, respectively. Since, this farming system was dominated by fruit crops,

therefore, investment on orchards and plantations and miscellaneous items accounted for about 3 and 4 per cent of total farm investment, respectively.

Looking across the different farming systems, it was found that livestock and farm buildings accounted for a higher percentage of total farm investment under all the farming systems. The investment made during 2004-05 as per cent of total capital stock revealed that investment was about 12 per cent of total capital stock under FTFS, which was higher in comparison to other farming systems. In other words, it could be inferred that there was about 12 per cent growth in capital stock during 2004-05 under FTFS. While, capital stock on farm grew at 11.02 and 11.90 per cent under FFS and VFS, respectively. The per cent increase in capital stock in case

Table 4.16: Total capital stock and pattern of private investment under FTFS (Rs/farm)

Item	Total capital stock	Investment during 2004-05		Investment as % of capital stock
		Amount	%	
Land improvement	3268	57	0.62	1.74
Farm building	25491	2187	23.91	8.58
Livestock	23074	4779	52.26	20.71
Implements and machinery	4357	707	7.74	16.23
Irrigation structures	6099	83	0.91	1.20
Orchards and plantations	6928	277	3.03	4.00
Transport equipments	2634	667	7.29	25.32
Miscellaneous*	2315	388	4.24	16.76
Total per farm**	74166	9145	100.00	12.33
Total per hectare	74915	9237	100.00	12.33

* Others include investment over fencing, furniture, grain bins, etc.

** This does not include investment over residential houses and store rooms being simultaneously used for residence.

of irrigation and implements and machinery were higher under FFS, indicating thereby that farmers in this farming system were more concerned about having their own irrigation source and about improved implements. Likewise, the per cent growth in capital stock of orchards and plantations were higher under VFS and that of transport equipments under FTFS. Per farm investment was found comparatively higher in case of FTFS followed by VFS and FFS. The private agricultural investment as per hectare of operational area was about Rs 8876, 9730 and 9237 under FFS, VFS and FTFS, respectively, which indicated the higher per hectare investment under VFS and lower in case of FFS.

4.3 STRUCTURAL CHANGES IN AGRICULTURAL INVESTMENT

Estimates of public investment and private agricultural investment (excluding investment made by private corporate sector) deflated at 1970-71 prices have been presented in Table 4.17. Himachal Pradesh underwent many structural changes after Independence and attained statehood during 1971. There after, the policies of the government were directed mainly for the development of agricultural sector and building of basic infrastructure. In view of this government investment in agriculture steadily increased from about Rs. 1162 lakh (1969-70) to Rs. 2541 lakh (1980-81). After this public investment suffered a minor set back, the emphasis might have been shifted to other sectors, which led to decline in public investment during 1985-86. However, during 1990's this decline in public investment was arrested and more funds were allocated for agricultural development. Towards the end of Ninth Plan (i.e. during 2001-02), it again showed a decline and went down from about Rs. 3381 lakhs (1995-96) to about Rs. 2936 lakhs (2001-02):

The private investment in agriculture showed an inconsistent pattern. After showing some deceleration towards 1980-81, the real private investment spurt

towards termination of Ninth Plan. The private investment decreased to about Rs. 312 lakhs during 1980-81 from Rs. 703 lakhs during 1969-70. But, later it increased more or less three times from 1980-81 to 2001-02.

Table 4.17: State level investment in agriculture at 1970-71 prices (Rs. in lakh)

Year	Public investment	Private investment	Total investment
1969	1162	703	1865
1975	1276	474	1750
1980	2541	312	2853
1985	2279	563	2842
1990	3230	679	3909
1995	3381	1224	4605
2001	2936	1563	4499
CGR (%)	3.99*** (0.35)	3.79*** (0.60)	3.87*** (0.24)

Source: Financial accounts of state government and other publication of Department of Planning commission, National Sample Survey Organization – Reserve Bank of India.

*** denotes significance at 0.01 level of probability.

Figures in the parentheses indicate standard error.

4.3.1 Growth and Intensity of Agricultural Investment

Using the time series data pertaining to different items of state agricultural investment, analysis was carried out at 1970-71 prices. Ratios (per hectare real investment), intensities (real investment as per cent of agricultural gross domestic product) and compound growth rates (CGRs%) were estimated to find out the growth and performance of agricultural investment over time.

4.3.1.1 Public agricultural investment

Public investment in agriculture was made on broad items like rural infrastructure, soil and water conservation, irrigation and flood control, agricultural research and education, rural development, crop husbandry and others including dairy development, animal husbandry, fishery, forestry.

4.3.1.1.1 Per hectare public agricultural investment

Item-wise per hectare public agricultural investment has been estimated and presented in Table 4.18 and revealed that the real public agricultural investment on almost all items increased from period-I (1969-79) to period-III (1991-01). Few items of public investment like minor irrigation, agricultural financial institution and dry land farming showed fluctuations attaining peak during period-II and then again declined during period-III. During Green Revolution era (1969-79), the major emphasis was on the development of agriculture and irrigation. Therefore, much investment was allocated to agricultural crop husbandry (Rs 24.89/ha) followed by minor irrigation (Rs 18.18/ha), horticulture (Rs 15.75/ha) and soil and water conservation (Rs. 11.13/ha).

Since, major thrust areas during period-II were removal of poverty, development of irrigation, modernization, etc, thus, huge amount of funds were invested on rural development schemes (Rs. 51.12/ha), minor irrigation (Rs. 48.17/ha), agricultural crop husbandry (Rs. 26.02/ha), horticulture (Rs 18.73/ha) and for soil and water conservation (Rs.13.98/ha). It was also realized that the agricultural development could not be achieved in isolation without increasing investment in other sectors like physical infrastructure, education and research and rural development structures, etc. The resources were, therefore, deviated towards development and rehabilitation of basic infrastructure like agricultural financial institution, roads and bridges, rural electrification and market development. In this period, although no special attention was paid to agricultural research and education but, the structure of funds were improved over this item. Per hectare investment on major irrigation, forestry and animal husbandry were also found to improve during this period.

Table 4.18: Public investment in agriculture as per hectare of net sown area at 1970-71 prices (Rs/ha)

Item	Period-I (1969-80)	Period-II (1980-91)	Period-III (1991-2001)
Soil and water conservation	11.13	13.98	14.64
Agricultural research and education	6.83	9.99	25.01
Rural development	9.17	51.12	77.72
Irrigation and flood control			
• Major and medium irrigation	6.01	8.64	13.43
• Minor irrigation	18.18	48.17	40.70
• Flood control and command area development	1.55	4.18	8.72
Rural infrastructure			
• Agricultural financial institutions	2.50	10.09	1.44
• Rural electrification	3.15	5.32	3.69
• Roads and bridges	10.60	14.73	22.75
• Market development	0.48	6.58	16.49
Crop husbandry			
• Agriculture	24.89	26.02	37.00
• Horticulture	15.75	18.73	20.41
• Dry land farming	0.00	8.31	0.89
Fishery	1.01	2.66	5.81
Dairy development	4.78	4.05	5.15
Animal husbandry	7.89	10.93	20.32
Forestry	3.01	6.82	0.96
TOTAL	126.93	250.32	315.13

Later in Eighth and Ninth Plan periods (corresponding to period-III), the major emphasis was on improvement of work productivity, quality of life and skill development, etc. Therefore, investment on agricultural research and education increased from about Rs. 10 per hectare (period-II) to Rs. 25 per hectare (period-III). Rural development still remained a priority sector for upliftment of rural masses and self-reliance during period-III (1991-01) and, hence, the investment on rural development increased to about Rs 78 per hectare during this period. During this period irrigation continued to enjoy the special status in terms of investment. Investment on flood control and command area development almost doubled from period-II to period-III. Per hectare investment in agricultural financial institutions (includes debenture support to co-operatives and land development banks and share capital to agro-industries, etc. for their financial viability and rehabilitation, etc.) decreased towards period-III. Besides, there has been a constant increase in per hectare investment in crop husbandry, animal husbandry, fishery and dairy development during period-III.

4.3.1.1.2 Intensity of public agricultural investment

With an intention to find out the pattern of investment on different items of public investment, intensities were estimated as per cent of agricultural gross domestic product (AGDP). However, the intensities of investment on roads infrastructure and rural electrification were estimated with respect to gross domestic product (SGDP). The estimates of intensities were presented in Table 4.19. The analysis presented in the table revealed that during period-I, the public investment as a whole was about 12 per cent of agricultural gross domestic product (AGDP), which in the later period rose to more than 18 per cent. However, it remained almost stagnant during period-III. The intensities of most of the public investment items

increased toward period-III while, few investment items like soil and water conservation, minor irrigation, agricultural financial institutions and rural electrification showed fluctuating pattern that increased during period-II and then declined again towards period-III. The intensity of investment on major and medium irrigation showed persistent increase over the years. The intensity of investment on flood control and command area development increased continuously from 0.06 per cent to 0.25 per cent. Increasing intensity of rural development showed higher emphasis on rural well-being. Investment on rural roads and bridges as per cent of state gross domestic product (SGDP) also showed an increase over the years. The intensities of other investment items like fishery and animal husbandry also showed an increase from period-I to period-II.

4.3.1.1.3 Compound growth rate of public agricultural investment

The compound growth rates of public agricultural investment do not indicate any consistent pattern (Table 4.20). During Green Revolution period, there has been a spurt in public agricultural investment. It increased at an annual growth rate of about 7 per cent. The public investment declined during period-II and grew at an annual growth rate of 2.94 per cent. However, its growth rate almost remained stagnant at 2.12 per cent during period-III. The declining growth of public investment need to be reversed immediately to achieve desired growth rate of agricultural sector and state income *per se*. Investment on soil and water conservation showed fluctuating pattern. Firstly, it grew at an annual growth rate of about 8 per cent (period-I), then it showed negative growth rate at -7 per cent (period-II) but later during period-III, it registered higher growth rate of about 10 per cent per annum. Investment on agricultural research and education marked positive and significant growth during all the three period although; it grew at slower growth rate towards

Table 4.19: Intensities of public investment in agriculture at 1970-71 prices (% of AGDP)

Item	Period-I (1969-79)	Period-II (1980-90)	Period-III (1991-2001)
Soil and water conservation	0.46	0.52	0.43
Agricultural research and education	0.28	0.37	0.73
Rural development	0.38	1.91	2.27
Irrigation and flood control			
• Major and medium irrigation	0.24	0.32	0.39
• Minor irrigation	0.74	1.80	1.19
• Flood control and command area development	0.06	0.16	0.25
Rural infrastructure			
• Agricultural financial institutions	0.10	0.38	0.04
• Rural electrification	1.34	1.95	1.06
• Roads and bridges	4.49	5.40	6.55
• Market development	0.02	0.25	0.48
Crop husbandry			
• Agriculture	1.01	0.97	1.08
• Horticulture	0.64	0.70	0.60
• Dry land farming	0.00	0.31	0.03
Fishery	0.04	0.10	0.17
Dairy development	0.19	0.15	0.15
Animal husbandry	0.32	0.41	0.59
Forestry	1.28	2.50	2.75
TOTAL	11.59	18.20	18.76

period-III. Rural development investment showed negative growth rate (-1.55%) during period-I but in post-reform era (1991-2001), there was a major shift of emphasis towards rural development as the investment showed rising trend and increased significantly at an annual growth rate of about 12 per cent. The growth rate of investment on minor irrigation declined drastically from about 18 per cent (period-I) to just 6 per cent (period-II) and later it marked negative growth rate during period-III. During Green Revolution period various medium irrigation schemes were started for developing agriculture sector as a consequence the investment on major and medium irrigation grew at an alarming annual growth rate of about 76 per cent during first period. There was a decline in the growth rate of this investment during period-II but, later it attained a rising trend and grew at an annual growth rate of 13 per cent. All the items of rural infrastructure registered significant positive growth during period-I and period-II, which later showed declining growth during period-III. Investment on other items like fishery, dairy development, etc. showed a declining trend towards third period.

4.3.1.2 Private agricultural investment

Private investment in agriculture is mainly classified into investment on construction/reclamation of land/buildings, investment on irrigation structures, investment on orchards and plantations, investment on agricultural implements and machinery and investment on other items like fencing and furniture and fixtures, etc.

4.3.1.2.1 Per hectare private agricultural investment

The private investment in agriculture at 1970-71 prices was found to be Rs. 97 per hectare during Green Revolution phase (Table 4.21). The investment later declined to Rs. 92 per hectare during post-green revolution phase (1980-90). However, towards beginning of period-III, people started investing on irrigation

Table 4.20: Compound growth rates of public investment in agriculture at 1970-71 prices (%)

Particulars	Period-I (1969-79)	Period-II (1980-90)	Period-III (1991-2001)
Soil conservation	7.95*** (2.18)	-7.02* (3.76)	9.69*** (1.48)
Agricultural research and education	10.93*** (3.20)	9.59*** (2.00)	5.14* (2.61)
Rural development	-1.55 (1.03)	2.96 (3.24)	11.94*** (2.86)
Irrigation			
• Major and medium irrigation	75.78*** (13.59)	0.51 (3.93)	13.03*** (3.33)
• Minor irrigation	17.71*** (1.72)	6.43* (3.25)	-24.48*** (5.61)
• Flood control and command area development	29.31*** (7.47)	-1.07 (1.87)	12.20*** (2.84)
Rural infrastructure			
• Agricultural financial institutions	38.11*** (8.69)	19.77* (9.32)	-20.05** (7.66)
• Rural electrification	3.68 (2.19)	-2.71 (2.77)	-0.83 (7.01)
• Roads and bridges	3.77* (1.99)	0.62 (1.57)	3.80 (3.25)
• Market development	21.27*** (8.04)	40.06*** (5.58)	4.86 (5.62)
Crop husbandry			
• Agriculture	2.41 (1.74)	3.82 (5.24)	-6.61 (4.41)
• Horticulture	10.49*** (2.05)	-1.86 (1.92)	-1.84 (2.96)
• Dry land farming	0.00 (0.00)	-32.65*** (9.31)	-8.53 (6.67)
Fishery	-3.07 (5.59)	9.99*** (1.82)	-7.39* (4.08)
Dairy development	12.31*** (2.04)	-9.12*** (2.55)	4.22 (2.58)
Animal husbandry	13.86*** (2.81)	-2.57 (3.31)	3.51 (4.54)
Forestry	7.01*** (1.34)	16.02*** (3.51)	-2.24 (1.96)
TOTAL	6.57* (1.42)	2.94 (1.42)	2.12 (1.95)

Figures in the parentheses indicate standard errors.

***, ** and * denote significance at 0.01, 0.05 and 0.10 level of probability, respectively.

structures and resources were diverted to lay new orchards. Allocations were also made over transport equipments. As a result of these investments, private investment as a whole rose to about Rs 216 per hectare of net sown area. Item-wise classification of private sector agricultural investment during 1991-92, indicated that investment on transport equipments enjoyed special status with an investment of over Rs. 47 per hectare, followed by investment on farm houses, orchards and plantations and construction/reclamation of land/buildings. The investment on irrigation structures amounted to Rs. 5 per hectare. The amount of investment on other items like fencing of newly laid orchards and farm furniture, etc. was meagre. Private agricultural investment was found to increase three times during 2001-02 from 1991-92. Investment on all the items showed an appreciable increase from 1991-92 to 2001-02.

Table 4.21: Private Investment in agriculture as per hectare of net sown area at 1970-71 prices (Rs/ha)

Period	Investment	
Period-I (1969-79)	97.09	
Period-II (1980-90)	92.07	
Period-III (1991-2001)	215.74	
Item-wise classification	1991-02	2001-02
Improvement/reclamation of land/buildings	12.91	29.17
Orchards and plantations	14.74	38.89
Irrigation structures	5.33	17.53
Agricultural implements and machinery	9.03	35.34
Transport equipments	46.58	102.67
Farm houses	18.58	49.80
Others*	2.43	8.43
Total	109.60	281.83

4.3.1.2.2 Intensity of private agricultural investment

The private sector investment made in agriculture was about 4 per cent of agricultural gross domestic product (AGDP) and it almost remained stagnant during period-II as is evident from Table 4.22. The intensity of private investment almost doubled from first to third period. Item-wise intensities of private investment showed that investment on transport equipments increased from 1.49 per cent (1991-92) to 2.36 per cent of AGDP (2001-02). The intensity of all the private investment items almost doubled from 1991-92 to 2001-02.

Table 4.22: Intensities of private investment in agriculture at 1970-71 prices (% of AGDP)

Period	Intensity	
Period-I (1969-79)	3.97	
Period-II (1980-90)	3.44	
Period-III (1991-2001)	6.49	
Item-wise classification	1991-02	2001-02
Improvement/reclamation of land/buildings	0.41	0.67
Orchards and plantations	0.47	0.89
Irrigation structures	0.17	0.40
Agricultural implements and machinery	0.29	0.81
Transport equipments	1.49	2.36
Farm houses	0.59	1.15
Others	0.08	0.19
Total	3.50	6.47

4.3.1.2.3 Compound growth rates of private agricultural investment

It is evident from the Table 4.23 that real private investment in agriculture showed declining trend during period-I and decreased at an annual growth rate of

about -7 per cent. After this, it spurts, which takes private investment to substantially higher level during the period-II and registered an all time high annual growth rate of around 9 per cent. During period-III, the private agricultural investment persistently grew at an annual growth rate of about 8 per cent.

Table 4.23: Compound growth rates of private investment in agriculture at 1970-71 prices (%)

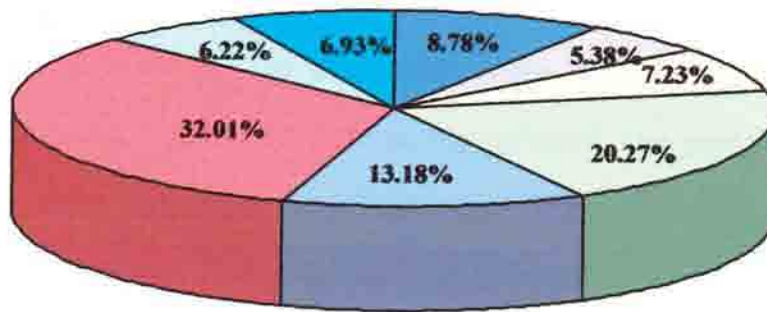
Period	CGR (%)
Period-I (1969-79)	-6.83*** (0.56)
Period-II (1980-90)	9.15*** (1.08)
Period-III (1991-2001)	7.79*** (1.11)

Figures in the parenthesis denote standard error

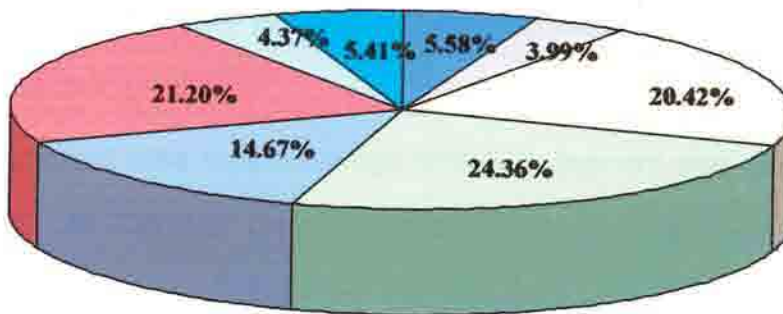
*** denotes significance at 0.01 level of probability

4.3.2 Composition of agricultural investment

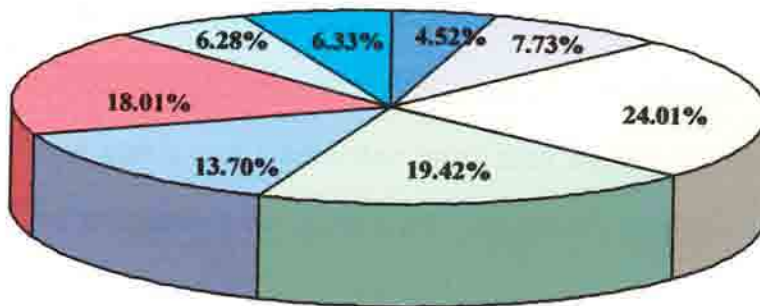
The public investment formed the main component of total investment in agriculture and its proportion almost remained constant in all the periods. The public agricultural investment comprises almost 74 per cent of total investment in agriculture while, private investment (excluding corporate private investment) constituted only 26 per cent during third period. The composition of public investment showed some fundamental changes based upon new priorities (Figure 4.1). During Green Revolution phase, 32 per cent and 20 per cent of total investment was made on crop husbandry and irrigation, respectively. The share of rural infrastructure came next and constituted 13 per cent of total public investment. On the other hand, only about 9 per cent and 7 per cent of investment was allocated to soil and water conservation and rural development, respectively. During period-II, irrigation and rural infrastructure were placed among priorities in the state plan and the percentage



During 1969-1979



During 1980-1990



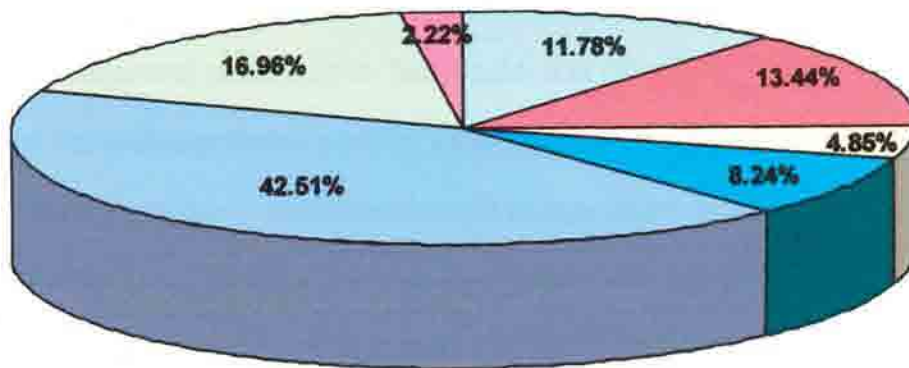
During 1991-2001

- | | |
|-------------------------------|---------------------------------------|
| ■ Soil and water conservation | ■ Agricultural research and education |
| ■ Rural development | ■ Irrigation and flood control |
| ■ Rural Infrastructure | ■ Crop husbandry |
| ■ Animal husbandry | ■ Others |

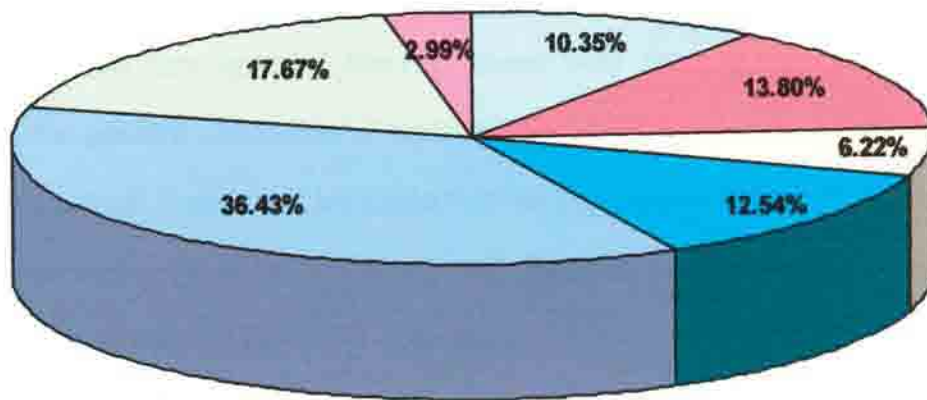
Fig. 4.1: Composition of public agricultural investment

share of these investment items increased considerably. The share of rural development which was around 7 per cent during period-I increased by more or less three times during period-III. The percentage share of agricultural research and education increased to about 8 per cent during period-III. The percentage share of soil and water conservation and crop husbandry decreased continuously towards period-III. The percentage share of animal husbandry firstly decreased from about 6 per cent (period-I) to about 4 per cent (period-II) but, later it again attained the same level towards third period. The percentage share of other items like fishery, forestry and dairy development firstly decreased during period-II but, ultimately recovered the same share as in period-I.

The classified data on private agricultural investment was available for the years 1991-92 and 2001-02. The composition of private investment did not show much changes (Figure 4.2). Transport equipments and farm houses formed the main items of private investment during 1991-92 with the percentage share of about 43 per cent and 17 per cent, respectively. While, around 13 and 12 per cent of private investments were made over orchards and plantations and construction/reclamation of land/buildings, respectively. During 2001-02 transport equipments still enjoyed a special status and contributed more than 36 per cent to the total private investment. The investment on agricultural implements and machinery which was about 8 per cent during 1991-92, increased appreciably to about 13 per cent during 2001-02. The percentage share of irrigation also improved from 5 per cent to 6 per cent from 1991-92 to 2001-02. The percentage share of other items of private investment was found to increase marginally from around 2 per cent (1991-92) to 3 per cent (2001-02).



During 1991- 92



During 2001-02

- Improvement/Reclamation of Land/Buildings
- Irriation Structures
- Transport equipments
- Other
- Orchards and Plantations
- Agricultural implements and machinery
- Farm Houses

Fig. 4.2: Composition of private agricultural investment

4.3.3 Complementarity Between Public and Private Investment

The association between public and private investment in agriculture and other macro-variables for the period 1969-70 to 2001-02 can be seen from the correlation coefficients presented in Table 4.24. It is clear from this table that private investment showed significant positive association with agricultural gross domestic product, public investment, institutional credit to agriculture as well as terms of trade.

The positive correlation of private investment with agricultural gross domestic product and public investment indicated that agricultural growth may encourage private investment in agriculture and incentive in the form of increasing public investment further enhanced it. Agricultural gross domestic product showed positive association with institutional credit to agriculture. In this way improvement of agricultural productivity also attracted various institutions to advance credit to farmers, which in turn enabled them to invest over fixed capital in agriculture. Moreover, the positive correlation of terms of trade with agricultural gross domestic product and private investment indicated that the improvement of agricultural prices in relation to non-agricultural prices not only catalyze the agricultural growth but, also allure private sector to invest in agriculture.

Table 4.24: Association between public investment, private investment and other macro-variables at 1970-71 prices

Variables	AGDP	PRINV	PBINV	TT	CRD
AGDP	1	0.779***	0.702***	0.337***	0.822***
PRINV		1	0.657***	0.471***	0.811***
PBINV			1	-0.012	0.806***
TT				1	0.086
CRD					1

*** denotes significance at 0.01 level of probability.

4.4 CAPITAL USE EFFICIENCY IN AGRICULTURE

Incremental capital-output ratio (ICOR) and marginal efficiency of capital (MEC) were estimated with an intention to find out the efficiency of capital use in agricultural sector over the time. The calculated ICOR and MEC for the period-I turned out to be 4.62 and 0.22, respectively (Table 4.25). During period-II, various micro-irrigation schemes were funded, which along with use of quality inputs and fertilizers after Green Revolution resulted in efficient utilization of resources and improvement of crop productivity *per se* and calculated ICOR declined to 2.73. Later during period-III calculated ICOR again increase to 4.46 indicating less efficient use of capital.

Table 4.25: Capital use efficiency in agricultural sector at 1970-71 prices

Period	r	g	ICOR	MEC	Target growth rate %	Desired growth rate in investment
Period-I (1969-79)	3.26** (1.25)	1.23* (0.76)	4.62	0.22	4.00	11.29
Period-II (1980-90)	3.77*** (1.14)	3.33*** (0.86)	2.73	0.33	4.00	4.78
Period-III (1991-2001)	3.55** (1.53)	1.92*** (0.68)	4.46	0.22	4.00	7.82

r and g are the growth rates of investment and AGDP, respectively.

***, ** and * denote significance at 0.01, 0.05 and 0.10 level of probability, respectively.

Figures in the parentheses indicate standard errors.

Setting the same target growth rate of 4 per cent in agricultural output (AGDP) in all the periods, the conditions were good enough and favourable during period-II, when the desired growth in output required the agricultural investment to increase at an annual growth rate of 4.78 per cent. Instead agricultural investment increased at lower growth rate of 3.55 per cent per annum, which led to inefficient utilization of resources and the growth rate of agriculture declined to 1.92 per cent.

Since period-III onwards, the agricultural investment need to be increased at 7.82 per cent growth rate, if we are to achieve target growth rate of 4 per cent in output.

4.5 ECONOMIC DEVELOPMENT, AGRICULTURAL GROWTH AND INCIDENCE OF POVERTY

4.5.1 Economic Development and Agricultural Growth

State gross domestic product is an economic indicator of the degree of economic development. An attempt was made in this section to examine the growth and share of different economic sectors in state gross domestic product (SGDP). In this context, Table 4.26 showed the relative changes in the development of agricultural and other economic sectors over different periods. At constant prices, the agricultural gross domestic product (AGDP) increased from Rs. 13048 lakhs (1969-79) to Rs. 18764 lakhs (1991-01). The domestic product of primary economic sector (PGDP) also increased by somewhat same magnitude during the same period. The non-agricultural sector (including service and industrial sector) was found to increase from Rs. 14949 lakhs during period-I to an average of Rs. 60814 lakhs during period-III.

Table 4.26: Share of different sectors in state gross domestic product at 1970-71 prices (Rs. In lakh)

Economic sector	Period-I (1969-79)	% of SGDP	Period-II (1980-90)	% of SGDP	Period-III (1991-01)	% of SGDP
AGDP	13048	46.60	15185	34.83	18764	23.58
PGDP	15093	53.91	16486	37.82	20709	26.02
NAGDP	14949	53.40	28407	65.17	60814	76.42
SGDP	27997	100.00	43592	100.00	79578	100.00

Source: Department of Economics and Statistics (Shimla)

The percentage share of different sectors in state gross domestic product varied dramatically over the years. During Green Revolution period primary sector contributed about 54 per cent to SGDP in which agricultural sector alone contributed about 47 per cent. Although, the agricultural domestic product (AGDP) increased in absolute terms but, its percentage share in state accounts decreased from about 47 per cent during 1969-79 to about 24 per cent during 1991-01. Contrary to this, in same span of time the percentage share of non-agricultural domestic product increased drastically over the years from 53 per cent to about 76 per cent of SGDP.

The growth analysis of state economy presented in the Table 4.27 clearly indicated that SGDP showed rising trend in all the periods and its growth rate increased drastically from 2.51 per cent (1969-79) to 6.55 per cent (1990-01). The growth rate of agricultural sector increased from 1.23 per cent (period-I) to 3.33 per cent (period-II) but, later it decelerated drastically to just 1.92 per cent during period-III. On the other hand, non-agricultural domestic product (NAGDP) increased with faster growth rate towards period-III. The increase of NAGDP at alarming rate not only resulted in increased growth of SGDP but, also compensated the declining share of agricultural sector.

Table 4.27: Compound growth rates of different economic sectors at 1970-71 prices (%)

Periods	SGDP	AGDP	PGDP	NAGDP
Period-I (1969-79)	2.51*** (0.46)	1.23** (0.76)	1.21* (0.70)	3.61*** (0.37)
Period-II (1980-90)	4.91*** (0.56)	3.33*** (0.86)	2.16** (0.90)	5.74*** (0.63)
Period-I (1991-01)	6.55*** (0.34)	1.92*** (0.68)	1.99*** (0.57)	8.06*** (0.29)

***, ** and * denote significance at 0.01, 0.05 and 0.10 level of probability, respectively. Figures in the parentheses indicate standard errors.

4.5.2 Agricultural Growth and Pattern of Poverty

The average incidence of poverty, per hectare agricultural productivity and per capita income at 1970-71 prices during three different periods were examined. The results are presented in Table 4.28. The main focus of this analysis was to see the period-wise pattern of poverty and agricultural growth. It can be visualized from the table that the agricultural productivity increased from Rs 2444 per hectare (period-I) to Rs 3325 per hectare (period-III). The per capita income also increased from Rs 666 to Rs 1176 per annum in same period of time, which improved the living conditions of the people and enabled the state to alleviate poverty to a great extent.

Table 4.28: Level of Agricultural productivity, per capita income at 1970-71 prices and incidence of poverty

Period	AGDP Rs/ha	Per capita income Rs/annum	Poverty (%)		
			Rural	Urban	Total
Period-I (1969-79)	2444	666	26.85	13.26	25.94
Period-II(1980-90)	2678	734	18.76	9.07	17.98
Period-III(1991-2001)	3325	1176	20.49	6.53	19.22

The pattern of the poverty showed that percentage of the population living below poverty line steadily declined from 1969-70 to 2001-02 with minor fluctuations till late 1980's. The incidence of the poverty was found to be much severe in rural areas in all the three period as clear from the table. The rural population living below poverty line declined from about 27 per cent (period-I) to 20 per cent (period-III). Despite the drastic increase in per capita income, poverty is still existent in some pockets of the state particularly in rural areas. The poor section of the society was

engaged in agricultural and allied activities while, the richer section made their way in secondary and tertiary sectors. Therefore, complete eradication of poverty and upliftment of weaker section requires development of all economic sectors particularly agricultural sector in view of its great potential in providing living and employment opportunities to those living below poverty line.

4.6 DETERMINANTS AND IMPACT OF AGRICULTURAL INVESTMENT

4.6.1 Farming Systems and Level of Investment: Micro-Analysis

To study the determinants of agricultural investment and its impact on agricultural growth under different farming systems, two variables (i.e. per hectare total capital stock (TCS) and per hectare gross farm returns (GFR)) were specified as endogeneous variables and the model has been estimated in simultaneous way by using Two Stage Least Square (2SLS) procedure.

4.6.1.1 Model estimation

The estimates of simultaneous equation model for FFS have been presented in the Table 4.29. Both capital stock and gross farm returns equations turned out to be best fit equations on the basis of estimated F-value. The estimates of the capital stock equation indicated that per hectare gross returns (GFR), average size of operational holding (HOLD) and off-farm income (OFINC) were the significant and positive determinants of total capital stock. The regression coefficient for per hectare expenditure on variable inputs (EVC) turned out to be -0.066, which indicated that further expenditure over this variable will reduce capital stock significantly. Calculated adjusted R^2 revealed that about 92 per cent of the total variation in per hectare of total capital stock was explained by the explanatory variables specified in the model.

The estimated productivity equation showed that accumulation of capital (TCS), literacy rate (LIT), per cent irrigated area (IRA) and cropping intensity (CI) would improve per hectare gross returns (GFR) significantly as indicated by their positive and significant coefficients. The coefficient of literacy rate indicated that with one per cent increase in literacy rate, the gross farm returns will increase by about Rs 678 per hectare. The increase in irrigated area is also associated with improvement of gross returns. The coefficient of irrigated area indicated the irrigation facilities have contributed significantly in improving gross farm returns. The exogeneous variables in this equation were significantly explaining about 92 per cent of total variation in the per hectare gross farm returns.

Table 4.29: Estimates of simultaneous equation model for FFS

Variables	EQUATION			
	TCS		GFR	
	B	T _(cal)	B	T _(cal)
CONST	-58718.98	-0.566	-302047.81	-5.304***
TCS	-	-	0.102	3.689*
HOLD	55032.08	2.658***	1160.396	0.164
LIT	1419.23	1.237	677.891	2.566***
EVC	-0.066	-3.663***	0.006	1.093
IRA	-	-	239.883	1.793**
CI	-	-	1857.563	5.508***
GFR	2.514	5.628***	-	-
OFINC	287118.54	5.943***	-	-
FAM	8291.65	0.819	-	-
R²	0.9234	-	0.9234	-
F_(cal)	143.74***	-	119.49***	-

*** and ** denote significance at 0.01 and 0.05 level of probability, respectively.
B is the regression coefficient.

Under VFS, the calculated value of adjusted R^2 revealed that more than 80 per cent of the variation in total capital stock on farm and 93 per cent of variation in per hectare gross returns were explained by the model. The calculated F-values for both per hectare capital stock and gross returns equations were significant at 0.01 level of probability. The estimates of capital stock equation revealed that average size of operational holding (HOLD) significantly affected the level of capital stock in agriculture (Table 4.30). The land holding was found to be the constraining factor in capital accumulation. The coefficient of average size of operational holding revealed that increase in the holding size will significantly improve the level of capital stock in agriculture. The coefficients of gross farm returns (GFR) and off-farm income (OFINC)

Table 4.30: Estimates of simultaneous equation model for VFS

Variables	EQUATION			
	TCS		GFR	
	B	T _(cal)	B	T _(cal)
CONST	429793.31	0.542	-442419.95	-3.572***
TCS	-	-	0.099	2.236***
HOLD	790566.18	4.197***	21738.38	0.395
LIT	-12596.37	-1.477	2656.28	2.374***
EVC	-0.121	-1.051	0.005	0.281
IRA	-	-	3638.82	3.491***
CI	-	-	1798.48	6.350***
GFR	1.682	2.82***	-	-
OFINC	297187.53	2.043***	-	-
FAM	-46389.58	-1.105	-	-
R^2	0.8006	-	0.9342	-
F _(cal)	45.97***	-	117.92***	-

*** denotes significance at 0.01 level of probability.
B is the regression coefficient.

came out to be positive indicating that these variables have significantly contributed in improving capital stock in agriculture.

In per hectare gross farm returns equation, the coefficients of per hectare capital stock (TCS), literacy (LIT), per cent irrigated area (IRA) and cropping intensity (CI) turned out to be positive and highly significant indicating that these variables exert positive impact on gross farm returns. The coefficients of these variables indicated that one per cent increase in literacy, irrigated area and cropping intensity will lead to improvement of gross returns to an extent of Rs 2656, Rs 3639 and Rs 1798 per hectare, respectively. However, the relationship of holding size (HOLD) and expenditure on variable inputs (EVC) with gross returns were non-significant indicating weak links between these variables with gross farm returns.

Under FTFS, both the equations of the model were best fit as the calculated F-value turned out to be significant at given probability level (Table 4.31). The coefficients of per hectare gross returns (GFR), average size of holding (HOLD) and the literacy rate (LIT) revealed that they were strong determinants of total capital stock under this farming system. The estimates of the equation further revealed that average family size (FAM) and expenditure on variable inputs (EVC) have negative effect on total capital stock in agriculture. The coefficients of these variables indicated that increase in family size and variable cost would significantly reduce capital accumulation in agriculture.

In gross farm returns equation, the coefficients of cropping intensity (CI) turned out to be positive and significant indicating thereby that cropping intensity has significantly contributed in improving gross farm returns. The coefficients of literacy (LIT) revealed that education level of farmers has significant impact on farm returns under this farming system. The coefficient of total capital

stock turned out to be positive although the relation was not statistically significant.

Table 4.31: Estimates of simultaneous equation model for FTFS

Variables	EQUATION			
	TCS		GFR	
	B	T _(cal)	B	T _(cal)
CONST	22314.19	0.048	-102627.69	-0.229
TCS	-	-	-0.176	0.626
HOLD	229356.54	3.551***	72309.04	0.748
LIT	18193.16	3.397***	1584.31	2.376***
EVC	-1.077	-4.432***	-0.723	-1.993**
IRA	-	-	2007.64	1.059
CI	-	-	5510.95	2.157***
GFR	1.128	5.048***	-	-
OFINC	86309.07	0.788	-	-
FAM	-143544.10	-6.375***	-	-
R²	0.8325	-	0.5205	-
F_(cal)	49.86***	-	11.68***	-

***and ** denote significance at 0.01 and 0.05 level of probability, respectively.

4.6.2 State Agriculture and Level of Investment: Macro-Analysis

To capture the direct and indirect effects of investment on agricultural growth and rural development and to study the determinants of investment, a five equation simultaneous model was specified and estimated simultaneously. Using the order conditions of identification, it was found that the whole model is over-identified and thus, can be estimated using Two State Least Square (2SLS) procedure.

4.6.2.1 Hausman's specification test

Hausman's specification test has been employed with an intention to find out the simultaneity between pair of endogeneous variables. The estimates of the test have been presented in Table 4.32. The perusal of the table revealed that in public

investment equation (PBINV), the regression coefficient of residual agricultural productivity (AGDP) turned out to be statistically significant, which indicated endogeneity between agricultural productivity and public investment. The coefficient of private investment (PRINV), poverty (POVT) and non-farm employment (NEMP), however, were statistically non-significant, which showed that no simultaneity exist between public investment and these variables. Regression coefficients of residues of agricultural productivity, poverty, non-farm employment and public investment turned out to be significant in private investment equation. The coefficient of private and public investment confirmed their simultaneity with agricultural productivity. In poverty equation, residuals of all endogeneous variables except that of private investment turned out to be statistically significant indicating their endogeneity with poverty ratio. In same manner, simultaneity between non-farm employment and agricultural productivity was also confirmed by the test. The estimate of Hausman's specification test revealed simultaneity between pair of endogeneous variables, therefore, to overcome the simultaneous equation bias Two Stage Least square (2SLS) procedure of estimation was found to be the best option.

4.6.2.2 Model estimation

The results of the five equation simultaneous model estimated by employing Two Stage Least Square (2SLS) procedure are presented in Table 4.33. The high adjusted R^2 values for all the five equations implied that the model is a best fit and was successful in explaining systematic variations in agricultural investment (public and private), agricultural productivity, poverty and non-farm employment over the years. The estimated F-values for all the equations were significant at 0.01 level of probability.

Table 4.32: Estimates of Hausman's specification test (Macro-analysis)

Variables	EQUATION				
	PBINV	AGDP	PRINV	POVT	NEMP
AGDP	0.033** (0.019)	-	0.003* (0.001)	-0.0014*** (0.0006)	0.0002** (0.00009)
PRINV	0.006 (0.686)	8.796** (5.16)	-	-0.011 (0.039)	-0.0000002 (0.000007)
POVT	2.588 (6.316)	-50.208 (54.304)	-0.018** (0.01)	-	-0.0041 (0.0211)
NEMP	82.914 (84.243)	-421.648 (446.795)	126.027*** (29.178)	-6.848*** (2.837)	-
PBINV	-	1.976** (1.132)	0.0094** (0.0053)	0.0023** (0.0013)	0.0008 (0.0006)

Figures in the parentheses indicate standard errors.

***, ** and * denote significance and endogeneity at 0.01, 0.05 and 0.10 level of probability, respectively.

▪ Determinants of public agricultural investment

The estimated public investment equation revealed that agricultural productivity (AGDP) and state income (SGDP) were the positive and significant determinants of public agricultural investment. The literacy level (LIT) has a positive and strong effect on public investment, which was evident from its regression coefficient. The coefficient of literacy rate revealed that one per cent increase in literacy in the state leads to improvement of public investment by Rs 4.66 per hectare. The coefficient of per hectare grants from central government (2.247) turned out to be positive as was expected, which indicated that this variable can significantly enhance public investment in agriculture through improving resource position of the government. Unlike grants, expenditure on fertilizer subsidies (SUBS) have negative impact on public investment. Lagged population growth (POP) also showed negative and significant effect on public agricultural investment.

▪ **Determinants of private agricultural investment**

The estimated private agricultural investment equation showed that it is highly dependent on lagged values of the per hectare public agricultural investment (PBINV), which confirmed the long run complementarity between private and public investment in agriculture. The coefficient of agricultural productivity (AGDP) also turned out to be positive and significant indicating that it has contributed in the improvement of private investment over the years. As expected coefficient of per capita income (0.173) turned out to be positive and highly significant, implying thereby that this variable has a positive impact on private investment. The positive and significant coefficient of literacy rate (LIT) indicated that education level of farmers positively influenced investment decision in agriculture. Improvement of prices of agricultural commodities in relation to non-agricultural commodities (TT) also had positive effect on private investment. The coefficient of per cent area under marginal holdings (-4.546) turned out to be negative and significant, which indicated marginalization of holdings significantly decreased private investment in agriculture.

▪ **Determinants of agricultural productivity**

The results of Two Stage Least Square (2SLS) for agricultural productivity model revealed that both public and private investment in agriculture significantly and positively influenced agricultural productivity. The coefficient of literacy was positive and statistically significant indicating its crucial role in agricultural development. It is evident from the coefficient of the literacy that one per cent improvement of literacy in the state will increase the agricultural productivity significantly. The coefficient of per cent area under marginal holdings (125.74) turned out to be positive, which was in line to our expectations. Marginal holdings are more intensively cultivated, which resulted in higher productivity. The coefficient

of cropping intensity (CI) indicated that the increase in it over the years has contributed in increasing agricultural productivity. The area under high yielding varieties (HYVs) and per cent irrigated area (IR) showed positive and significant relation with agricultural productivity. The irrigation is the most critical factor for intensification of agriculture. The negative and significant coefficient of rainfall deviation index (-8.985) indicated that higher per cent deviation from normal rainfall has negative effect on agricultural productivity. Similarly population growth (POP) has also negative effect on agricultural productivity.

▪ **Determinants of poverty**

The results of poverty equation revealed that public investment and agricultural productivity have a negative and desirable effect on poverty. However, the private investment did not help in reducing poverty directly but, it could effect the poverty indirectly by enhancing agricultural productivity. The literacy rate also turned out to be an important variable which reduce the poverty significantly. The significant coefficient of non-farm employment (NEMP) indicated that this variable was instrumental in reducing poverty. The coefficient of agricultural labour wages (-4.145) turned out to be negative and statistically significant. The coefficient of population growth (0.713) and terms of trade (0.071) turned out to be positive indicating that these variables were worsening the conditions of those living below poverty line in the state but, their relation was not statistically significant.

▪ **Determinants of non-farm employment**

The estimates of the non-farm employment equation showed that all the variables specified in the equation turned out to be positive and statistically significant except agricultural productivity. The regression coefficient of lagged investment on soil and water conservation (0.020), rural development (0.006),

Table 4.33: Estimates of simultaneous equation model (Macro-analysis)

EQUATION					
PBINV _t	=	72.535 (87.404)	+ 0.130AGDP _{t-1} *** (0.026)	- 2.173SUBS _t ** (1.140)	+ 6.932SGDP _{t-1} *** (0.556)
		-106.426POP _{t-1} *** (37.988)	+ 2.247GRNTS _t ** (1.027)		+ 4.659LIT _t *** (1.823)
PRINV _t	=	-1138.47 (284.815)	+ 0.136PBINV _{t-6} ** (0.062)	+ 0.010AGDP _{t-1} ** (0.006)	Adj R² = 0.8780
		-0.197POVT _t (0.875)	+ 0.173PCI _t *** (0.036)	+ 374.774POP _{t-1} (94.412)	+ 0.642TT _t ** (0.351)
AGDP _t	=	329.795 (1179.4)	+ 5.037PBINV _{t-6} *** (1.618)	+ 10.539PRINV _{t-1} *** (3.064)	F = 39.40***
		-507.057POP _{t-1} *** (216.723)	+ 10.055CI _t *** (2.819)	+ 0.007HYVS _t ** (0.004)	+ 8.999LIT _t * (2.536)
POVT _t	=	290.047 (281.93)	- 0.025AGDP _{t-1} *** (0.001)	- 0.007PBINV _{t-6} *** (0.001)	F = 66.62***
		-1.839MF _t *** (0.519)	- 0.250RUDI _{t-5} *** (0.075)	- 4.145ALW _t ** (1.806)	+ 125.739MF _t * (88.253)
NEMP _t	=	25.461 (0.225)	+ 0.0015AGDP _{t-1} (0.007)	+ 0.0200SOIL _{t-6} ** (0.011)	+ 115.244IR _t *** (39.439)
		+ 0.003ROAD _t *** (0.001)	+ 0.012IR _{t-1} *** (0.003)		F = 7.30***
					F = 25.51***
					+ 0.047LIT _t *** (0.019)
					Adj R² = 0.9771
					F = 228.98***

***, ** and * denote significance at 0.01, 0.05 and 0.10 level of probability, respectively.

Figures in the parentheses indicate standard errors.

irrigation and flood control (0.012) turned out to be positive and significant, which indicated that these variables were strong determinants of non-farm employment. Literacy statistics played a dominant role in finding employment in various sectors other than agricultural sector as indicated by its regression coefficient (0.047). Road infrastructure (ROAD) improved the connectivity of villages to near-by towns/cities, thereby, increasing their access to non-farm jobs as revealed by its positive and significant coefficient (0.003).

4.7 PROBLEMS AND CONSTRAINTS THWARTING INVESTMENT

Himachal Pradesh is considered a model of hill states for agricultural development. The agriculture in mountains is entirely different from that in plains and important decisions are taken considering various specificities in different regions of the state. The investment decisions in agriculture are influenced by large number of problems and constraints. However, the extent and magnitude of these problems varied from one farming system to another. The responses of farmers regarding different problems/constraints in three distinct farming systems were obtained in the study area and the results summarize in Table 4.34 to 4.39.

4.7.1 Resource Based Problems/Constraint

Any business unit takes into consideration its resource structure while adopting innovation or investing over new technology. Farmers were asked about the problems related with resources and majority of the farmers expressed small size of holdings as main problem that hindered investment in agriculture (Table 4.34). This constraint was perceived by about 72, 57 and 27 per cent of sample farmers under VFS, FFS and FTFS, respectively. The holdings were more scattered under FFS and less in case of FTFS. Slopy fields were another problem that hindered investment in agriculture. Slopy fields as a constraint in investment was

highly perceived under FFS (53.33%) followed by FTFS (40%) and VFS (20%). Shortage of critical inputs like water for irrigation and quality inputs was another problem. About 63 per cent of farmers under FFS revealed this problem while, the intensity of this problem was less under VFS. The farmers might be willing to invest but, the suitable capital goods were not available in the market. This kind of problem was much concentrated under FTFS (48.33%). Lack of sense of belonging and ownership made the farmers unwilling to invest on leased-in land. The problem of land lease system was reported by 10 per cent of the farmers under VFS. While, this kind of the problem was marginally perceived by farmers under other farming system.

Table 4.34: Resource based problems thwarting investment in agriculture as perceived by farmers under different farming systems (Multiple response %)

Problem	FFS	VFS	FTFS
Small holdings	56.67	71.67	26.67
Scattered holdings	78.33	51.67	35.00
Slopy fields	53.33	20.00	40.00
Shortage of critical inputs	63.33	16.67	38.33
Non-availability of capital goods	30.00	26.67	48.33
Land lease system	6.67	10.00	3.33

4.7.2 Socio-Economic Problems/Constraint

Socio-economic status of farmers is the main determinant of investment in farming. Numbers of problems were reported by sample farmers related to socio-economic conditions (Table 4.35). Low returns in farming were found to be the main socio-economic problems that thwart investment in agriculture. Low returns in

farming were perceived by majority of the farmers under FFS followed by FTFS and VFS. About 83 per cent of farmers under FFS, 55 per cent under VFS and 50 per cent under FTFS reported low savings to be the main problem in farm investment. Non-farm liabilities of the farmer like marriage expenses, repayment of loans, festivals, litigation, etc. were main problems faced by the farmers. Majority of sample farmers of FTFS brought to notice this kind of problem followed by farmers of VFS and FFS. High cost of capital goods was yet another problem revealed by about 63, 58 and 50 per cent of sample farmers under FTFS, VFS and FFS, respectively. Expenditure once made on fixed asset cannot be withdrawn back and majority of sample farmers were afraid of irreversibility of investment. The intensity of this problem was higher under FFS and lower under FTFS. Engagement with subsidiary occupations was highly expressed by farmers under FFS followed by FTFS and VFS. Considerable amount was being required to bring-up large family. The large family as a problem in investment was found much prevailing under FTFS (58.33%) followed by VFS (41.67%) and FFS (36.67%). Lack of perspectives, poverty, land conflicts, less earners in family and joints farms were other problems of lower intensities prevailing in the study area.

4.7.3 Personal/Educational Problems/Constraints

With regards to personal/educational problems, majority of farmers indicated that lack of risk bearing capacity was the main problem that hindered investment in agriculture. The magnitude of this problem was high under FFS and less under VFS. Most of farmers were lacking entrepreneurial skills, which is essential for successful farm business. About 20 per cent of farmers under FFS, 23 per cent under VFS and 22 per cent under FTFS reported this type of problem. Illiteracy was found another problem that affected farmer's investment decision. The intensity of this problem

was higher under VFS in comparison to other farming systems. Besides, poor health and lack of knowledge about how and where to invest were the other problems reported by sample farmers under different farming systems (Table 4.36).

Table 4.35: Socio-economic problems thwarting investment in agriculture as perceived by farmers under different farming systems
(Multiple response %)

Problem	FFS	VFS	FTFS
Low returns	86.67	48.33	51.67
Low savings	83.33	55.00	50.00
Non-farm liabilities	51.00	70.00	77.00
High cost of capital goods	50.00	58.33	63.33
Irreversibility of investment	78.33	45.00	36.67
Engagement with subsidiary occupations	50.00	30.00	41.67
Large family	36.67	41.67	58.33
Lack of perspectives	36.67	18.33	31.67
Poverty	21.67	16.67	20.00
Land conflicts	26.67	10.00	15.00
Less earners in family	23.33	8.33	13.33
Joint farms	26.67	13.33	5.00

Table 4.36: Personal/educational problems thwarting investment in agriculture as perceived by farmers under different farming systems
(Multiple response %)

Problem	FFS	VFS	FTFS
Lack of risk bearing capacity	46.67	30.00	35.00
Lack of entrepreneurial skills	20.00	23.33	21.67
Illiteracy	11.67	21.67	8.33
Poor health	18.33	15.00	20.00
Lack of knowledge	11.67	6.67	13.33

4.7.4 Institution/Political Problems/Constraint

With regards to institutional/political problems most of the problems were related with credit (Table 4.37). Majority of farmers expressed the cumbersome loaning procedure as the main institutional problem. Farmers of VFS perceived this problem more intensely followed by FFS. Costly credit was another associated problem reported mostly by farmers under VFS and less by farmers of FTFS. Defective marketing system also hampered the capital investment in agriculture. The problem was felt by about 82, 47 and 42 per cent of the farmers under FTFS, VFS and FFS, respectively. Lack of irrigation schemes/projects was critically expressed by about 82, 48 and 20 per cent of farmers under FFS, FTFS and VFS, respectively. Poor road network as a constraint in agricultural investment was felt highly by farmers under FFS followed by FTFS and VFS. Unfavourable support prices of crops were yet another problem perceived highly under FFS. Farmers also expressed concern about subsidies and 48 per cent of farmers under VFS reported problem of low or no subsidy over capital goods. This problem was also felt by about 42 and 43 per cent of farmers under FFS and FTFS, respectively. Subsidy on selected items was a related problem, which was more intense in case of FTFS. Lack of fair-price shops increased the cost of cultivation and in turn decreased profit. This problem was found much intense under FTFS and lesser under FFS. Innovative farmers sometimes do not investment because they did not know about latest technology. Know how of the latest technology could be disseminated by extension agencies. About 35, 33 and 25 per cent farmers of FTFS, FFS and VFS, respectively reported inadequate extension staff (Table 4.36). Lack of government assistance and heavy taxes and revenues were other minor institutional problems expressed by the farmers.

Table 4.37: Institutional/political problems thwarting investment in agriculture as perceived by farmers under different farming systems (Multiple response %)

Problem	FFS	VFS	FTFS
Cumbersome loaning procedure	60.00	78.33	48.33
Costly credit	50.00	55.00	48.33
Credit not timely available	50.00	31.67	38.33
Defective marketing system	41.67	46.67	81.67
Lack of irrigation schemes/projects	81.67	20.00	48.33
Poor road network	78.33	21.67	36.67
Unfavourable support prices	80.00	31.67	31.67
Low or no subsidy	41.67	48.33	43.33
Subsidy on selected items	43.33	36.67	45.00
Lack of government assistance	25.00	60.00	40.00
Lack of fair-price shops	25.00	36.67	45.00
Inadequate extension staff	33.33	25.00	35.00
Heavy taxes and revenue	11.67	13.33	28.33

4.7.5 Miscellaneous Problems/Constraints

Unfavourable weather conditions were also found to hamper investment in agriculture. The magnitude of this constraint was found maximum under FTFS followed by FFS and VFS. Uncertainties in yields and prices were another problem highly revealed by the farmers under FTFS. Capital goods may not suit with hilly condition and this problem was reported by about 38, 30 and 27 per cent of farmers under FTFS, FFS and VFS, respectively. Wild/stray animals were the other problem highly concentrated under FTFS (Table 4.38).

Table 4.38: Miscellaneous problems thwarting investment in agriculture as perceived by farmers under different farming systems (Multiple response %)

Problem	FFS	VFS	FTFS
Unfavourable weather conditions	41.67	26.67	70.00
Uncertainties in yields and prices	48.33	28.33	51.67
Capital goods not suitable for hilly conditions	30.00	26.67	38.33
Wild/stray animals	45.00	43.33	58.33

4.7.6 Extent and Magnitude of Different Problems/Constraints

To find out the extent and magnitude of different problems/constraints under different farming systems, average cumulative response has been estimated and to test the association between different problems/constraints and different farming systems chi-square test (χ^2) was employed and the estimates have been presented in Table 4.39. The perusal of the table indicated that resource based constraints were much intense under FFS followed by VFS and FTFS. It means that the resource position of FTFS was more favourable for investment than other two farming systems. The estimates of chi-square test of this problem/constraint turned out to be 84.00, which is statistically significantly. Hence, it can be concluded that this problem was significantly associated with different farming system and FFS, VFS and FTFS differ significantly in reporting this problem/constraint.

The average cumulative response of the socio-economic problems/constraints turned out to be around 47, 39 and 36 per cent in case of FFS, FTFS and VFS, respectively. This indicated that the magnitude of these problems/constraints was much under FFS and less under VFS. The calculated value of chi-

square (47.62) was significant, which means that there is significant difference among different farming systems in perceiving this problem/constraint as there was significant association between this problem/constraint and different farming systems.

The extent of personal/educational problems/constraints was found to be higher under VFS (20.67%) followed by FTFS (20%) and FFS (18.67%). Calculated chi-square value (6.11) was non-significant indicating that there was no relation between these problems/constraints and different farming systems.

The intensity of institutional/political problem was more under FFS followed by FTFS and VFS. The institutional/political conditions seem to be favouring VFS more than other farming systems. The results of chi-square test (94.29) turned out to be statistically significant, which revealed that the effect of this problem/constraint was significantly different under different farming systems in terms of strong relation between this problem/constraint and different farming systems.

The magnitude of miscellaneous problem/constraint was found to be high under FTFS as revealed by average cumulative response of these problems/constraints. The calculated chi-square (4.75) turned out to be non-significant. Thus, it could be concluded that the three farming systems does not differ significantly with respect to the effect of this problem/constraint.

Moreover, the coefficient of mean square contingency revealed that the degree of association between institutional/political problems and different farming systems was higher in comparison to other problems followed by resource based problems. The coefficient of mean square contingency for personal/educational and miscellaneous problems/constraints revealed weaker link between these problems and different farming systems.

Table 4.39: Estimates of average cumulative response (%) and Chi-Square test

Problem/constraint	FFS	VFS	FTFS	χ^2	C
Resource based	48.06	32.78	31.94	84.00***	0.56
Socio-economic	46.79	36.03	39.23	47.62***	0.46
Personal/educational	18.67	20.67	20.00	6.11	0.18
Institutional/political	47.82	38.85	43.85	94.29***	0.59
Miscellaneous	41.25	31.25	54.58	4.75	0.16

*** denotes significant at 0.01 level of probability.

Therefore, it can be concluded from the above results that investment in hill agriculture is weighted down by large number of major and minor problems. All these problems/constraints need to be taken up and tackled in a systematic manner to enhance investment in agriculture. These problems/constraints highlighted above seem to be some what interlinked and, therefore, needs a system approach to achieve more investment in agriculture.

DISCUSSION

DISCUSSION

Logical interpretation of the results emerged out of the present investigation and their consistency with the past studies is of paramount value to put forth policy options. This chapter has been devoted to describe the results in a logical and conclusive manner. In consonance with the objectives, the discussion of the results of the study has been arranged under the following seven headings:

- General socio-economic profile of sample households
- Pattern of investment under different farming systems
- Structural changes in agricultural investment
- Capital use efficiency in agriculture
- Economic development, agricultural growth and incidence of poverty
- Determinants and impact of agricultural investment
- Problems and constraints thwarting investment in agriculture

5.1 GENERAL SOCIO-ECONOMIC PROFILE OF SAMPLE HOUSEHOLDS

5.1.1 General Information of the Study Area

In view of considerable variation in socio-economic features of farming community across different farming systems, it is obvious that these factors have a great bearing on the status of resource endowment, which determines their production system and investment behaviour.

It was observed that FTFS revenue villages have comparatively higher geographical area and consequently less population density. However, the proportion of area available for cultivation was found higher under FFS in comparison to VFS and FTFS. The lower proportion of cultivated area under FTFS in comparison

to other farming system was due to hilly terrains and more undulating topography. It was observed that under all the farming systems, small farmers were dominating though, the proportion of large farmers was higher under FTFS. The dominance of small sized holdings in mountain was also reported by (Chauhan and Mehta, 2002, Jodha, 1992).

The non-workers under all the farming systems out numbered the working population as majority of population either belongs to young age group (below 15 years) or old age group (above 60 years). Thus, majority of members were either minor or too old to be able to work as labourers or cultivators. The pattern of working population indicated that around 50 per cent of workers were engaged in agriculture or related activities.

5.1.2 Land Holding and Utilization

Farming is a land based activity and, as such, size and type of operational holding plays a crucial role in making decisions regarding enterprise/crop mix. The average size of the holdings under FTFS (2.01 ha) was relatively higher than VFS (1.51 ha) and FFS (1.29 ha). It was interesting to note that there was dominance of small farmers under all the farming systems. This may be due to increasing tendency of nuclear family structure that give rise to sub-division of holdings over a period of time. Sharma *et al.* (1999) also confirmed the sub-division of holdings caused by inheritance laws and tenancy reforms. However, the proportion of the operational holding was relatively higher under FFS as compared to VFS and FTFS. This finding was similar to some past studies (Sharma *et al.*, 1997). They reported that the percentage of cultivated area to total owned area was higher under cereal dominated agriculture. About 92 per cent of the operational area under VFS was irrigated, which was higher in comparison to FFS (41.86%) and FTFS (36.36%). It indicated that VFS

has comparatively higher endowment of water resources. Sharma *et al.* (2003) also recorded that the percentage of irrigated area was more under vegetable growing pockets of Himachal Pradesh. In other words, the irrigation facilities have promoted vegetable cultivation under this farming system.

5.1.3 Family Structure and Literacy Level

The educational status and structure of farm families are the indicators of human capital formation and production potential of an area. An educated family is better equipped to avail numerous opportunities/facilities made available to them. It was found that the average size of family was slightly higher under FTFS, which was in consonance with relatively higher proportion of joint family structure under this farming system. About 64 and 59 per cent of the families under FFS and VFS have nuclear structure, respectively. The tendency of newly married couple to live apart from their parents explains higher percentage of nuclear families in these farming systems. Further, the literacy rate was found more on VFS farms (86.50%) followed by FTFS (83.60%) and FFS farms (82.25%). This might be due to more thrust on human resource development under VFS farms.

5.1.4 Capital Formation in Farm Implements and Machinery

Farm tools and machinery form the capital stock used for farm operations and determine the efficiency and extent of mechanization of farming. It was observed that the proportion of capital formation in the form of transport equipments was relatively higher under all the farming systems, though only few farmers in the study area were found to keep tractor and other power driven equipments. The low level of mechanization on all the farming systems might be due to the marginal holdings, undulating topography and non-availability of small machinery suitable under hilly conditions. Thakur and Sharma (1984) also pointed out low level of mechanization of

mountain agriculture due to lack of innovation in the development of hill specific small tools and machinery. The proportion of capital formation in the form of cutting/harvesting and digging/hoeing tools was higher in case of FTFS. The value of implements and machinery per farm revealed better capital formation under VFS in comparison to FFS and FTFS, which was in consonance with more implements and machinery under this farming system. Singh (1980) also reported that assured irrigation in any area was complementary with mechanization and new technology and in turn capital formation in agriculture. Needless to mention, the irrigated area was higher under VFS as compared to FFS and FTFS.

5.1.5 Capital Formation in the form of Livestock

Since time immemorial, livestock formed an integral part of farming in hills. Being highly complementary with agriculture, practically all households were found to keep some animals to maintain food security, to carry on their agricultural operations and to augment their meagre income through sale of main and by-products. It was found that the proportion of capital formation in the form of cross-bred cows and buffaloes was higher under all the farming systems as the number of cross-bred cows and buffaloes were comparatively higher in the study areas. The higher number of improved cows and buffaloes might be due to availability of better breeds and better performance of these animals in hilly areas. Bullocks were also kept at farms for ploughing and threshing in absence of tractors and threshers. The proportion of capital formation in terms of bullock was comparatively higher under VFS followed by FFS and FTFS. However, the number of bullocks was reported to be decreasing under all the farming systems, which was due to increasing use of mechanical power. Sharma *et al.* (2003) also revealed substitution of bullock labour with mechanical power in Himachal Pradesh. Per farm capital formation in the form of livestock was

higher in case of FTFS farms, which was in consonance with higher number of animals under this farming system. The higher number of animal under FTFS might be due to the availability of natural grasses and fodder through out the year as the area under forests/pastures was higher under this farming system.

5.1.6 Production System and Economics

5.1.6.1 Cropping pattern and yield levels and cropping intensity

The study of spatial distribution of crops helps in understanding the nature of production systems patronized by the farmers. Besides, the yield levels of different farm enterprises/crops show the production potential of the system. The cropping pattern and yield levels also reveal the status of farm diversification and economic well-being.

▪ Food-grain based farming system (FFS)

Higher proportion of operational area under this farming system was rainfed and heavy or unevenly distributed rainfall often leads to low yield or crop damage. The sources of irrigation under this farming system were natural kulhs although, few of the farmers also have constructed water harvesting structures. But, the seasonal nature of these irrigation sources also posed a problem. In view of these constraints farmers under this farming system preferred to go for the production of cereals crops. The common crops grown under this system were maize, wheat, paddy, potato, cauliflower, ginger, etc. It was observed that about 78 per cent of the total cropped area was under cereal crops (Fig. 5.1). Among cereal crops, maize in kharif and wheat in rabi season were the predominant crops of the study area. These crops were mostly grown under rainfed conditions. Sharma and Tiwari (1985) also recorded predominance of maize in kharif and wheat in rabi season in different districts of Himachal Pradesh. Vegetables occupied second place in area after cereals. The

vegetable crops were preferably grown under irrigated conditions under this farming system. Similar findings were revealed by Sharma, (2002).

The average yield of maize was found higher in comparison to other cereals. This might be due to the fact that rainfall distribution was better during kharif season and agro-climatic conditions also were favourable for maize production. Kumar (2001) also reported higher yield of maize than other cereals under both irrigated and rainfed conditions in hills of Himachal Pradesh. The yield of vegetables was found higher in comparison to other crops under this farming system. Singh and Bhati (1992) also stated that vegetable crops give much higher yield than cereals under irrigated conditions. The cropping intensity on farms of this farming system was around 200 per cent indicating thereby that farmers were generally growing two crops in a year.

- **Vegetable based farming system (VFS)**

Higher proportion of the operational area (92%) under this farming system has assured irrigation facilities. The major sources of irrigation were tube wells, canals, kulhs, etc. The abundant supply of irrigation water along with favourable soil type and climatic conditions has prompted vegetable cultivation under this farming system. Vegetable crops predominantly grown under this farming system, alone accounted for 65 per cent of the cropped area. Singh and Bhati (1992) also revealed that because of natural niche and other favourable conditions, Himachal Pradesh has a vast potential for the production of vegetable crops, which have high pay-off. Among vegetable crops, maximum area was allotted to cauliflower and cabbage due to their higher productivity and returns. Cereal crops were found to be grown over 26 per cent of total cropped area. Among cereals paddy was major cereal crop of kharif season and mostly grown under irrigated conditions while, wheat was major cereal

crop of rabi season grown under both irrigated and rainfed conditions. This also supports the findings of study conducted by Kapila (1985). Her findings revealed that under irrigated conditions, higher proportion of total area was under paddy during kharif season whereas, 24 per cent of the total cropped area was under wheat during rabi season. The cropping intensity of VFS (228%) was higher in comparison to other farming systems. This was mainly due to multiple cropping of vegetable crops under irrigated conditions. Panday and Gaglani (1992) also revealed that cropping intensity was higher on irrigated farms as compared to unirrigated farms.

▪ **Fruit based farming system (FTFS)**

Under this farming system, higher proportion of cropped area was under orchards (59.87%), followed by cereals (25%) and vegetables (8.55%). The land topography was relatively undulating and irrigated area was also less. Besides, the soil and climatic conditions were favourable for production of various temperate and sub-tropical fruits. Pant and Gautam (1990) also reported that agro-climatic conditions of mountains are conducive to fruit production. The average yield of mango was relatively higher among fruits. Vegetable crops were mostly grown under irrigated conditions. The yield of tomato was found to be higher in comparison to other vegetable crops.

To sum up, it has been observed that average yield of crops was relatively higher on VFS farms that might be due to better irrigation facilities, fertile lands, better use of improved inputs and technology.

5.1.6.2 Financial overview of crops

The economics of different crops irrespective of commercial yardstick would be very helpful in finding out the relative profitability of different crops in order to enhance the farm income under different farming systems. It was found that under

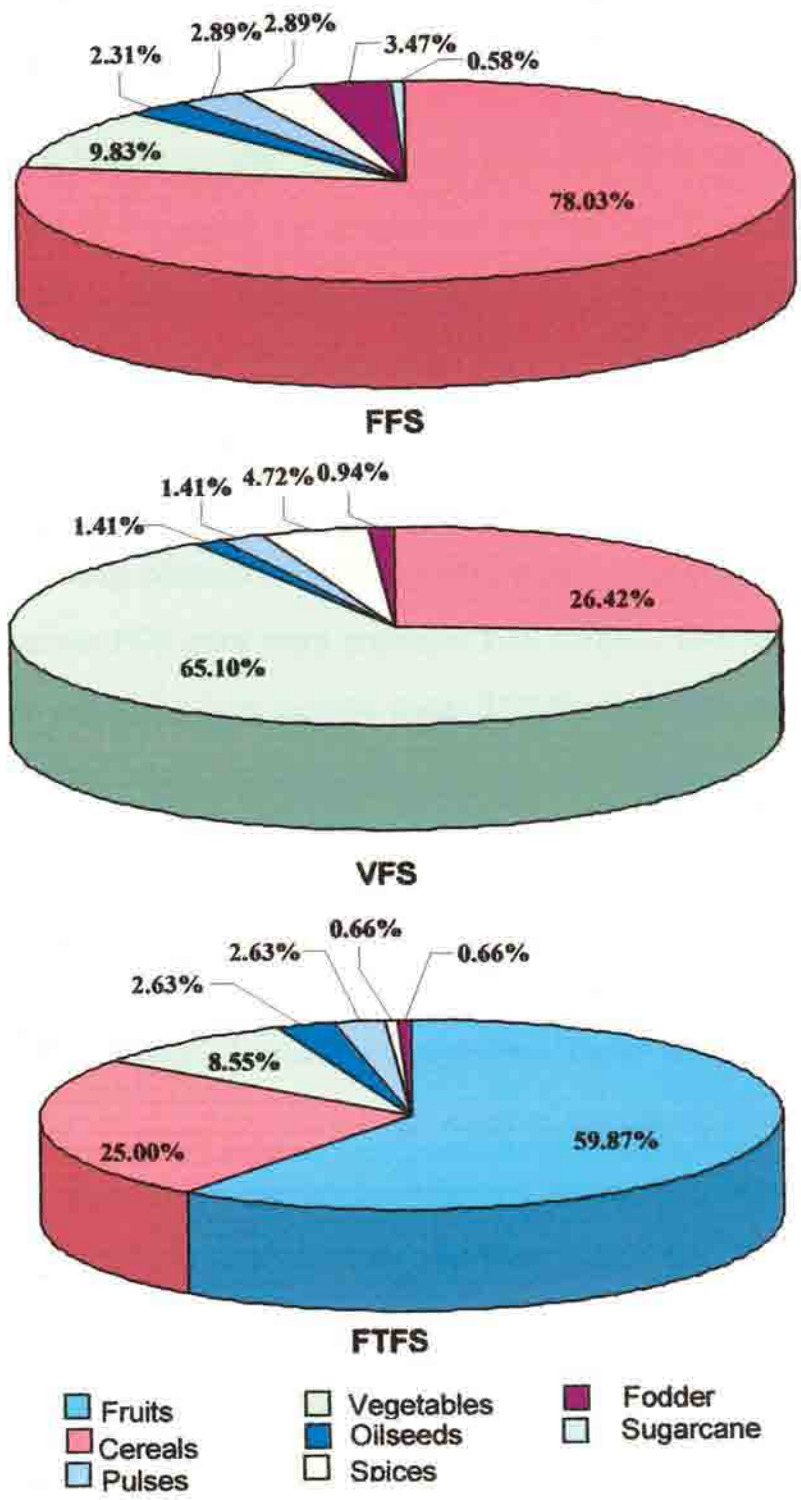


Fig. 5.1: Cropping pattern in different farming systems

FFS farms, ginger recorded higher gross as well as net returns followed by garlic. Thakur (2000) also reported higher relative profitability of spice crops. Despite this the proportion of area under ginger was found to be low as ginger is a labour and capital intensive cash crop due which it becomes difficult for the resource poor farmers to efficiently manage a larger proportion of area under this crop. Further, the continuous attack of serious diseases like rhizome rot and poor marketing facilities prohibited the farmers from allocating more area under this crop. Among cereals, paddy was quite profitable than other cereals. Among vegetables, onion and potato gave higher net returns in comparison to other vegetable crops. Gram among pulses and mustard among oilseeds recorded higher returns. In general, the vegetable crops grown under FFS were more profitable than cereals. This clearly shows the possibilities of enhancing farm income under FFS by increasing more area under vegetable crops.

Under VFS, garlic was found quite profitable in comparison to other crops. But, recently garlic farming has received a major set back due to the increased import from China. The Chinese garlic was found to be cheap, which resulted in its higher demand in main wholesale markets of our country. Garlic could be considered as major alternative among other commercial crops in the future, provided increasing production is matched with market development. Among vegetables, tomato was found to give higher returns followed by cauliflower and potato. In this way tomato and cauliflower enjoys comparative advantage over other crops. Needless to mention, the off-season nature of these crops ensures lucrative prices and higher returns *per se*. The higher profitability of tomato was also reported by Kumar *et al.* (2002). They concluded that per hectare net profitability was highest in tomato.

Under FTFS, dry fruits recorded higher returns followed by mango and orange.

It was due to remunerative prices of dry fruits within and outside the state. However, the farmers were growing dry fruits on limited scale because of natural niche for raising this fruit crop across this farming system. Moreover, newly laid dry fruit orchards takes several years to come into bearing and requires higher initial expenditure. The lower returns from apple in comparison to dry fruits and orange might be due to higher price fluctuations in the market. Moreover, the frequent road blockade due to natural calamities in apple growing pockets of this farming system made the farmers to dispose-off bulk of their apple produce at lower prices. Paddy recorded higher returns among cereals while, tomato recorded higher returns among vegetable crops.

5.1.7 Economics of Livestock

The study revealed that under all the farming systems, the cost of rearing per animal was higher for cross-breed cows followed by buffaloes and local cows. The cost of production for sheep/goats was quite low in comparison to cows and buffaloes due to low feed and fodder requirements as these animals were allowed to graze for most part of the year. However, due to higher yield the gross and net returns were more in case of cross-bred cows and buffaloes under all the farming systems. This was the major reason behind more popularity of cross-bred cows in the state. Therefore, farm income can certainly be enhanced further by replacing indigenous cows with cross-bred animals. Singh and Raman (1994) also reported that cross-bred animals were found more profitable in mountains.

It was interesting to note that cross-bred cows and buffaloes were found to yield higher returns in case of FTFS followed by VFS and FFS. Since, the area under permanent pastures and forests was higher under FTFS and there was availability of grasses in most part of the year, which in turn reduce cost of production and improve

returns.

5.2 PATTERN OF INVESTMENT UNDER DIFFERENT FARMING SYSTEMS

Investment can be regarded as an indicator of agricultural development. Investment in agriculture is made both by private sector as well as by government sector. However, the magnitude and share of investment on different items appeared to be different under different farming systems at different time periods. The pattern of investment has been examined in detail in the ensuing section.

5.2.1 Public Agriculture Investment

The public investment plays a catalytic role in agricultural development. It was observed that the public investment on irrigation structure was relatively higher under VFS situation. The government has designed micro-irrigation structure by tapping the available sources of water. Consequently, the irrigated area has increased that encouraged the farmers to adopt commercialized farming by growing vegetable crops. The share of private investment in such endeavours has been quite low. The proportion of public investment on rural infrastructure and rural development (including rural employment, rural housing, community development, etc.) was relatively higher under FTFS and lower in case of VFS. The higher investment on rural infrastructure under FTFS might be due to the fact that government was making efforts for building essential infrastructure on hilly terrains of this farming system and more investment was made on construction of link roads. The proportion of investment on miscellaneous items was around 7 per cent under FFS which was higher than under VFS and FTFS. It indicated that government laid higher emphasis on improvement of livestock and development of forestry under this farming system. The total and per hectare village level public investment was found to be higher under VFS followed by FTFS and FFS.

5.2.2 Private Agricultural Investment

It was found that major proportion of total private farm investment during 2004-05 was on livestock and farm buildings in all the farming systems. The higher investment on these two items was also reported by other studies (Kalla, 1978; Goswami and Saika, 1972, Sharma, 1987). The proportion of investment on irrigation structures was relatively higher under FFS indicating thereby that farmers in this farming system were more concerned about having their own source of irrigation. However, in absolute terms the investment on irrigation was higher under VFS in comparison to other farming systems. This is in consonance with the higher proportion of irrigated area under VFS. Desai (1969) and Shah (1972) also revealed that in progressive farms with available water supply for irrigation, the investment on irrigation system was higher in comparison to investment on other items. The proportion of investment on livestock was relatively higher under FTFS. This was in consonance with the higher number of animals under this farming system. Since, FTFS was dominated by fruit crops, therefore, investment on orchards and plantations and miscellaneous items (including fencing of newly laid orchards, storage containers, etc.) was found higher under this farming system. The investment on land improvement was mainly to prepare land for cultivation and this investment was found higher on FFS farms. However, due to unfavourable conditions for growing fruit crops farmers showed least interest towards plantations under FFS.

Per farm total capital stock revealed higher capital formation under VFS, which was mostly due to higher investment on irrigation structure under this farming system. Moreover, investment made during 2004-05 as per cent of present value of total capital stock on farm was over 12 per cent under FTFS. In other words, it could be inferred that capital was accumulating at an annual growth rate of around 12 per cent

in this farming system, which was higher than the investment growth in other farming systems.

To sum up, the per farm investment during 2004-05 was Rs 9145, 9049 and 7633 in case of FTFS, VFS and FFS, respectively, which indicates higher investment under FTFS. However, per farm total capital stock under different farming systems revealed higher capital formation under VFS. Per hectare investment made during 2004-05 also revealed the same pattern. These results lend support to the observation of Singh and Patil (1972) and Shiyani and Vekariya (1996). They reported that per hectare investment was higher on the irrigated farms than on partially irrigated farms. In this way, water is an important determinant of capital formation in agriculture.

5.3 STRUCTURAL CHANGES IN AGRICULTURAL INVESTMENT

The real public investment in agriculture steadily grew upto early 1980's for building basic infrastructure for agricultural development. After this, it suffered a minor set back and the growing tempo of public investment could not be maintained during 1985-86. This may be due to the shift of emphasis to other economic sectors like administrative services, health and social welfare, information and publicity, etc. This decline in public agricultural investment was also observed in different studies at country level. Researchers have attributed this decline to the shift of emphasis in the Seventh Five Year Plan away from agriculture, particularly towards industrial research and development and communication and sharp protest of environmentalists against construction of irrigation projects, etc. (Mishra and Chand, 1995; Gulati and Sharma, 1997). During 1990's this decline in public investment has been arrested and it increased from Rs 2279 lakhs (1985-86) to Rs 3381 lakhs (1995-96). The public investment again showed decline during 2001-02.

The private agricultural investment on other hand also showed a fluctuating pattern. It showed a decline during 1970's. It declined from Rs 703 lakhs (1969-70) to just Rs 312 lakhs (1980-81), which indicated increased dependence of farmers on government sector during this period. There might also be a shift in emphasis of private sector towards new input technologies during period-I (1969-79), which led to the decline in private investment in agriculture. But, later the real private investment spurt towards the termination of Ninth Plan. It might be due to the fact the farmers have realized that agricultural productivity growth could not be achieved without increasing productive capacity of farms. The government incentives might also be favouring private investment in agriculture. The persistent increase in private investment in Himachal Pradesh was consistent with studies conducted at country level (Chand, 2001).

5.3.1 Growth and intensity of Agricultural Investment

5.3.1.1 Public agricultural investment

All the items of public agricultural investment increased from period-I (1969-79) to period-III (1991-2001) with exception of few items. During period-I, per hectare investment was higher on agricultural crop husbandry followed by minor irrigation, horticulture and soil and water conservation. It was because the major emphasis of government policies during this period was on development of agriculture, irrigation and improvement of land for cultivation. Since, major thrust areas during period-II (1980-90) were the modernization of agriculture, development of irrigation, development of rural areas, etc. thus, huge amount of funds were invested on rural development schemes, irrigation, agricultural crop husbandry and soil and water conservation. During this period it was also realized that the agricultural development would not be achieved in isolation without development of infrastructure (Singh *et al.*,

2004). Therefore, the resources were also allocated for development of physical infrastructure. During period-III, the major emphasis was on improvement of work productivity through skill development and improving quality of life, etc. Therefore, per hectare investment on agricultural research and education increased more than two-folds from second period to third period. Self-reliance and development of rural areas constantly remained a priority sector for upliftment of rural areas during third period. Per hectare investment on items like flood control, command area development, animal husbandry, etc. also showed an increase in third period.

The public investment was about 12 per cent of agricultural gross domestic product during first period, which later rose to 18 per cent during period-II. However, its intensity has remained almost stagnant during period-III. This stagnation of public agricultural investment needs to be corrected for faster development of the agricultural sector. The investment on minor irrigation that was on the rise till second period decreased towards third period. The intensity of investment on agricultural research and education showed an increase over the years but, the intensity of investment on agricultural research has remained much lower than in developed countries (Pardey and Beintema, 2001). Increasing intensity of rural development investment witnessed higher emphasis on rural well-being while, the declining intensities of investment in some components may be due to diversion of more funds to non-farm sector.

Estimates of compound growth rates of different components of public investment revealed that during period-I, there has been an increase in public agricultural investment and it rose at an annual growth rate of about 7 per cent per annum. But, later the growth of public investment slackens and it grew at an annual growth rate of about 2 per cent during period-III. The declining trend of public

investment in agriculture was also confirmed by the studies conducted at national level (Dhawan and Yadav, 1997; Misra and Hazell, 1996; Shetty, 1990, Gandhi, 1996). Investment on soil and water conservation showed fluctuating pattern, firstly it grew at an annual growth rate of about 8 per cent during period-I and then witnessed negative trend (-7.02%) during period-II. But, later it registered higher growth rate of about 10 per cent per annum during period-III. The increase of investment over this component might be due to increased investment on construction of soil erosion structures, water harvesting structures, check dams, etc. The growth rate of investment on minor irrigation schemes was as high as high as 18 per cent during first period and later it recorded negative growth (-24.48%) in period-III. The investment on rural infrastructure also showed a decline, which might be due to diversion of resources towards recurring expenditures and non-farm sectors.

5.3.1.2 Private agricultural investment

It has been observed that per hectare private investment in agriculture at 1970-71 prices showed a minor decline of Rs 5 per hectare from period-I to period-II. But in period-III, private agricultural investment increased and reached to about Rs 216 per hectare. This indicates that the incentives for private investment were improved during post-reform period. Item-wise classification of private investment revealed that private investment in agriculture as a whole grew almost three times from 1991-92 to 2001-02.

The private sector agricultural investment which was about 4 per cent of agricultural domestic product (AGDP) during period-I increased to about 6 per cent of AGDP towards period-III with minor fluctuation during period-II. The increasing intensity of private agricultural investment might be due to liberal government policies

and incentives in the form of power subsidies, credit, etc. that in turn enhanced private investment in agriculture.

The compound growth rates of real private investment in agriculture showed increasing trend from first period to period third. The rising trend of private investment was also advocated by number of scholars at country level (Misra and Hazell, 1997, Gandhi, 1996). There was a minor decline in growth rate of private agricultural investment from about 9 per cent (1980-90) to 8 per cent (1991-01). This decline in growth rate of private investment might be as result of decline in public investment in view of their complementary relationship.

5.3.2 Composition of Agricultural Investment

National Sample Survey Organization-Reserve Bank of India (NSSO-RBI) estimates of state level private agricultural investment have been used in the present study, which does not include private corporate investment in agriculture. Therefore, the public investment formed the main component of total agricultural investment and its proportion remained more or less constant in all the periods.

The period-wise composition of public investment showed some fundamental changes according to new priorities in different periods. During Green-Revolution period, the major emphasis was on improvement of agricultural productivity, therefore, major proportion of public investment was allocated to crop husbandry (32%) and irrigation (20%). During period-II, development of irrigation and rural infrastructure were placed among priorities in the state policies, hence, their per cent share in public investment increased considerably. The share of rural development and agricultural research and education increased drastically towards period-III, due to the emphasis of government policies on rural development, work productivity and human capital formation.

The period-wise composition of private investment did not show any considerable change. Although the per cent share of investment on transport equipments declined from about 43 per cent (1991-92) to 36 per cent (2001-02) but, it continued to be the main item of private investment in agriculture. The higher investment on transport equipments (which includes tractor and other power driven equipments) in both the years might be due to the fact that farmers were keen to supplement their income by renting out these equipments besides replacing the bullock used for ploughing the land. The investment on farm buildings came next followed by investment on orchards and plantations. About 5 per cent of the private investment was spent on irrigation structures during 1991-92 which later increased to over 6 per cent during 2001-02. The increase in proportion of investment on irrigation might be due to the apprehension about role of irrigation in increasing productivity and also the adequate incentives extended to this component in terms of power subsidy and tube well subsidy. The percentage share of other items (which includes fixtures and furniture kept on farm) also showed an increase over the years.

5.3.3 Complementarity Between Public and Private Investment

It was found that private investment showed significant positive association with agricultural gross domestic product, state gross domestic product, public investment, institutional credit advanced to agricultural sector as well as terms of trade. The long term complementarity between private and public investment was in line with the studies conducted at country level (Krishnamurty, 1985; Bhattacharaya and Rao, 1988; Shetty, 1990; Rao, 1994). Some scholars attributed this association to the inducement effect of public investment on private investment (Rath, 1989; Patnaik, 1987). It indicated that agricultural growth encourages private investment in agriculture and also attracts various institutions to advance credit to the farmers, who

in turn made investment over fixed capital in agriculture. Public investment also showed positive association with agricultural gross domestic product and institutional credit to agriculture. The increase in the prices of agricultural commodities in relation to non-agricultural commodities (terms of trade) also showed positive association with private investment. Public investment also showed positive association with agricultural gross domestic product and institutional credit to agriculture. In view the complementarity between private and public investment, the public investment in agriculture should be increased to boost private sector investment in agriculture.

5.4 CAPITAL USE EFFICIENCY IN AGRICULTURE

The profitability of any enterprise depends upon how efficiently and judiciously the resources are utilized. The calculated incremental capital output ration (ICOR) and marginal efficiency of capital (MEC) for period-I turned out to be 4.62 and 0.22, respectively. During period-II, various micro-irrigation schemes were funded which coupled with use of quality inputs and other production technologies during Green Revolution period resulted in efficient utilization of resources, thereby, improving the crop productivity. This also resulted in efficient use of capital during this period and calculated ICOR decreased to 2.73. The improvement of capital use efficiency during second period was also reported by Mishra and Chand (1995) at national level. But later during period-III, calculated ICOR again increased to 4.46 indicating less efficient utilization of resources. After economic reforms (during 1991), more production technologies like HYVs, chemicals, fertilizers, etc. were used this has led to higher demand of water for irrigation. But, irrigation facilities in the state are meagre that could irrigate only about 18 per cent of the total cropped area, which consequently resulted in less efficient utilization of capital in agriculture during third period. Moreover, harsh climatic conditions were also responsible for less efficient

use of capital in agriculture.

Desired growth rate of investment indicated that if we set the same target growth rate of agricultural gross domestic product (4%) in all the periods, the conditions were favourable enough during period-II where, investment was required to be increased at an annual growth rate of 4.78 per cent to achieve 4 per cent growth in AGDP. Instead, agricultural investment increased at lower annual growth rate of 3.55 per cent and state could achieve only 1.92 per cent annual growth rate in agricultural sector. Since period-III onwards, the agricultural investment was required to be increased at about 7.82 per cent growth rate, if we are to achieve target growth rate of 4 per cent per annum in output. In view of this, investment in agriculture particularly on low gestation irrigation projects and infrastructure should be enhanced to improve the efficiency of capital use in agriculture.

5.5 ECONOMIC DEVELOPMENT, AGRICULTURAL GROWTH AND incidence of POVERTY

5.5.1 Economic Development and Agricultural Growth

It was observed that although the agricultural gross domestic product increased in absolute terms but, its percentage share in state domestic product decreased from about 47 per cent (1969-75) to just 24 per cent (1991-2001). But, it is interesting to note that the declining share of agricultural sector in state domestic product was not accompanied with proportionate decline of the dependence on this sector (Singh, 2004, Anonymous, 2003). This is a major cause of concern for the planners of the country. It could be argued that the declining share of agricultural sector in state accounts might be due to neglect of this important sector in new economic policies.

The comparative growth performance of different economic sectors revealed that state gross domestic product and non-agricultural gross domestic product were

increasing at increasing rate from period-I to period-III. The estimates of growth rates for agricultural sector revealed that its growth rate increased from 1.23 per cent (1969-79) to 3.33 per cent (1980-90). However, its growth rate slowed down towards third period, which is in consonance with decline in the production of major crops in the state (Singh, 2004). Moreover, the shrinking net sown area in the state also resulted in declining growth of agricultural sector. Despite these structural changes, agricultural sector still remained a key sector in providing employment and livelihood opportunities to the weaker section particularly in rural areas.

5.5.2 Agricultural Growth and Pattern of Poverty

The study of average incidence of poverty in relation to growth of agricultural productivity and per capita income at 1970-71 prices revealed that the considerable improvement in the agricultural productivity and the per capita income helped the state in alleviating the poverty to a great extent. The role of agricultural development in poverty reduction was also advocated by researcher at the national level (Ravallion and Dutta, 1996, Kumari and Singh, 2002). The rural poverty declined from an average of about 27 per cent during period-I to about 20 per cent during period-III. The poverty was found much concentrated in rural areas.

Despite the remarkable increase in per capita income poverty is still existent in some pockets of the state particularly in rural areas. This might be due to inequality in distribution of productivity asset and wealth. Beteille (2003) also reported that poverty and inequality did not change at the same pace and they might change in opposite directions, which again aggravate the conditions of poverty. Since, weaker section of the state resides in rural areas and depends on agriculture for employment and living, therefore, if poverty is to be eradicated from the state then due emphasis should be laid on development of agricultural sector along with the growth of non-

farm sector.

5.6 DETERMINANTS AND IMPACT OF AGRICULTURAL INVESTMENT

5.6.1 Farming Systems and Level of Investment: Micro-Analysis

It was found that under all the farming systems, gross farm returns and dummy variable for off-farm income were the positive and significant determinants of total capital stock on farm. These variables might improve financial position of farmers, which in turn encourage them to invest more capital in the farming business. However, more expenditure on variable inputs certainly reduced the surpluses with the farmer and thus, affects the farm investment negatively. Though, the coefficient of expenditure on variable inputs was not statistically significant under VFS. Average size of the operational holding was other variable, which have positive and significant effect on level of capital stock under all the farming systems. Increase in size of the operational holding made the application of tractors and machines possible, which in turn resulted in accumulation of more capital on farm. In this way the land reform measures have a major role to play in increasing the level of capital stock on farm. The significant negative coefficient of average size of family in case of FTFS indicated that large size of the family have negative effect on capital formation in agriculture. Literacy was found to be an another determinant of total capital stock, which revealed the mutual association between human capital formation and level of total capital stock on farm.

Per hectare total capital stock on farms was found to be a positive and significant determinant of gross farm returns under all the farming systems thus, confirming the complementarity between capital stock and gross farm returns. Per cent area irrigated and cropping intensity showed positive relation with gross farm returns. Irrigation was found to be a limiting factor in agricultural development. Thus,

provision of irrigation facilities leads to more use of new technology, which in turn improves agricultural productivity and returns *per se*. The positive coefficient of expenditure on variable inputs has contributed in the improvement of gross farm returns. The farmers in all the farming systems can improve farm returns by using more quality inputs as per scientific recommendations. However, expenditure on variable inputs on FTFS farms has negative effect on gross farm returns as indicated by its regression coefficient. The negative effect of this variable might be due to the fact that farmers in this farming system were not using inputs as per scientific packages. It indicated that this expenditure should be rationalized to improve farm returns. Level of education also showed positive and significant relation with gross farm returns under all the farming systems. The literacy level was found to be an important determinant of gross returns as well and total capital stock on farms under all the farming systems.

5.6.2 State Agriculture and Level of Investment: Macro-Analysis

The estimates of the Hausman's specification test confirmed simultaneity between different pairs of endogeneous variables and, therefore, the equations were estimated simultaneously using Two Stage Least Square (2SLS) estimation procedure.

▪ Determinants of public agricultural investment

The agricultural productivity, per hectare state gross domestic product, literacy rate and grants from Central Government have positive and significant impact on public investment. The positive and significant coefficient of agricultural productivity in public investment model might be due to strong demand for agricultural commodities, which led to the allocation of more funds to support agricultural research, extension and other productivity enhancing items of investment such as

irrigation, storage, road, market, etc. These results are consistent with studies on public funding of agricultural research (Huffman and Miranowski, 1981; Evenson and McKinsey, 1991; Pal and Singh, 1997). State income has an expected positive and significant effect on public investment. Literacy rate also improved public investment as education level cast inducement effect on public investment in agriculture. Literacy level improves the managerial capability of farmers and consequently attracts public investment. Grants from Central Government showed positive relation with public investment. It has been found that central grants improve state government's access to the resources for agricultural development. However, the expenditure on fertilizer subsidy negatively affect the public investment by depleting the state resources for this cause. This supported the view that farm subsidies were declining the investment in agriculture (Rao, 1994; Gulati and Sharma, 1997, Fan *et al.*,2000b). Population growth showed negative impact on public investment. The negative effect of population growth might be due to the fact that with the increase in population, government has to divert the funds towards public health, nutrition, urban area development, and industrial development, etc.

▪ **Determinants of private agricultural investment**

The analysis of Two Stage Least Square (2SLS) for private investment model indicated that the lag values of public investment, agricultural productivity, per capita income, population growth, terms of trade and literacy were the positive and significant determinants of private investment in agriculture. The positive coefficient of public investment indicated that this variable plays an inducement effect on private investment (Dhawan and Yadav, 1995, Wagle, 1994, Gulati and Bathla, 2002). In this way private investment in agriculture could be increased by exploiting its complementary relationship with public investment. The coefficient for agricultural

productivity turned out to be positive and statistically significant in private investment model. Agricultural productivity enhanced private investment in agriculture by improving surpluses available for investment. The per capita income and terms of trade showed positive relation with private investment. The favourable terms of trade facilitated the growth process by increasing the private investment in agriculture (Misra and Hazell, 1996, Misra, 1998). Per cent area under marginal holdings in the state showed negative and significant relation with private investment. This might be because, the small size of holding hinders mechanization of agriculture and investment on implements and machines, which are essential items of capital formation in agriculture. Marginal farmers also have less surpluses with them and, hence, are also unable to invest in agriculture. This result supports the findings of Roy and Pal (2002). The positive and significant coefficient of literacy was as per our expectation as education level makes a farmer innovative and aware about the possible benefits of investment. Poverty showed negative relation with private investment but, the relation was not statistically significant. Poverty limits the investing power of the farmer, which leads to decrease in private investment in agriculture.

▪ **Determinants of agricultural productivity**

Except population growth and per cent deviation in rainfall, all the variables included in the model i.e. per hectare investment, literacy rate, per cent area under marginal holdings, cropping intensity, area under HYVs, per cent area irrigated have positive and significant coefficients, implying thereby that these variables have contributed in the improvement of agricultural productivity over the years. Both public and private investments were positively and significantly related with agricultural productivity. These results are consistent with studies conducted by Rao (1993),

Mukherjee (1996), Anderson and Lorch (1999). The coefficient of literacy rate also turned out to be positive and significant. Thus, educated farmer can avail the benefits of scientific practices and improved production techniques, which are instrumental in improving productivity. The key role of literacy was also reported by Duraisamy (1992) and Nadal (1972). Per cent area under marginal farms also showed positive and significant effect on agricultural productivity. Bhati (1975) reported that small farms have comparatively more cropping intensity. Sharma *et al.* (1992) also reported that returns were more on small farms due to better management and more input use. The number of crops taken up in a year (cropping intensity) also has positive effect on productivity of agriculture. Per cent area under irrigation has strong and positive effect on agricultural productivity. Srinivasan (1977) and Pendse *et al.* (1996) advocated the expansion of expenditure on irrigation projects in view of its crucial role in improving productivity. Weather is an important determinant of agricultural productivity in the state. More fluctuations in rainfall were associated with lower agricultural productivity. A significant negative coefficient of per cent deviation from normal rainfall indicated that the fluctuations in rainfall have negative effect on agricultural productivity.

- **Determinants of poverty**

All the exogeneous variables except terms of trade and population growth rate showed negative significant effect on poverty. The key role of agricultural productivity in reducing poverty has been identified by number of researchers (Rao, 1977; Desai and Namboodiri, 1998, Ahluwalia, 1978, Murgai *et al.*, 2001). Agricultural development is essential in helping the poor not only by directly increasing their income but, also by releasing labour and capital that can be used in non-agricultural enterprises and by stimulating the demand for non-agricultural goods (Johnson, 2000,

Lanjouw and Lanjouw, 2001). Higher agricultural productivity improves the consumption and surpluses with the farmers and consequently improves their living conditions. Agricultural investment has both direct and indirect (mainly through gain in agricultural productivity) effect on reducing poverty. The role of public investment in alleviating the poverty through various development schemes and through improving agricultural production was also reported by Hazell and Fan (2003). Non-farm employment and agricultural labour wages have negative and significant effect on poverty. These variables improve the financial position of the farmer and shift them above the poverty line. The education is one of the effective instruments in reducing poverty. The role of education in poverty reduction was also reported by Sen (1997). The increase in investment on rural development and institutional credit flow to agriculture were also associated with the reduction in poverty ratio.

- **Determinants of non-farm employment**

It was observed that investment on soil and water conservation, rural development and irrigation and flood control have positive and significant effect on non-farm employment. Large numbers of rural poor were able to get jobs in irrigation projects, construction of check dams and water harvesting structures, etc. Funding of various rural development schemes also generate direct non-farm employment. The role of public investment in employment generation in off-farm sectors was also observed by number of research scholars (Sen, 1997, Fan *et al.*, 1999). The road density has positive impact on non-farm employment. The construction of main and link roads increases the connectivity of villages to nearby cities/towns and improves their access to avenues of non-farm employment. Education level also opens more opportunities and enables a person to make his way in the various sector other than agriculture. However, agricultural productivity showed weak link with non-farm

employment. These results are consistent with the findings of Hazell and Haggblade (1991). They stated that there is a weak relationship between agricultural growth and the growth of rural non-farm activity in many parts of the country and it is more significant in agriculturally advanced regions such as Punjab and Haryana.

To sum up, the rural development through agricultural growth, employment generation and poverty alleviation requires more investment to be made in agricultural sector. Further, public investment should be increased to provide incentives for improving private agricultural investment.

5.7 PROBLEMS AND CONSTRAINTS THWARTING INVESTMENT

Investment in agriculture is essential for improving productive capacity on farm, which in turn increases agricultural productivity. Various mountain specificities characterizing agriculture in mountains are usually considered while making any important decision like that of investment. Besides, there were number of problems and constraints faced by the farmers that thwart investment in agriculture. These problems/constraints were categorized as resource based, socio-economic, personal/educational, institutional/political and miscellaneous problems/constraints. The extent and magnitude of these problems/constraints varied from one farming system to another (Fig. 5.2 to 5.6). These problems have been discussed under the following sub-headings:

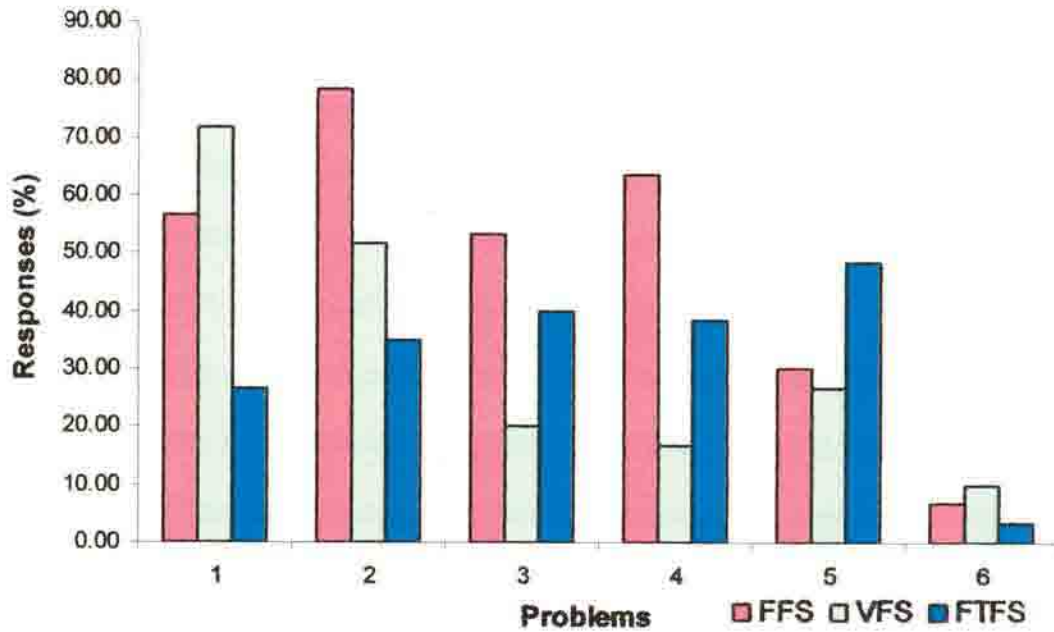
5.7.1. Resource Based Problems/Constraints

Resource endowment of the farmers determines their financial status and their capability to invest in agriculture. Since, hill agriculture is characterized by small, slopy and scattered holdings, which often comes in the way of mechanization, construction of irrigation and water harvesting structures, etc. These characteristic also impede investment flow in the farming business. These constraints cannot be

removed but, their unfavourable effect can be reduced by promoting consolidation of holdings, encouraging cooperative farming, etc. The government should increase investment on land improvement and soil and water conservation as the private investment in such endeavours were meagre. Shortage of critical inputs like irrigation and quality inputs deprived the farmers of better returns due to poor yield and poor quality of produce. The farmers showed serious concern about this problem as it upsets investment in agriculture. Kohli (2000) also brought to light this problem, which came in the way of agricultural development. About 63.33 per cent of farmers under FFS revealed this problem while, the intensity of this problem was less under VFS. Sometime few farmers were willing to invest but, the capital goods were not available in the market. This problem was reported by other researchers to hinder farmer's investment decision (Kivistik and Sallinen, 1993). This kind of problem was much concentrated under FTFS where the plant protection and other equipments available at cooperative stores often fall short of the demand. Lack of sense of belonging made the farmers unwilling to invest on leased-in land. In this way, land lease system decreases investment in agriculture. This problem was also reported by Pender and Kerr (1998).

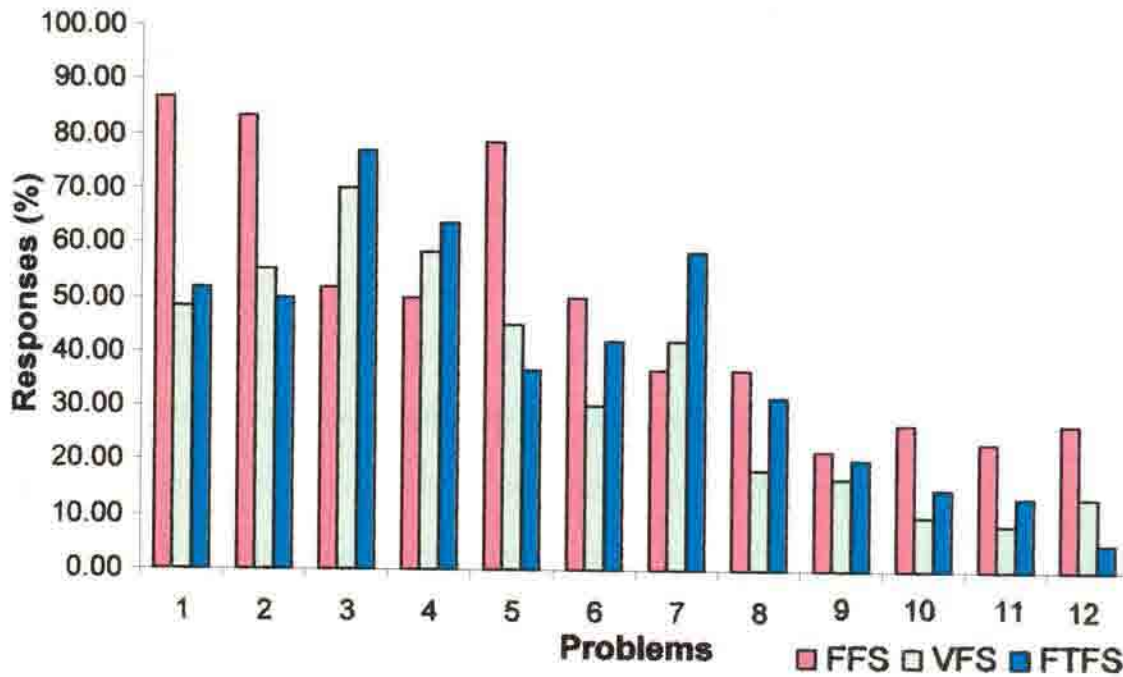
5.7.2 Socio-Economic Problems/Constraints

Socio-economic status of farmers is the main determinant of investment in farming. Handsome returns not only encourage farmers to produce much but, also persuade them to invest on capital goods. Low returns were perceived by about 87 per cent of farmers under FFS, 52 per cent under FTFS and 48 per cent under VFS. Farmer's propensity to invest depends upon his level of savings. Varadarajan and Sankari (1996) also highlighted the role of past savings in capital formation. Low savings as the main constraint in farm investment was highly reported by the farmers



1. Small holdings 2. Scattered holdings 3. Slopy fields 4. Shortage of critical inputs
5. Non-availability of capital goods 6. Land lease system

Fig. 5.2: Resource based problems/constraints



1. Low returns 2. Low saving 3. Non-farm liabilities 4. High cost of capital goods 5. Irreversibility of investment
6. Engagement with subsidiary occupation 7. Large family 8. Lack of perspective 9. Poverty
10. Land conflicts 11. Less earners in family 12. Joint farms

Fig. 5.3: Socio-economic problems/constraints

of FFS. Non-farm liabilities of the farmer like marriage expenses, repayment of loan, festivals, litigation, etc. often put him into financial hardship. Majority of sample farmers of FTFS brought to notice this kind of problem as main reason for low investment in agriculture followed by farmers of VFS and FFS. High cost of capital goods was yet another problem, which discouraged farmer's investment decision. Adequate supply of investment goods should be made available at lower prices at various cooperative and retail points. Expenditure once made on fixed asset cannot be withdrawn back and majority of sample farmers were afraid of irreversibility of investment. The intensity of this problem was much under FFS and less under FTFS. Farmers engaged in the subsidiary occupation paid comparatively less interest in farm business and consequently made less investment in agriculture. Liability of subsidiary occupation to effect investment in agriculture was expressed by 50 per cent of farmers under FFS, 41 per cent under FTFS and 30 per cent under VFS. Huge expenses are required to bring up large family. Farmers having large family have little or no surpluses with them to invest in farming business. This problem was reported mostly by the farmers of FTFS. Besides, lack of perspectives, poverty, land conflicts, less earner in family and joint farms were some other socio-economic problems/ constraints that hinder investment in agriculture.

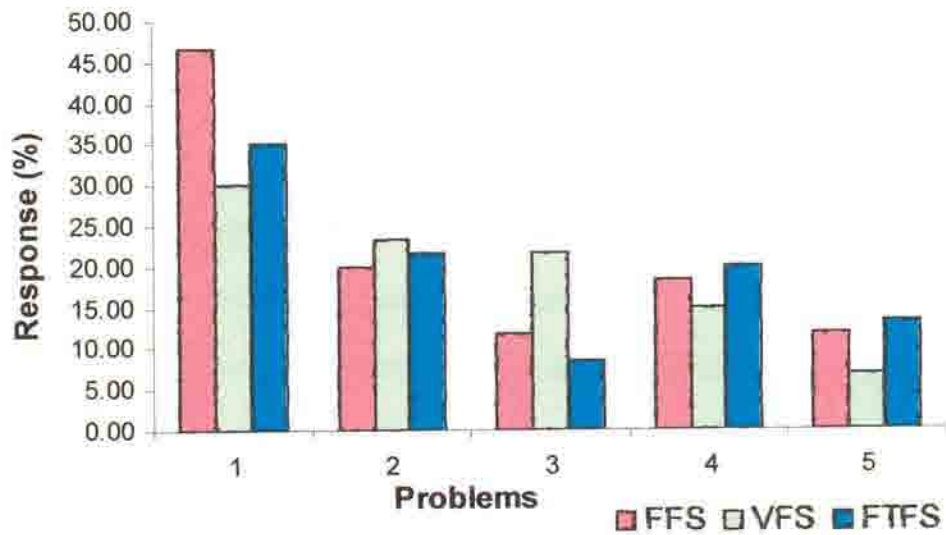
5.7.3 Personal/Educational Problems/Constraints

With regards to personal/educational constraints, majority of farmers brought to notice lack of risk bearing capacity as main problem hindering investment in agriculture. The magnitude of this problem was high under FFS and less under VFS. Most of farmers were lacking entrepreneurial skills, which is essential for successful farm business. The intensity of this problem was almost same under all the farming systems. In this way investment can be encouraged in agriculture by providing

necessary training regarding scientific management of farming business to the farmers. Education plays a crucial role in adoption of new technology and investment in farming business. While, illiteracy was found another problem reported by 21.67, 11.67 and 8.33 per cent of farmers under VFS, FFS and FTFS, respectively. More education facilities should be provided so that educated farmers can make investment on latest technology like improved agricultural implement and machinery.

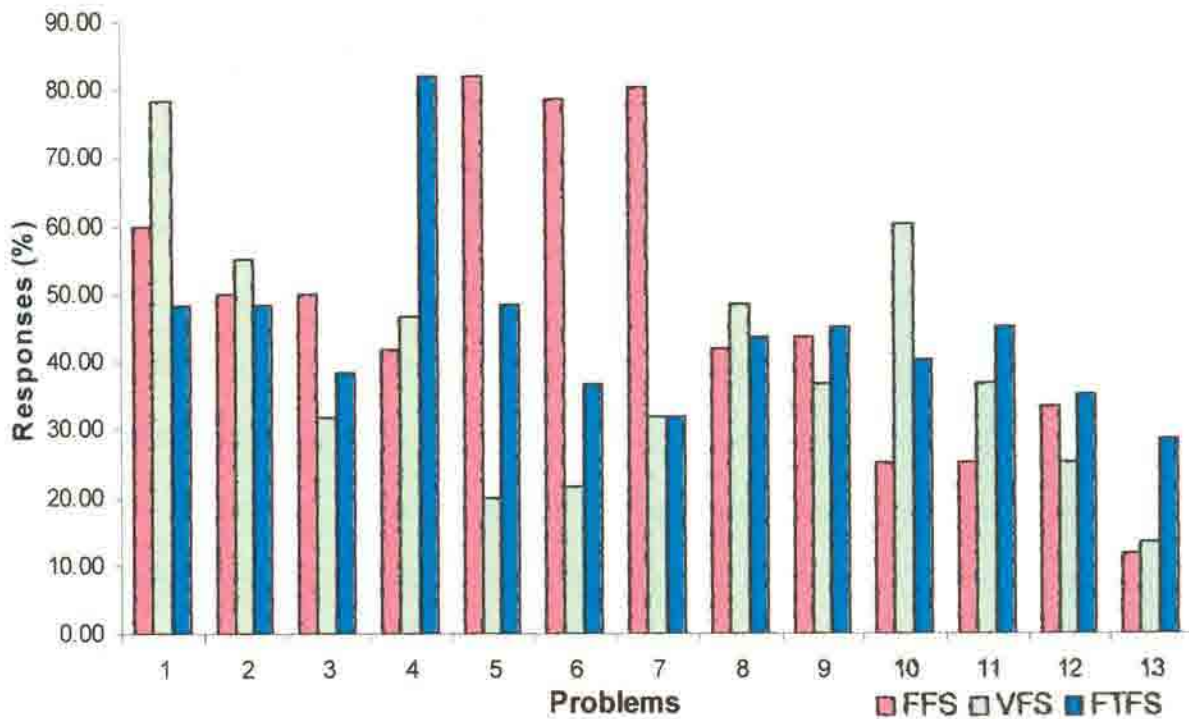
5.7.4 Institution/Political Problems/Constraints

With regards to institutional/political problems most of the problems were related with credit. Majority of farmers expressed the cumbersome loaning procedure as the main institutional problem. Farmers of VFS perceived this problem more intensely followed by FFS. These results were also observed by Baltas (1983). He stated that the easy availability of credit enhances investment while, its non-availability constraints investment in agriculture. Therefore, the number of banks should be increased to make the loan easily available so as to enable farmers to increase their investment on irrigation, improved livestock and implements, etc. Moreover, loaning system should be further simplified. Efficient marketing system not only encourages farmers to increase production but, also to produce quality products and encourage capital investment in farming. But, defective marketing system hampered the capital investment in agriculture. This kind of problem was severe under FTFS followed by VFS and FFS. Irrigation is very essential for intensification of agriculture and improving productivity. Instead only 18 per cent of gross cropped area is irrigated in the state. Lack of irrigation schemes were critically expressed by 81.67, 48.33 and 20 per cent under FFS, FTFS and VFS, respectively. Prema and Thomson (1996) also identified the lack of irrigation as major constraint in capital investment. In view of this, irrigation facilities should be increased by constructing



1. Lack of risk bearing capacity 2. Lack of entrepreneurial skills 3. Illiteracy
4. Poor health 5. Lack of knowledge

Fig. 5.4: Personal/educational problems/constraints



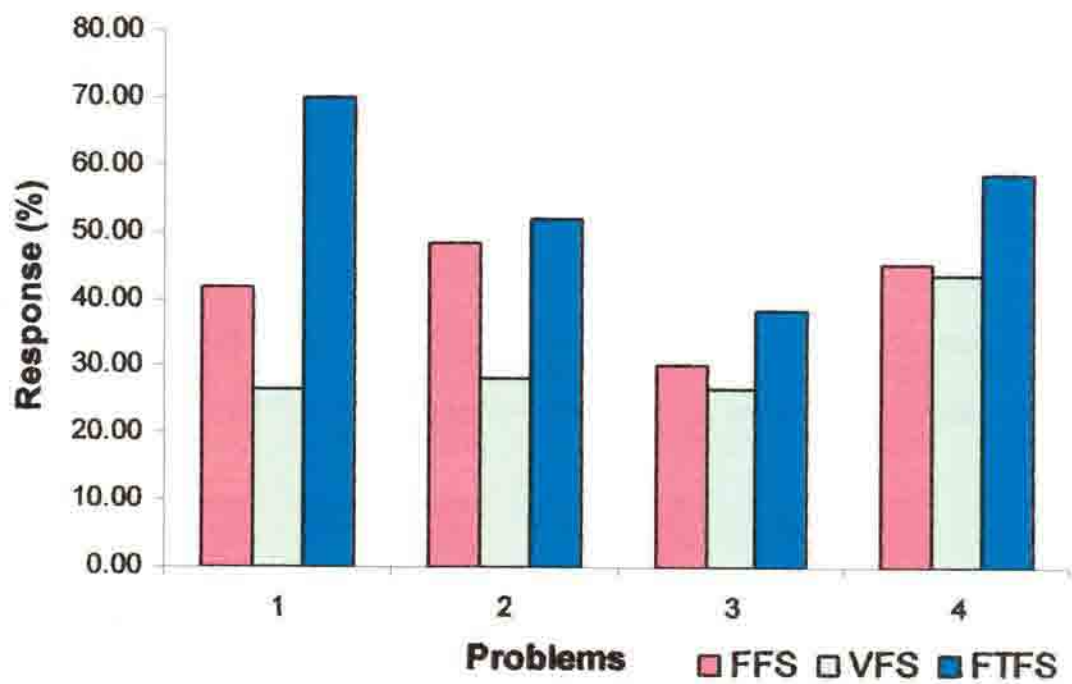
1. Cumbersome loaning procedure 2. Costly credit 3. Credit not timely available 4. Defective marketing system
5. Lack of irrigation schemes 6. Poor road network 7. Unfavourable support prices 8. Low or no subsidy
9. Subsidy on selected items 10. Lack of government assistance 11. Lack of fair price shops
12. Inadequate extension staff 13. Heavy taxes and revenue.

Fig. 5.5: Institutional/political problems/constraints

water harvesting structures, tanks, tube wells, etc., firstly in those areas where it is much needed so that farmers could intensify their agriculture. This move will also encourage them to increase investment on fixed farm capital. Efficient and good road network is necessary to facilitate easy transport and development of markets. Poor road network increases marketing cost and in turn decrease returns to farmers. Poor road network as a constraint in agricultural investment was felt mostly by the farmers under FFS. Farmers also expressed concern about subsidies and 48 per cent of farmers under VFS reported problem of low or no subsidy over capital goods. This problem was also felt by farmers under FTFS and FFS. Subsidy on selected items was a related problem, which was reported by 45 per cent of farmers under FTFS, 43 per cent under FFS and 37 per cent of farmers under VFS. Government should increase the subsidy especially on the hill specific tools. Lack of fair-price shops increase the cost of cultivation and in turn decrease farmer's purchasing power. This problem was found much intense under FTFS and less under FFS. Innovative farmers sometimes do not investment because they did not know about latest technology. Know how of new technology could be disseminated by extension agencies. But, 35 per cent farmer of FTFS, 33 per cent of farmers of FFS and 25 per cent of farmers under VFS reported the inadequate extension staff. Therefore, agriculture extension services should be strengthened and streamlined for dissemination of knowledge about latest capital goods in the areas by providing more staff and training facilities to the existing staff.

5.7.5 Miscellaneous Problems/Constraints

Unfavourable weather conditions were found to hamper investment in agriculture. The magnitude of this problem was found maximum under FTFS followed by FFS and VFS. The negative role of weather on agricultural investment was also



1. Unfavourable weather conditions 2. Uncertainties in yields and prices
 3. Capital goods not suitable for hilly conditions 4. Wild/stray animals

Fig. 5.6: Miscellaneous problems/constraints

confirmed by Dinar and Keck (1997). Uncertainties in yields and prices were another constraint revealed mostly by farmers of FTFS and less by farmers under VFS. Crop and other insurance schemes should be started to minimize these uncertainties to encourage investment. Capital goods available in the market may not suit the hilly condition and this problem was reported by about 38, 30 and 27 per cent of farmers under FTFS, FFS and VFS, respectively. Goswami and Saikia (1972) also observed this problem and stated that the prospect of investment in hill agriculture should be widened by evolving improved agricultural implements suitable for hilly areas.

All the problems/constraints highlighted above seem to be some what interlinked and, therefore, require a system approach to achieve more investment in agriculture.

SUMMARY

SUMMARY

6.1 INTRODUCTION

Development of rural areas has remained a core theme of government policies in India since its Independence. Most of the India's poor live in rural areas and are engaged in farming. Agriculture is an integral part of general development system. It is serving the system as a whole and is being served by it. Agriculture has the proven capacity and potential to support the vitality of rural communities through maintaining family farming, rural employment, quality of life and cultural diversity. Agricultural growth acquires an additional importance in alleviating poverty in relatively poor economies like India with population concentration in rural areas. This fact led to conclude that agricultural development is essential in helping the poor not only by directly increasing their income but, also by releasing labour and capital that can be used in non-agricultural enterprises and by stimulating the demand for non-agricultural goods. Agricultural and allied activities constituted the single largest contributor to the gross domestic product in India. Agriculture is accounting for around 60 per cent of aggregate employment and its growth performance has important implications for overall economic growth.

Substantial progress has been made in increasing production and productivity of major crops during the last 50 years. Following the onset of Green Revolution, increase in public investment in agriculture in the 1970's coupled with technical progress, provided further impetus to the production process. Agricultural growth accelerated significantly during 1980's with a spread in growth across different regions of the country. But, since 1980's all items of public investment in agriculture

has experienced a decline. With shrinking public investment, the growth impetus for agriculture has been declining. Private investment in agriculture has been rising, yet it has not fully compensated for the loss from falling public investment.

A comparison of the growth performance of agriculture at state level revealed that some states/regions have performed better than other states/regions in different time periods. The regional differences in agricultural development arises out of varied agro-climatic conditions, resource endowment, etc., tended to get further accentuated because of varying levels of investment in agriculture and rural infrastructure. Since, agriculture in mountains is different than that in plains because of various mountain specificities, therefore, an attempt has been made in this study to investigate the behaviour of investment and its impact on agricultural growth and rural development in Himachal Pradesh.

6.2 OBJECTIVES

Specifically, the main objectives of the present study are:

- a. To analyze the trends and composition of investment in agriculture and study its determinants.
- b. To examine the impact of investment on agricultural growth and rural development.
- c. To study the problems and constraints thwarting investment in agriculture and rural development and suggest policy options.

6.3 METHODOLOGY

The present study was conducted in Himachal Pradesh. Based upon the agro-climatic diversity state's agriculture was divided into three farming systems viz food-grain based farming system, vegetable based farming system and fruit based farming system. Each farming system was then divided into two sub-farming systems. Food-

grain based farming system was divided into maize based and rice based sub-farming systems, vegetable based farming system was divided into off-season and main-season vegetable based sub-farming systems and in like manner fruit based farming system was divided into temperate fruit based and sub-tropical fruit based sub-farming systems.

Three stage stratified random sampling method was employed for the selection of blocks, villages and cultivators. In the first stage of sampling, two blocks representing each sub-farming system were randomly selected on the basis of dominant cropping pattern thus, making a total of 12 blocks. In second stage of sampling, one village from each selected block was randomly selected, thus making a sample of 12 villages. In the third stage of sampling, a complete list of all the cultivators was prepared in consultation with the revenue officials. Keeping the time and financial constraints at the disposal of the researcher in view, a manageable sample of sixty farmers from selected villages of each farming system representing small (≤ 2 ha) and large (> 2 ha) farmers were chosen randomly through proportion allocation method thus, making a total sample size of 180 farmers. However, the information obtained from two farm categories were ultimately pooled for comparative study of different farming systems.

Both primary and secondary data were collected and used for economic analysis. The primary data on various aspects of farming and investment pattern were collected from the sample households on well designed and pre-tested household schedule through personal contact method for an agricultural year (2004-05). The secondary information related to agricultural investment (public and private) and other rural development indicators were collected from various published (NSSO-RBI Survey Reports, Annual Plan Drafts of Himachal Pradesh, Statistical

Outline of Himachal Pradesh, State Statistical Abstract of Himachal Pradesh, Economic Review of Himachal Pradesh, UCO Bank Agenda Papers, etc.) and unpublished sources of state government (Directorate of Planning Commission, Department of Economics and Statistics, Directorate of Land Records, etc.). Besides, the secondary data pertaining to sampled villages and village level public agricultural investment were collected on well designed and pre-tested village schedule from village level officials, ADO circles, Patwar circles and various offices at Tehsil and Block level.

Tabular analysis was attempted to examine the existing resource structure, investment pattern and problems/constraints thwarting investment in agriculture in different farming systems. Exponential function, incremental capital-output ratio and marginal efficiency of capital were employed to meet out the first objective. To meet out the second objective Hausman's specification test and Two Stage Least Square (2SLS) simultaneous equation models were used. The problems/constraints faced by the farmers that thwart investment in agriculture were analyzed by computing average cumulative response. Chi-square test was used to test the association between different problems/constraints faced by the farmers and different farming systems while, the degree of association was estimated by using coefficient of mean square contingency.

6.4 MAIN FINDINGS

The main findings emerged out of present investigation are summarized as:

- It was observed that sample villages under FTFS have comparatively higher geographical area and consequently less population density. However, the proportion of area available for cultivation was found higher under FFS in comparison to VFS and FTFS. The lower proportion of cultivated area under FTFS

in comparison to other farming system was due to hilly terrains and more undulating topography.

- It was observed that under all the farming systems small farmers were dominating the large farmers though the proportion of large farmers was comparatively higher under FTFS. This clearly indicates that holdings are becoming smaller in mountains due to regressive fragmentation of holdings. It calls for the reform measures that promote consolidation of holdings and discourage further fragmentation. So far as the pattern of working population is concerned, around 50 per cent of working population was engaged in agriculture or allied activities under different farming systems. It implies that agricultural sector is providing livelihood and employment opportunities to bulk of labour force.
- The proportion of capital formation in the form of transport equipments was relatively higher under all the farming systems though, only few farmers in the study area were found to keep tractor and other power driven equipments. The pattern of per farm capital formation in terms of implements and machinery indicated higher investment under VFS in comparison to other farming systems which confirmed the relation between irrigation and mechanization of agriculture.
- The higher proportion of capital formation in the form of cross-bred cows and buffaloes indicated the dominance of improved milch animals under all the farming systems. Per farm capital formation in the form of livestock was higher in case of FTFS farms, which was in consonance with higher number of animals under this farming system.
- Under FFS, about 78 per cent of the total cropped area was under cereal crops. Among cereal crops, maize in kharif and wheat in rabi season were the predominant crops of the study area. The vegetable crops were preferably grown

under irrigated conditions under this farming system. Under VFS, obviously vegetables were dominating the cropping pattern (about 65% of cropped area) due to the assured irrigation facilities. Only around 26 per cent of cropped area was allocated to cereals. The cropping intensity (228%) on VFS farms was higher in comparison to other farming systems due to multiple cropping of vegetables under irrigated conditions. Under FTFS farms, higher proportion of cropped area was under orchards (59.87%), followed by cereals (25%) and vegetables (8.55%). Among fruits, the average yield of mango was higher than other fruits followed by orange. The average yield of major crops was relatively higher on VFS farms due to higher irrigated area (92%), better use of inputs and technology and favourable agro-climatic conditions.

- It was found that under FFS farms, ginger recorded higher gross as well as net returns followed by garlic. In general, the vegetable crops grown under FFS were more profitable than cereals, which clearly show the possibilities for enhancing farm income under FFS by increasing more area under vegetable crops. Under VFS, garlic was found quite profitable in comparison to vegetable crops. This crop can be taken up on commercial lines if its increasing production is accompanied with market development. Needless to mention, the off-season nature of vegetable crops ensures lucrative prices and higher returns *per se*. Under FTFS, dry fruits recorded higher returns followed by mango and orange. It was due to remunerative prices of dry fruits within and out side the state. Paddy recorded higher returns among cereals under all the farming systems.
- The study revealed that under all the farming systems, the gross and net returns were more in case of cross-bred cows and buffaloes due to higher yield in all the farming systems. The yield per milch animal also supported that the performance of

cross-bred cattle and buffaloes was markedly higher under all the farming systems.

This was the major reason behind more popularity of cross-bred cows in the state

- The pattern of village level public agricultural investment revealed that investment on irrigation structures was relatively higher under VFS situation. The proportion of public investment on rural infrastructure and rural development was relatively higher under FTFS and lower in case of VFS. The total as well as per hectare village level public investment was found to be higher under VFS followed by FTFS and FFS.
- Pattern of village level private investment in agriculture revealed that livestock and farm buildings constituted for higher proportion of investment under all the farming systems. The investment on irrigation was higher under VFS in comparison to other farming systems, thereby, showing direct relationship between availability of irrigation water and investment on irrigation. Per farm investment was comparatively higher under FTFS. However, per hectare private investment revealed higher investment on VFS farms. Moreover, the net investment made during 2004-05 as per cent of total capital stock revealed that the capital was accumulated at the rate of around 12 per cent per year in case of FTFS, which was higher in comparison to FFS (11.02%) and VFS (11.90%).
- The real public investment in state agriculture steadily grew up to early 1980's. After this, it suffered a minor set back during 1985-86, which might be due to the shift of emphasis to other economic sectors. Later it increased continuously up to 1995-96. The public investment again showed decline during 2001-02. On the other hand, the private investment in state agriculture after fluctuating during 1970's showed constant and appreciable increase over the years. The government incentives might have become favourable for private investment in the state.

- Per hectare public investment increased almost three times from period-I (Rs 126.93/ha) to period-III (Rs.315.13/ha). The intensity of the public investment (investment as per cent of AGDP) increased from 12 per cent of AGDP during period-I to about 18 per cent of AGDP during period-II. But, its intensity remained almost stagnant at around 18 per cent during period-III. The compound growth rates revealed that there has been a decline in the growth rate of public investment from about 7 per cent during period-I to about 2 per cent during period-III. The irrigation investment also showed declining trend over the years. This declining trend needs to be corrected to achieve desired growth in output.
- The state level private investment in agriculture as per hectare of net sown area increased more than two times from first period (Rs 97.09/ha) to third period (Rs 215.74/ha). The intensity of private investment increased significantly over the years from about 4 per cent in first period to 6 per cent of AGDP during third period. Private investment showed declining trend during period-I but, later showed an increasing trend and grew at an annual growth rate of about 9 per cent during second period. In period-III, its growth rate slightly declined to about 8 per cent per annum, which might be attributed to declining trend of public investment in view of their complementary relationship.
- It was observed that public investment has remained the major constituent of total investment in agriculture. It constituted major proportion of total agricultural investment. The composition of public investment showed some fundamental changes based on new priorities in different plan periods. The relative contribution of different items in public investment revealed that during period-I, agricultural crop husbandry and irrigation constituted for about 32 and 20 per cent of total investment while, rural infrastructure contributed about 13 per cent to the total

public investment. Although, the per cent share of these items decreased during second period (1980-90) but, still they constituted higher proportion of total public investment. The per cent share of rural development and agricultural research and education showed a constant increase over the years.

- However, the composition of private investment did not show any appreciable change. Although, the proportion of investment on transport equipments and farm houses declined from 1991-92 to 2001-02 but, these items still contributed higher proportion towards total private investment indicated that farmers have purchased tractors and power driven equipments to supplement their income and to replace bullock labour. The increase in the share of investment on irrigation indicated that farmers were realizing the role of irrigation in improving agricultural productivity.
- The results of correlation coefficient revealed that there exists a long term complementarity between public and private investment. This might be due to inducement effect of public investment on private investment. Therefore, in view of the positive association between private and public investment, the public investment in agriculture should be increased to boost private sector investment in agriculture. The positive association of investment with AGDP, institutional credit to agriculture and terms of trade was also confirmed in the study.
- Results of the incremental capital-output ratio (ICOR) and marginal efficiency of capital (MEC) revealed that the efficiency of capital used in agriculture improved during period-II but, later during third period there was less efficient utilization of capital in this sector. The increasing use of production technologies like HYVs, chemicals, etc. was not accompanied with increase in irrigation facilities. Moreover, the harsh climatic conditions also led to less efficient utilization of capital in agriculture during period-III.

- It was found that although the agricultural gross domestic product (AGDP) was increasing in absolute terms but, its percentage share in state accounts decreased from about 47 in first period to just 24 per cent during third period. The growth performance of agricultural sector showed that its growth rate increased from 1.23 per cent (1969-79) to 3.33 per cent (1980-90). However, its growth rate slowed down towards third period, which is in consonance with decline in the production of major crops in the state. Moreover, the shrinking net sown area in the state also resulted in declining growth of agricultural sector.
- There is no denying the fact that considerable improvement in the agricultural productivity and the increase in per capita income helped the state in alleviating the poverty to a great extent. Despite the remarkable increase in per capita income, poverty is still existent in some pockets of the state particularly in rural areas. This might be due to inequality in distribution of productive asset and wealth. Complete eradication of poverty requires emphasis on development of agricultural sector along with the growth of non-farm sector.
- The estimates of micro-models revealed that in all the farming systems, gross farm returns, average size of operational holding and dummy variable for off-farm income were the positive and significant determinants of total capital stock on farm. However, more expenditure on variable inputs certainly reduced the surpluses with the farmer and thus, affects the farm investment negatively. Although, the coefficient of expenditure on variable inputs was not statistically significant under VFS. The significant coefficient of average size of family in case of FTFS indicated that this variable have negative effect on capital formation in agriculture.

Per hectare total capital stock on farms, per cent area irrigated and cropping intensity showed positive relation with gross farm returns. The expenditure on

variable inputs on FTFS farms has negative effect on gross farm returns as indicated by its regression coefficient. It suggested the use of quality inputs as per scientific recommendations to improve returns and in turn attract more investment. The coefficients of literacy in both the equation indicated that the education level not only improved gross returns directly by scientific management of farm business, but, also indirectly by higher capital accumulation on farm.

- The Two Stage Least Square (2SLS) estimates for macro-model revealed that agricultural productivity, SGDP, literacy level and grants from central government were positive and strong determinants of public investment whereas, depletion of public resources in the form of subsidies was found to have negative effect on public investment. The positive and significant coefficients of population growth, per hectare public investment, agricultural productivity, terms of trade and literacy revealed their positive influence on private investment. Marginalization of holdings and incidence of poverty were found to reduce private investment in agriculture. Per hectare investment, literacy level, cropping intensity and area under HYVs have contributed significantly in improving agricultural productivity. Whereas, fluctuations in the weather have negative effect over it. Except for terms of trade and population growth rate, all the other variable specified in the poverty equation like agricultural productivity, per hectare investment, agricultural labour wages, literacy level, non-farm employment, institutional credit and expenditure on rural development have helped in reducing poverty in the state. The investment on soil and water conservation, rural development and irrigation were found to be the strong determinants of off-farm employment. Literacy level and road density were other determinants of non-farm employment. Agricultural investment is instrumental in development of rural areas by improving agricultural productivity, increasing non-

farm employment and consequently alleviating poverty from rural sectors.

- It was found that there were number of problems/constraints that thwart investment in agriculture. The extent of resource based, socio-economic and political/institutional problems were found to be higher under FFS as revealed by average cumulative response of respondents. The intensity of personal/educational problems was found higher under VFS while, the intensity of miscellaneous problems/constraints was relatively higher under FTFS. The estimates of the chi-square test indicated that except personal/educational and miscellaneous problems/constraints, there was significant association between different problems/constraints and different farming systems and the effect of different problems differ significantly under different farming systems.

6.5 POLICY OPTIONS

Based upon the findings of the present study, the following policy options have emerged out :

- I. Considering the direct impact of investment on agricultural growth and development, the declining trend in the public investment need to be reversed. There is a need to develop a consensus on investment themes and priorities. The investment in agriculture needs to be supported through appropriate policies that should not discriminate rural poor. The policies should confirm the greater investment opportunities in underdeveloped regions of the state to remove inequality.
- II. The investment on agriculture technology development and its dissemination, rural infrastructure (road, electricity), irrigation, rural development and soil and water conservation amounts to a "win-win" strategy for reducing rural poverty. There is simultaneous increase in non-farm avenues of employment, higher rural wages and reduction of poverty. Hence, investment on such components needs to be enhanced.

III. The private investment has been the principal source of agricultural growth. Private investment in agriculture must be encouraged by providing the necessary support like credit, cheap power, tube-well subsidy, etc. Resource poor farmers in hills can not invest on costly technology. In that case group investment needs to be encouraged.

IV. Since, input subsidies have negative effect on public agricultural investment, the state government should restrain from diverting further resources to subsidize agriculture at the cost of more productive investment. At the same time, whatever subsidies to be provided should be targeted to the poor and to backward regions, where productivity is less and farmers are unable to invest more in agriculture.

V. Recognizing that in the liberalized economic environment, efficiency and growth orientation will attract maximum attention. Also future agriculture will increasingly be science and market led avocation. Therefore, it would require modern economic management and the return to investment on education and research will be high. For this, public investment in agricultural research, education and extension should be increased as these are dominant sources of agricultural productivity.

VI. Capital use efficiency in the state agriculture should be improved, by developing hill specific tools and implements and by dissemination of package of appropriate technology. Further fragmentation of holdings should be discouraged and the consolidation of holdings should be promoted by enforcing effective land reform measures in the state.

LITERATURE CITED

LITERATURE CITED

- Ahluwalia, M.S. 1978. Rural poverty and agricultural performance in India. *Journal of Development Studies* 14(3): 298-323.
- Alagh, Y.K. 1997. Agricultural investment and growth. *Indian Journal of Agricultural Economics* 52(2): 279-287.
- Anderson, P.P. and Lorch, P.R. 1999. The role of agriculture to alleviate poverty. *Agriculture and Rural Development* 6(2): 53-56.
- Anderson, P.P. and Lorch, P.R. 1994. Alleviating poverty, intensifying agriculture and effectively managing natural resources. Discussion Paper No. 1, International Food Policy Research Institute, Washington D.C., U.S.A.
- Anonymous, 2001. Agriculture and rural enterprise in Africa: Is there an investment gap. Oxford Policy Management, December.
- Anonymous, 2002a. Better livelihood for poor people: The role of agriculture. Issue Paper, Consultation Document, Rural Livelihood Department, Department of International Development, London, May.
- Anonymous, 2002b. Sound choices for development, the impact of public investments in rural India and China: Sustainable options for ending hunger and poverty, International Food Policy Research Institute, Washington D.C., U.S.A.
- Anonymous, 2003. Agricultural Policy: Vision 2020. Indian Agricultural Research Institute, Pusa, New Delhi.
- Anonymous, 2004. Tenth five year plan (2002-2007) and annual plan (2003-2004). Planning Department, Government of Himachal Pradesh, Shimla (H.P.).
- Aron, J. 2000. Growth and institutions: A review of the evidence. *The World Bank Research Observer* 15(1): 99-135.

- Baltas, N.C. 1983. Modelling credit and private investment in Greek agriculture. *European Review of Agricultural Economics* 10(4): 389-402.
- Banerjee, A. 1996. Dynamic capital formation in agriculture and financial reforms. *Indian Journal of Agricultural Economics* 51(4): 560-598.
- Bastine , L.C. and Palanisami, K. 1996. Private investment in irrigation in northern agro-climatic zone of Kerala- An economic analysis. *Indian Journal of Agricultural Economics* 51(4): 619-620.
- Bell, C. and Rich, R. 1994. Rural poverty and aggregate agricultural performance in post-independence India. *Oxford Bulletin of Economics and Statistics* 56(May): 111-133.
- Beteille, A. 2003. Poverty and Inequality. *Economic and Political Weekly* 38(48): 4455-4463.
- *Bhagwati, J. and Srinivasan, T.N. 1993. India's economic reforms: Report. Ministry of Finance, Government of India, New Delhi.
- Bhati, S.S. 1975. Problems of small scale farming- A case study of tribals of Uttar Pradesh. *Indian Journal of Agricultural Economics* 30(3): 240.
- *Bhattacharya, B.B. and Rao, C.H.H. 1988. Agriculture-industry interaction: Issues of relative prices and growth in the context of public investment. Paper Presented at the Eighth World Economic Congress, 1-5 December, 1988, New Delhi.
- Bhuvaneshwari, S. and Alagumani, T. 1996. Determinants of capital formation in agriculture in Dindigul-Anna district of Tamil Nadu. *Indian Journal of Agricultural Economics* 51(4): 601-602.
- Braun, J.V., Gulati, A., Hazell, P., Rosegrant, M.W. and Ruel, M. 2005. Indian agricultural and rural development strategic issues and reform options. A strategy paper prepared by IFPRI's senior management team for

consideration by the policy makers of the Government of India, International Food Policy Research Institute, Washington D.C., U.S.A.

Cairncross, A.K. 1955. The short term and the long term in planning. 10th anniversary lecture, Economic Development Institution, Washington D.C., U.S.A., 6 January.

*Cavassa, A.M., O-del, C., Timmer, C.P. and Goldberg, R.A. 1995. Agriculture and economic growth in Vietnam. *Research in Domestic and International Agribusiness Management* 12: 161 -203.

Chadha, R. and Sharma, P. 2005. Liberalising Indian agriculture. *Margin* 37(3): 23-110.

Chand, R. 2000. Emerging trends and regional variations in agricultural investments and their implications for growth and equity. Policy Paper 11, National Centre for Agricultural Economic and Policy Research, Pusa, New Delhi.

Chand, R. 2001. Emerging trends and issues in public and private investments in Indian agriculture: A state-wise analysis. *Indian Journal of Agricultural Economics* 56(2): 161-184.

Chauhan, S.K. and Mehta, P. 2002. Problems and constraints in vegetable marketing: A case study of Himachal Pradesh. *The Bihar Journal of Agricultural Marketing* 10(1): 25-30.

Cleaver, K.M. and Donovan, W.G. 1995. Agriculture, poverty, and policy reform in Sub-Saharan Africa. World Bank Discussion Paper No. 280, Washington D.C., U.S.A.

Desai, B.M. 1969. Level and pattern of investment in agriculture- A micro cross-sectional analysis of a progressive and backward areas in central Gujarat. *Indian Journal of Agricultural Economics* 24(4): 70-79.

- Desai, B.M. 1997. Agricultural paradigm: A synthesis. In: Bhupat M. Desai (Ed.) (1997), Agricultural development paradigm for the Ninth Plan under new economic environment. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Desai, B.M. and Namboodiri, N.V. 1998. Policy strategy and instruments for alleviating rural poverty. *Economic and Political Weekly* 33(41): 2669-2674.
- Dev, S.M. 1997. Subsidies and investment in Indian agriculture: Issues and perspectives. In: RGICS Project No. 21, Subsidies and investment in Indian agriculture. Conference Papers, Rajiv Gandhi Institute for Contemporary Studies, New Delhi.
- Dhawan, B.D. 1996. Trend and determinants of capital investments in agriculture. *Indian Journal of Agricultural Economics* 51(4): 529-541.
- Dhawan, B.D. and Yadav, S.S. 1995. Private fixed capital formation in agriculture: Some aspects of Indian farmer's investment behaviour. *Economic and Political Weekly* 30(39): A103-A111.
- Dhawan, B.D. and Yadav, S.S. 1997. Public investment in Indian agriculture: Trends and determinants. *Economic and Political Weekly* 32(14): 710-714.
- Dinar, A. and Keck, A. 1997. Private irrigation investment in Colombia: Effects of violence, macroeconomic policy, and environmental conditions. *Agricultural Economics* 16: 1-15.
- Dinger, S. M. 1996. Analysis of the trend and determinants of capital formation Indian agriculture. *Indian Journal of Agricultural Economics* 51(4): 612-613.
- Dolgiev, M. 1995. Investment. *Journal of Economic Development* (4): 28-33.
- Duraisamy, P. 1992. Effects of education and extension contacts on agriculture production. *Indian Journal of Agricultural Economics* 47(2): 205-214.

- Dwivedi, R.C. 1972. New strategies of agricultural development in India. Loyal Book Depot, Meerut (U.P.).
- *EPW Research Foundation 1997. National accounts statistics of India: 1950-51 to 1995-96 (Revised edition). EPW Research Foundation, Mumbai.
- *Evenson, R.E. and Mckinsey, J.W. 1991. Research, extension, infrastructure and productivity change in Indian agriculture. In: R.E. Evenson and C.E. Pray (Eds.)(1991), Research, extension, productivity and income in Asian agriculture. Cornell University Press, Ithaca.
- Evenson, R.E., Pray, C.E.M. and Rosegrant, W. 1999. Agricultural research and productivity growth in India. Research Report No. 109, International Food Policy Research Institute, Washington D.C., U.S.A.
- Fan S., Hazell, P. and Haque, T. 2000c. Targeting public investments by agro-ecological zone to achieve growth and poverty alleviation goals in rural India. Food Policy 25: 411–428.
- Fan, S. and Hazell, P. 2000. Should developing countries invest more in less favoured areas? An empirical analysis of rural India. Economic and Political Weekly 35(17): 1455-1464.
- Fan, S., Hazell, P. and Throat, S.K. 2000b. Impact of public expenditure on poverty in rural India. Economic and Political Weekly 35 (40): 3581-3588.
- Fan, S., Hazell, P.B.R. and Thorat, S. 1999. Linkage between government spending, growth and poverty in rural India. Research Paper No. 110, International Food Policy Research Institute. Washington, D.C., U.S.A.
- Fan, S., Jitsuchon, S. and Ethakunnavut, N. 2004a. The importance of public investment for reducing rural poverty in middle-income countries: The case of Thailand. DSGD Discussion Paper No. 7, International Food Policy Research Institute, Washington D.C., U.S.A.

- Fan, S., Linxiu, Z. and Zhang, X. 2000a. Growth and poverty in rural China: The role of public investments. EPTD Discussion Paper No. 66, International Food Policy Research Institute. Washington D.C., U.S.A.
- Fan, S., Zhang, X. and Neetha, R. 2004b. Public expenditure, growth and poverty reduction in rural Uganda. DSGD Discussion Paper No. 4, International Food Policy Research Institute. Washington, D.C., U.S.A.
- FAO, 1999. Investment in agriculture for food security: Situation and resource requirements to reach the world food summit objectives twenty-fifth session. FAO, Rome, 31 May – 3 June.
- Fox, G. 1987. Models of resource allocation of public agricultural research: A survey. *Journal of Agricultural Economics* 38(3): 449-462.
- Gandhi, V.P. 1990. Investment behaviour in developing countries: The case of agriculture in India. International Food Policy Research Institute, Washington, D.C., U.S.A.
- Gandhi, V.P. 1996. Investment behaviour in Indian agriculture. *Indian Journal of Agricultural Economics* 51(4): 543-559.
- Gangwar, A.C. and Pandey, T.N. 1998. Policies for accelerating agricultural production in India. *The Bihar Journal of Agricultural Marketing* 1(3): 289-297.
- Garg, B.R., Jain, K.K. and Kumar, N. 1996. A temporal and spatial analysis of investment in Punjab agriculture. *Indian Journal of Agricultural Economics* 51(4): 622-623.
- *Gonzalez, C.F. 1987. Policies implicit in public investment in agriculture 1983-88. *Revista Nacional de Agricultura Sociedad de Agricultores de Colombia* 880: 101-129.

- Goswami, P.C. and Saikia, P.D. 1972. Pattern of investment in agriculture in prosperous area of Assam. *Indian Journal of Agricultural Economics* 27(4): 89.
- *Government of India, 1959. Report on India's food crisis and steps to meet it. Report of the Agricultural Production Team Sponsored by the Food Foundation, New Delhi.
- Government of India, 1998. Ninth Five Year Plan 1997-2002, Draft Prepared at the Internal Meeting of the Planning Commission, Volume 1, New Delhi, India.
- Gulati, A. and Bathla, S. 2002. Capital formation in Indian agriculture: Trends, composition and implications for growth. National Bank for Agricultural and Rural Development (NABARD) Chair Unit, Institute of Economic Growth, University Enclave, Delhi.
- Gulati, A. and Bathla, S. 2001. Capital formation in Indian Agriculture: Revisiting the debate. *Economic and Political Weekly* 36(20): 1697-1708.
- Gulati, A. and Bhidi, S. 1993. New economic policy: Likely implication for agriculture. Proceedings of first National Conference on Agricultural Policy in the Context of New Economic Policy, New Delhi, February 24-25.
- Gulati, A. and Sharma, A. 1997. Subsidies and investment in Indian agriculture. In: RGICS Project No. 21, Subsidies and investment in Indian agriculture. Conference paper, Rajiv Gandhi Institute for Contemporary Studies, New Delhi.
- Hanssinger, 1964. Saving and investment behaviour. Basil Blackwell, Oxford.
- Hazell, P. and Fan, S. 2003. Agricultural growth, poverty reduction and agro-ecological zones in India: An ecological fallacy. *Food Policy* 28(5&6): 433-436.

- Hazell, P.B.R. and Haggblade, S. 1991. Rural-urban growth linkages in India. *Indian Journal of Agricultural Economics* 46(4): 515-529.
- *Heidhues, F. 1996. Food security in developing countries. *Entwicklung Landlicher Raum* 30(5): 18-21.
- Huffman, W.E. and Miranowski, J.A. 1981. An economic analysis of expenditure on agricultural experiment station research. *American Journal of Agricultural Economics* 63(1): 104-118.
- Jairath, M. S. and Purohit, B.C. 1996. Trends in capital formation in agriculture- A case of arid India. *Indian Journal of Agricultural Economics* 51(4): 587-596.
- Janaiah, A. 1996. Flow of investment and transformation of Indian agriculture: Holds complementary relationship. *Indian Journal of Agricultural Economics* 51(4): 613-615.
- Jodha, N.S. 1992. Sustainable mountain agriculture. In: N.S. Jodha, M. Banskota and Tej Pratap (Eds.)(1992), *Mountain perspectives and sustainability, A frame work for development strategies*. Oxford and IBH Publication Co. Pvt. Ltd., New Delhi.
- Johnson, D.G. 2000. Population, food and knowledge. *American Economic Review* 90(1): 1-14.
- Johnston, B.M. 1997. Agriculture paradigm: A synthesis. In: Bhupat M. Desai (Ed.) (1997), *Agricultural Development paradigm for the Ninth Plan under new economic environment*. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
- Kalaitzandonakes, N.G. 1999. The agricultural knowledge system: Appropriate roles and interactions for the public and private sectors. *AgBioForum* 2 (1): 1-5.

- *Kalla, J.C. 1978. Savings and investment behaviour of farm families in Udaipur district of Rajasthan (India). Thesis Abstract 38(5). Ohio University, World Agricultural Rural Sociology Abstract 20: 700.
- Kapila, 1985. Credit requirement of off-season vegetable growers in Saproon valley of Solan district (H.P.). M.Sc. thesis submitted to CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.).
- Karmakar, K. G. 1998. Capital formation in agriculture and role of institutional credit. *Journal of Rural Development* 17(1): 37-52.
- Khatkar, R.K. and Singh, J.P. 1996. Gross domestic product and capital formation in Indian agriculture. *Indian Journal of Agricultural Economics* 51(4): 630.
- *Kim, Y.S., Kim, D.S. and Chung, H.W. 1988. Investment direction on agricultural development. The Research Report of Rural Development Administration, Suwan, Korea 30(3): 97-101.
- *Kivistik, J. and Sallinen, T. 1993. The need of investment for improving machinery park in Estonian agriculture, Agricultural development problems and possibilities in Baltic countries in the future. Finnish-Baltic Joint Seminar, Saku, Estonia (7): 77-81.
- Kohli, V.K. 2000. Off-season vegetable production: Perspectives and strategies. In: L.R. Verma (Ed.)(2000), National resource and development in Himalayas. Malhotra Publishing House, New Delhi.
- Kothari, C.R. 2001. Research methodology: Methods and techniques. *Wishwa Prakashan, New Age International (P) Ltd., New Delhi.*
- Krishnamurthy, K. 1985. Inflation and growth: A model for India. In: Krishnamurthy and V.N. Pandit (Eds.)(1985), *Macroeconomic modeling of the Indian economy: Studies in inflation and growth.* Hindustan Publishing Corporation, Delhi.

- Kulshrestha, U.C. 2000. Economic development and planning. Lakshmi Narain Agarwal Educational Publishers, Agra (U.P.).
- Kumar, A., Sharma, S.K. and Vashist, G.D. 2002. Vegetable farming holds potential in hills: A case study of Kullu region of Himachal Pradesh. *The Bihar Journal of Agricultural Marketing* 10(4): 353-361.
- Kumar, A.G. 1992. Falling agricultural investment and its consequences. *Economic and Political Weekly* 27(42): 2307-2312.
- Kumar, R. 2005. Constraints facing Indian agriculture: Need for policy intervention. *Indian Journal of Agricultural Economics* 60(1): 49-59.
- Kumar, V. 2001. Optimising farm production systems in hills: A case of Chuhar valley in Mandi district of Himachal Pradesh. M.Sc. thesis submitted to CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.).
- Kumari, V. and Singh, R.K. 2002. Impact of agricultural development on poverty alleviation and quality of life in rural Bihar. *The Bihar Journal of Agricultural Marketing* 10(1): 92-98.
- Kurain, N.J. 1987. IRDP: How relevant is it? *Economic and Political Weekly* 22(52): A161-A176.
- Kydd, J. 2002. Agriculture and rural livelihood: Is globalization opening or blocking paths out of rural poverty? *The Agricultural research and extension network (AgREN), Network Paper No. 121, Department of international development (DFID), UK.*
- Lanjouw, J.D. and Lanjouw. P. 2001. The rural non-farm sector: Issues and evidences from developing countries. *Agricultural Economics* 26(1): 1-23.
- Lewis, A.W. 1955. *The theory of economic growth.* George Allen and Unwin Ltd., London.

- Lewis, A.W. 1957. The theory of economic growth. George Allen and Unwin Ltd., London.
- Mallick, S.K. 1993. Capital formation in Indian agriculture: Recent trends. *Indian Journal of Agricultural Economics* 48(4): 667-677.
- Mani, K.P., Shaheen, P. and Chacko, J.P. 1996. Some reflections on capital formation in Indian agriculture. *Indian Journal of Agricultural Economics* 51(4): 569-578.
- Mishra, S.N. and Chand, R. 1995. Public and private capital formation in Indian agriculture: Comments on the complementarity hypothesis and others. *Economic and Political Weekly* 30(25): A64-A79.
- Mishra, S.N. 1997. Agricultural liberalization and development strategy in ninth plan. *Economic and Political Weekly* 31(25): A19-A25.
- Misra, V.N. 1998. Economic reforms, terms of trade, aggregate supply and private investment in agriculture: Indian experience. *Economic and Political Weekly* 33(31): 2105-2109.
- Misra, V.N. and Hazell, P.B.R. 1996. Terms of trade, rural poverty, technology and investment: The experience, 1952-53 to 1990-91. *Economic and Political Weekly* 31(13): A2-A13.
- Misra, V.N. and Hazell, P.B.R. 1997. Price and non-price factors in agricultural investment (Discussion). *Economic and Political Weekly* 32(31): 1991-1992.
- Mukherjee, S. 1996. Investment in agriculture: What are the real issues. *Indian Journal of Agricultural Economics* 51(4): 600.
- Murgai, R., Ali, M. and Byerlee, D. (2001). Productivity growth and sustainability in post-green revolution agriculture: The case of the Indian and Pakistan Punjab. *The World Bank Research Observer* 16(2): 199-218.

- Nadal, D.S. 1972. Pattern of income, expenditure and savings of selected demonstration farms in Haryana. *Indian Journal of Agricultural Economics* 27(4): 11-19.
- Namoodiri, K.V. 1996. Capital formation in agriculture: Role of institutional finance and government investment. *Indian Journal of Agricultural Economics* 51(4): 607.
- Nurkse, O.S.R. 1962. *Problems of capital formation in under developed countries.* Oxford University Press, Oxford.
- Pal, P.K., Pal, G.P. and Pal, D.P. 1996. Capital formation in Indian agriculture: Private versus public initiative. *Indian Journal of Agricultural Economics* 51(4): 627-628.
- Pal, S. and Singh, A. 1997. *Agricultural research and extension in India: Institutional structure and investment.* Policy Paper No. 7, National Centre for Agricultural Economics and Policy Research, Pusa, New Delhi.
- Pandey, R.K. and Gaglani, P.L. 1992. A study on the possibilities for increasing production and income on tribal farms in hilly area of Chotanagpur. *Agricultural Situation in India* 47(7): 587-594.
- Pant, M.P. and Gautam, J.C. 1990. Mountain farming system in Nepal. In: K.W. Kiley, N. Mateo, G.C. Hawtin and R. Yadav (Eds.)(1990), *Mountain agriculture and crop genetic resource.* Oxford and IBH Publication Co. Pvt. Ltd., New Delhi.
- Pardey, P.G. and Beintema, N.M. 2001. *Slow magic agricultural R & D a century after Mendel.* Food Policy Statement No. 36, International Food Policy Research Institute, Washington, D.C., U.S.A.

- Pardey, P.G. and Craig, B. 1989. Casual relationship between public sector agricultural research experience and output. *American Journal of Agricultural Economics* 71(1): 9-19.
- Patnaik, P. 1987. Recent growth experience of the Indian economy: Some comments. *Economic and Political Weekly* 22(19, 20, &21): 49-56.
- Pender, J.L. and Kerr, J.M. 1998. Determinants of farmer's indigenous soil and water conservation investments in semi-arid India. *Agricultural Economics* 19: 113-25.
- Pendse, N.G., Koshti, N.K. and Baghal, L.M.S. 1996. Trends in capital formation in Indian agriculture: A comparison of pre- and post green revolution period. *Indian Journal of Economics* 51(4): 135-140.
- Petrack, M. 2004. Farm investment, credit rationing and governmentally promoted credit access in Poland: A cross-sectional analysis. *Food Policy* 29: 275–294.
- *Pilati, L. 1986. Liquidity and agricultural investment in the main regions of Italy (1966-83). *Rivista- di – Economia – Agraria* 41(3): 301-321.
- Prakash, B. and Srivastava, S. 1996. Capital formation in Indian agriculture: Trends, constraints and prospects. *Indian Journal of Agricultural Economics* 51(4): 604-605.
- Prema, A. and Thomas, E. K. 1996. Capital formation in Indian agriculture- A block level study. *Indian journal of agricultural economics* 51(4): 624-625.
- Rai, K.N., Karnasra, J.C. and Singh, S.P. 1996. Capital formation in Indian agriculture: An overview. *Indian Journal of Agricultural Economics* 51(4): 612.
- Rangarajan, C. and Kannan, R. 1994. Capital-output ratios in the Indian economy (1950-51 to 1989-90). *The Indian Economic Journal* 42(1): 1-16.

- Rao, C.H.H. 1977. Agricultural growth and rural poverty: Some lessons from past experience. *Economic and Political Weekly* 12(33&34): 1369-1374.
- Rao, C.H.H. 1993. Agricultural growth and rural poverty in India: Emerging trends and perspectives. *Indian Economic Review* 28(2): 129-180.
- Rao, C.H.H. 1994. Agricultural growth, rural poverty and environmental degradation in India, Oxford University Press, Delhi.
- Rao, C.H.H. 1997. Agricultural growth, sustainability and poverty alleviation in India: Recent trends and major issues of reform. International Food Policy Research Institute, Washington D.C., U.S.A.
- *Rao, D.C. and Stern, E. 1978. World development report, The World Bank, Washington D.C., U.S.A., 1978: 47.
- Rath, N. 1989. Agricultural growth and investment in India. *Journal of Indian School of Political Economy* 1(1): 1-19.
- Ravallion, M. and Dutta, G. 1996. India's checkered history in fight against poverty. *Economic and Political Weekly* 31(35, 36 &37): 2479-2485
- *RBI, 1989. A review of the agriculture credit system in India. Report of the agriculture credit review committee (Chairman A. M. Khusro), Bombay.
- Reardon, T., Kelly, V. and Crawford, E. 1997. Promoting sustainable intensification and productivity growth in Sahel agriculture after macroeconomic policy reform-1. *Food Policy* 22(4): 317-327.
- Rostow, W.W. 1960. The stages of economic growth. Cambridge University Press, London.
- Roy, B.C. 2001. Investment and productivity in Indian agriculture. Ph.D. thesis, Post-Graduate School, Indian Agricultural Research Institute, Pusa, New Delhi.

- Roy, B.C. and Pal, S. 2002. Investment, Agricultural productivity and rural poverty in India: A state level analysis. *Indian Journal of Agricultural Economics* 57(4): 653-678.
- Sen, A. 1997. Agricultural Growth and Rural Poverty. *Economic and Political Weekly* 35(40): 3581-3588.
- Shah, S.L. 1972. Income, saving and investment in progressive and less progressive farms in eastern U.P. *Indian Journal of Agricultural Economics* 27(4):83.
- Sharma, A. 2002. An econometric study of technology gap and production potential of vegetable farming in Kangra district of Himachal Pradesh. M.Sc. thesis submitted to CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.).
- Sharma, A.K., Oberoi, R.C. and Moorti, T.V. 1992. Resource use efficiency and profitability of vegetable farming in Himachal Pradesh. *Indian Journal of Agricultural Economics* 47(3): 505-506.
- Sharma, H.R., Sharma, R.K., Kumar, V. and Mehta, P. 1997. Dimensions, effects and determinants of diversification of rural economy: A study of Himachal Pradesh. Research Report No. 2, Department of Agricultural Economics, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.).
- Sharma, K.D., Saini, A.S., Pathania, M.S. and Lal, H. 2003. System oriented socio-economic assessment of transitions in hill agriculture. NATP Research Report No. 27, Department of Agricultural Economics, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.).
- Sharma, K.D., Thakur, D.C. and Saini, A.S. 1999. Poverty in hills, causes and cures. ICSSR seminar on poverty and income distribution in north-western states of India. Department of Agricultural Economics, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, May, 28-29, 1999.

- Sharma, L.R. and Tewari, S.C. 1985. Rationality of the use of various factors of production and mid-hill farming of Himachal Pradesh. *Agricultural Situations in India* 40(8): 697-700.
- Sharma, S.K. 1987. Marketable surplus, income, savings and economic rationale of investment in tribal agriculture-A study of tribal farmers of Kinnaur district of Himachal Pradesh. Ph.D. thesis submitted to CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P).
- Shetty, S.L. 1990. Investment in agriculture: Brief review of recent trends. *Economic and political weekly* 25(7): 17-24.
- Shiyani, R.L. and Vekariya, S. B. 1996. Impact of watershed on capital formation in agriculture: A case study. *Indian Journal of Agricultural Economics* 51(4): 601.
- Singh R., Saraswat, S.P. and Singh, P. 2004. Agricultural policy matrix in Himachal Pradesh: A policy matrix in a federal system. Research Report, Agro-Economic Research Centre, Himachal Pradesh University, Shimla (H.P.).
- Singh, H. 2004. Analysis of growth performance of agriculture in Himachal Pradesh. M.Sc. thesis submitted to CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.).
- Singh, K. 1997. Rapporteur's report on trends and determinants of capital formation in Indian agriculture. *Indian Journal of Agricultural Economics* 52(1): 48-51.
- Singh, P. and Baleka, J.B. 1999. Factors affecting fertilizer consumption in the western Maharashtra. *Agricultural Situations in India* 56(6): 361-368.
- Singh, P.K. 1996. Relation between investment in agricultural research and growth of agricultural output in Gujarat. *Indian Journal of Agricultural Economics* 51(4): 608.

- Singh, R. and Bhati, J.P. 1992. Increasing farm income and employment in hilly area: A study of Himachal Pradesh. *Agricultural Situation in India* 46(12): 921-924.
- Singh, R. and Raman, T. 1994. Sustainable livestock in mountains of Himalayan region- A study of Himachal Pradesh. *Agricultural Situation in India* 48(11): 799-802.
- Singh, R., Singh, B. and Singh, J. 1996. A spatio-temporal analysis of capital accumulation on Punjab farms. *Indian Journal of Agricultural Economics* 51(4): 579-586.
- Singh, S. 1980. Capital formation for proportional allocation, *Sankhya Indian Journal of Statistics* 37(1): 110-115.
- Singh, S.B. and Patil, H.N. 1972. Income and investment in agriculture. *Indian Journal of Agricultural Economics* 27(4): 88.
- Sinha, R.P. and Kumar, R. 1996. Extent and pattern of income, saving and investment on farm households of Nalanda district (Bihar). *Indian Journal of Agricultural Economics* 51(4): 606-607.
- Srinivasan, T.N. 1977. Constraints on growth and policy option: A comment. *Economics and Political Weekly* 12(48): 1987-1990.
- Srinivasan, T.N. 1978. Constraints on growth and poverty option: Further comment, Srinivasan, T.N. (1977) Constraints on growth and policy option: A comment, *Economics and Political Weekly* 13(1): 30-31.
- Thakur, D.R. 2000. An economic analysis of principal spices and condiments in Himachal Pradesh. In: Prem Singh Arya (Ed.)(2000), *Spice crops in India*. Kalyani Publishers, Cuttack.
- Thakur, D.S. and Sharma, K.D. 1984. Weaklings of agriculture in Himachal Pradesh – An introspection. *Himachal Journal of Agricultural Research* 10(2): 1-10.

- Tripathi, R.S. 1996. Pattern of investment and capital formation in different subsistence hill farming systems of Uttar Pradesh. *Indian Journal of Agricultural Economics* 51(4): 626-627.
- *Van de Walle, D. 1985. Population growth and poverty: Another look at the Indian time series data. *Journal of Development Studies* 21(April): 423-439.
- Varadarajan, S. and Sankari, S. 1996. Private capital formation in agriculture. *Indian Journal of Agricultural Economics* 51(4): 609.
- Waghmare, R.E. and Marali, M.D. 1971. Comparative studies in capital investment and net income on irrigated and un-irrigated farms in a Deccan region of Maharashtra. *Indian Journal of Agricultural Economics* 34(4):62.
- Wagle, M.P. 1994. Estimates of aggregate function for demand for fertilizers and private investment in Indian agriculture. *Indian Journal of Agricultural Economics* 49(1): 56-69.
- Zhang, X. and Fan, S. 2004. Public investment and regional inequality in rural China. *Agricultural Economics* 30: 89–100.
- *Zheng, L.T. 1996. Establishing a mechanism to safeguard agricultural development and ensure a steady rate of development. *Chinese Rural Economy* 33(2): 13-17.
- Zhu, J. 2004. Public investment and China's long-term food security under WTO. *Food Policy* 29: 99–111.

* Original not seen.

APPENDICES

DEPARTMENT OF AGRICULTURAL ECONOMICS, CSK HPKV, Palampur (HP)

HOUSEHOLD SCHEDULE

(Ph.D. Research)

Impact of investment on agricultural growth and rural development in Himachal Pradesh

Objectives

- I. To analyze the trends and composition of investment in agriculture and study its determinants.
- II. To examine the impact of investment on agricultural growth and rural development.
- III. To study the problems and constraints thwarting investment in agriculture and rural development and suggest policy options.

Farming system:

Sub farming system:

Student

Sajad Hassan Baba
(A-2002-40-04)

Identification of respondent

- | | |
|-----------------------------|------------------------|
| 1 Name of cultivator: | 2 Father's name: |
| 3 Qualification: | 4 Age: |
| 5 Village: | 6 Post office: |
| 7 Block: | 8 District: |

A. LAND INVENTORY

S.No.	Particulars	Irrigated	Un-irrigated	Source of irrigation
1	Cultivated land a) leased in: b) leased out:			
2	Under fruits			
3	Pasture/forest/fallow			
4	Others(specify)			
Total holding (A/B/Ha)				

A/B/Ha = area in acres/beegas/hectares.

Rate of rent paid/received on leased-in and leased out.....

B. INVESTMENT IN AGRICULTURAL**I. Investment on land**

S. No.	Items	Owned		Purchased for agricultural use		Source of funds		
		Area	Value (Rs.)	Area	Value (Rs.)	Own	Instt.	Non instt.
1	Irrigated							
2	Un-irrigated							
3	Orchards							
Total								

II. Investment on building and farm structure

S. No	Item	No. P/K	Construction		Present value (Rs.)	Repair	Source of funds		
			Year	Value (Rs.)			Own	Instt	Non instt.
1	Farm house								
2	Implement shed								
3	Store room								
4	Cattle shed								
5	Poultry shed								
6	Labour room								
7	Threshing floor								
8	Manure pit								
9	Motor shed								
10	Others(specify)								
Total									

P = Pucca, K = Kucch

VI. Investment on livestock, input use and production

S. No.	Animals	No.		Present value(Rs)	Feeding expenditures./day			Labour /day	Production		Source of fund	
		M	D		Conc.	Green fodder	Dry fodder		Main	Bye	Own	Instit.
1	Cross breed cow											
2	Local cow											
3	Buffalo											
4	Heifers											
5	Calves											
6	Sheep/goat											
7	Horse/mule											
8	Poultry											
9	Rabbit											
10	Others											
Total												

M= milch, D= dry

Note cost of inputs and output: conc./Kg. green fodder...../ Kg, dry fodder...../Kg, wool..... eggs..... Meat.....

VIII. Investment on orchards and plantations, input use and production

S. No.	Particulars	Apple		Peach		Apricot		Walnut		Pear		Others	
		NB	B	NB	B	NB	B	NB	B	NB	B	NB	B
A	Plantation												
1	Area (B/K/A)												
2	No. of plants												
3	Seedling												
4	Material cost(Rs.)												
5	Labour charges(Rs.)												
6	Others												
7	Source of funds												
	• Own												
	• Institutional												
	• Non instt.												
B	Working capital and production												
1	Fertilizers												
	Urea												
	FYM												
	SSP												
	IFFCO												
	Others												
2	Pesticides												
3	Irrigation charges(Rs.)												
4	Human: hired labour												
5	Bullock labour												
C	Production box/plant												
D	Consumption												
	Total												

Specify rates/box (Rs.).....

NB = non bearing B = bearing

C. Cropping pattern, input use and production

Season /crop	Local		HYV		Area (K/ B/A)	Seed		Fertilizer(Kg)				Irr charges (Rs.)	Plant protection		Labour				Prod. (q)			
	I	UI	J	UI		Qty	V	FYM	Urea	IFFCO	SSP		Qty	V	Human	Hired	Bullock	Tractor				
Kharif																						
Maize																						
Paddy																						
Rajmash																						
Oil seed																						
Tomato																						
Bhindi																						
Others																						
Rabi																						
Pea																						
Gram																						
Lentil																						
Mustard																						
Other oilseeds																						
Cauliflower																						
Cabbage																						
Others																						
Zaid																						
Potato																						
Onion																						
Chilly																						
Cucurbits																						
Others																						

V = Value in Rs., I= irrigated, UI = unirrigated

D. Problems and constraints of farm business investment *

S. No	Problems/constraints	Response intensity			Suggestions
		High	Medium	Low	
I.	Resource based				
a)	Small holdings				
b)	Scattered holdings				
c)	Sloppy fields				
d)	Land lease system				
e)	Non-availability of capital goods				
f)	Shortage of critical				
II.	Socio-economic				
a)	Low returns				
b)	Non-farm liabilities				
c)	Large family				
d)	Less earners in family				
e)	Poverty				
f)	Low saving				
g)	Lack of perspectives				
h)	Joint farms				
i)	Land conflicts				
j)	Irreversibility of investment				
k)	High cost of capital goods				
l)	Engagement with subsidiary occupation				
III.	Personal/educational				
a)	Lack of knowledge				
b)	Illiteracy				
c)	Lack of risk bearing capacity				
d)	Poor health				
e)	Lack of entrepreneurial skills				
IV.	Institutional/political				
a)	Lack of government assistance				
b)	Cumbersome loaning procedure				
c)	Costly credit				
d)	Credit not timely available				
e)	Heavy taxes and revenues				
f)	Inadequate extension staff				
g)	Unfavourable support prices				
h)	Defective marketing system				
i)	Lack of irrigation projects				
j)	Low or no subsidy				
k)	Subsidy on selected items				
l)	Lack of fair price shops				
m)	Poor road network				
V.	Miscellaneous				
a)	Unfavorable weather conditions				
b)	Uncertainties in yield and prices				
c)	Investment goods not suitable for hilly conditions				
d)	Wild/stray animals				

E. Income from non-farm sector

S.No.	Member	Education	Occupation	Monthly income(Rs.)
1				
2				
3				
4				
Total				

Structure of family (nuclear of joint).....

F. Other expenditures

Particulars	Expenditure	Year	Present Value (Rs.)	Source of funds		
				Own	Instt.	Non-instt.
Consumption goods						
Health						
litigation						
House hold appliances						
Residential plots & building						
Durable assets						
Saving/ insurance						
Entertainment						
Others						
Total						

Annexure-II

DEPARTMENT OF AGRICULTURAL ECONOMICS, CSK HPKV, Palampur (HP)

VILLAGE SCHEDULE

(Ph.D. Research)

Impact of investment on agricultural growth and rural development in Himachal Pradesh**Objectives**

- I. To analyze the trends and composition of investment in agriculture and study its determinants.
- II. To examine the impact of investment on agricultural growth and rural development.
- III. To study the problems and constraints thwarting investment in agriculture and rural development and suggest policy options.

Farming system:	Student Sajad Hassan Baba (A-2002-40-04)
Sub-farming system:	

Identification of village

- 1 Name of village:
- 2 Post office:
- 3 Block:
- 4 Tehsil:
- 5 District:.....
- 6 No. of families:
- 6 Name of Pradhan:.....
- 7 Distance from the nearest town/city:
- 8 Total geographical area:.....
- 9 Net sown area:
- 10 Area under forests:
- 11 Area under pastures/wastelands:

A. Population

S No.	Sex	<18 years		>18 years	
		2002-03	2003-04	2002-03	2003-04
I	Male				
II	Female				
	Total				

B. Rural literacy

S.No	Particulars	Male (no.)	Female (no.)
I	Illiterate		
II	Literate		
	a) Primary		
	b) Middle		
	c) Matric		
	d) 10+2		
	e) Graduation		
	f) Post graduate		
III	Others (specify)		
	Total		

C. Investment over Irrigation structure

S.No	Type	IRA	No.	Construction		Beneficiaries /purpose
				Year	Investment(Rs)	
A	Major & medium irrigation					
I	Lift irrigation					
II	Sprinkler irrigation					
III	Wells					
IV	Drip irrigation					
V	Flow irrigation					
VI	Pipes					
VII	Tanks					
VIII	Kulh					
IX	Canals					
	Others (specify)					
B.	Major irrigation schemes					
	Total					

IRA = irrigated area

D. Investment on rural infrastructure

S. No	Particulars	No. of houses electrified /length (km)	Investment		Present Value (Rs)	Repair (Rs)
			Year	Amount (Rs)		
I	Rural electricity					
a)	HT					
b)	LT					
c)	Others					
II	Rural roads					
a)	Link (k/p)					
b)	Main (k/p)					
c)	Others					
Total						

HT= High tension, LT= low tension, k=kuccha and p=pucca.

E. Investment on crop husbandry, livestock and forestry

S. No	Particulars	Schemes of development	Investment		Area benefited (ha)
			Year	Amount (Rs)	
I	Agriculture				
a)	Seed				
b)	Implements				
c)	Others				
II	Horticulture				
a)	Plant protection equipments				
b)	Nursery				
c)	Others				
III	Animal husbandry				
IV	Forestry				
Total					

F. Agricultural research and educational investment

S. No	Institutions	No.	Construction		Present Value (Rs.)	Far from village
			Year	Investment (Rs.)		
I	Agricultural research institute					
II	ITI					
III	KVK					
IV	Others (specify)					
Total						

G. Investment on rural development

S. No	Particulars	No.	Year	Investment (Rs.)	Present Value (Rs.)
A.	Rural development				
I	Special programmes for rural development				
II	Rural employment schemes				
III	Land reform/improvement				
V.	Rural housing				
B	Community development programmes				
C	11 th finance commission				
D	Family benefit/welfare schemes				
E	Others (specify)				
Total					

H. Villages Govt. agro industries

S. No	Type	No	Construction		Present value(Rs.)	Far from village
			Year	Investment (Rs.)		
I	Atta chaki					
II	Oil expeller					
III	Saw mill					
IV	Handicraft					
V	Woolen (khadi) industry					
VI	Shops					
	a) Timber shops					
	b) Tea stall					
	c) Grocery shops					
	d) Hardware					
	e) Ag. Tools shop					
	f) Ag. Tool repair shop					
	g) Any other (specify)					
VII	Others(specify)					

I. Other village amenities

S. No	Amenities	No. (Or %)	Construction		Present Value (Rs.)	Far From village
			Year	Investment (Rs.)		
I	Financial institutes					
	a) Govt.					
	b) Cooperatives					
	c) Private					
II	Health centre					
	a) primary					
	b) hospital					
	c) veterinary					
III	Road					
	a) Kuccha (km)					
	b) Pucca (km)					
IV	No. of houses electrified					
V	Storage facilities					
VI	Community halls					
VII	Panchayat garh					
VIII	Patwari garh					
IX	Municipal office					
X	Villages water supply dept.					
XI	Post office					
XII	Horticultural office/research centre					
XIII	Forest building/check post					
XIV	Fishery pond/ office					

Appendix-III

Database	Source (s)
Public agricultural investment	<ul style="list-style-type: none"> • Annual plan drafts, Department of Planning, Government of Himachal Pradesh, Shimla (H.P.) • Published/unpublished Financial Accounts of State and Central Government
Private agricultural investment	<ul style="list-style-type: none"> • National Sample Survey Organization-Reserve Bank of India (NSSO-RBI) Survey Reports
State gross domestic product	<ul style="list-style-type: none"> • State Gross Domestic Product, Department of Economics and Statistics, Shimla (H.P.)
Non-farm employment (%)	<ul style="list-style-type: none"> • Statistical Outline of Himachal Pradesh • Research Reports (International Food Policy Research Institute, Washington DC.)
Poverty ration (%)	<ul style="list-style-type: none"> • Economic Research and Development (ERD), Asian Development Bank, • Planning Commission, Government of India.
Other variables used in the study like literacy rate, irrigated area, area under marginal holdings, fertilized subsidy, institutional credit to agricultural sector, etc.	<ul style="list-style-type: none"> • Statistical Outline of Himachal Pradesh • State Statistical Abstract of Himachal Pradesh • Economic Review of Himachal Pradesh • Fertilizer Statistics of India • UCO Bank Agenda Papers • Economic Survey of Himachal Pradesh, etc.

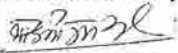


Department of Agricultural Economics
CSK HP Krishi Vishvavidyalaya, Palampur (HP)

Title of the Thesis : **Impact of Investment on Agricultural Growth and Rural Development in Himachal Pradesh**
Name of Student : Sajad Hassan Baba
Admission No. : A-2002-40-04
Subject : Agriculture Economics

ABSTRACT

An attempt was made in this study to analyze the behaviour of agricultural investment in relation with agricultural growth and rural development in Himachal Pradesh. The study was based upon both primary and secondary data. Various mathematical and statistical techniques were used to analyze the data. The study at micro-level revealed that farm buildings and livestock constituted higher proportion of private investment under all the farming systems. The net investment as per cent of total capital stock revealed that the capital was accumulating at higher rate under fruit based farming system (FTFS) followed by vegetable based farming system (VFS) and food-grain based farming system (FFS). The pattern of village level public investment showed that relatively higher proportion of the investment was made on rural development under all the farming systems. The investment on irrigation was relatively higher under VFS while, the proportion of investment on rural infrastructure was higher under FTFS. Total public investment was comparatively higher in case of VFS. Per hectare public investment at state level increased almost three times from 1969-79 (period-I) to 1991-2001 (period-III). The intensity of the public investment increased from 12 per cent (period-I) to about 35 per cent of agricultural gross domestic product (AGDP) (period-II), but in later period it almost remained stagnant. The compound growth rates showed that there has been a decline in the growth rate of state level public investment from about 7 per cent during period-I to just 2 per cent during period-III. On the other hand, state level private investment in agriculture increased more than two times from first to third period. The intensity of private investment increased significantly from about 4 per cent to 6 per cent of AGDP over the years. Private investment showed declining trend during period-I but, later it showed an increasing trend and grew at an annual growth rate of about 8 per cent during third period. The results of correlation coefficients confirmed the existence of long term complementarity between public and private investment. The analysis also revealed positive association of investment with AGDP, institutional credit to agricultural sector and terms of trade. The efficiency of capital used in agriculture was decreasing over the years as evident from calculated incremental capital-output ratio (ICOR) and marginal efficiency of capital (MEC). The estimates of micro-model revealed that average size of holdings, gross farm returns and dummy for off-farm income were the significant determinants of total capital stock on farm under all the farming systems. Expenditure on variable input was found to have negative impact on capital stock under FTFS while, their relation was not statistically significant under other farming systems. Total capital stock on farm, cropping intensity and per cent area irrigated were found to have positive influence on gross farm returns. Level of education was found to be an important determinant of total capital stock as well as gross farm returns. The estimates of simultaneous equation model for the state as a whole revealed that agricultural investment played a crucial role in rural development not only directly by alleviating rural poverty but, also indirectly by improving agricultural growth and employment in non-farm sector. Considering the direct impact of investment on agricultural growth and development, the declining trend in the public investment needs to be reversed. Moreover, number of problems/constraints were observed that thwart investment in agriculture. But all these problems seem to be somewhat interlinked and need to be tackled through holistic and systematic approach. Based upon the findings it could be claimed that the intensity of investment particularly on irrigation, infrastructure, rural development and soil and water conservation, etc. should be improved. Private investment in agriculture must be encouraged by providing the necessary support like credit, cheap power, tube well subsidy, etc. Capital use efficiency in state agriculture should be improved by developing and disseminating hill specific tools and implements and by dissemination of package of appropriate technology.




(15/06/2006)

(Signature of Student with date)



(Signature of Major Advisor)

Counter Signature


Head of Department

Dean

Postgraduate Studies

