IMPACT OF FARM FINANCE AND INVESTMENT ON PROFITABILITY OF FARMS IN ANNUR BLOCK OF COIMBATORE DISTRICT

Thesis submitted in partial fulfillment of the requirements for the Degree of

MASTER OF SCIENCE (AGRICULTURE) IN AGRICULTURAL ECONOMICS

to the Tamil Nadu Agricultural University, Coimbatore.

By

KAYALVIZHI.R,

I.D.No. 09-601-006

DEPARTMENT OF AGRICULTURAL ECONOMICS

CENTRE FOR AGRICULTURAL AND RURAL DEVELOPMENT STUDIES

TAMIL NADU AGRICULTURAL UNIVERSITY

COIMBATORE 641 003

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By

Miss.R.Kayalvizhi, B.Sc., (Ag)

ID.No. 09-601-006

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CERTIFICATE

This is to certify that the thesis entitled "Impact of Farm Finance and Investment on Profitability of Farms in Annur block of Coimbatore District" submitted in partial fulfillment of the requirement for the degree of **MASTERS OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS** to the Tamil Nadu Agricultural University, Coimbatore is a record of bonafide work carried out by **Miss.R.KAYALVIZHI,** under my supervision and guidance and that no part of this thesis has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes and that the work had not been published in part or full in any scientific or popular journal or magazine.

Place: Coimbatore
Date:

(Dr.T.R.SHANMUGAM)
Chairman

Approved by

Chairman : (**Dr. T.R.SHANMUGAM)**

Members : **(Dr.R.PALANISAMY)**

(Dr.K.GOVINDARAJAN)

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ABSTRACT

IMPACT OF FARM FINANCE AND INVESTMENT ON PROFITABILITY OF FARMS IN ANNUR BLOCK OF COIMBATORE DISTRICT

By

R.KAYALVIZHI

Degree : **Master of Science in Agricultural Economics**

Chairman : **Dr.T.R. SHANMUGAM**

Professor,

Department of Agricultural Economics,

Tamil Nadu Agricultural University,

Coimbatore – 641 003.

2011

Investment plays a vital role in the agricultural production process. It induces production and savings, further investment helps in the development of the economy. It plays an equally important role in farm economy especially in the era of technological revolution. Advances in farm technology signify a continuously shifting demand for industrial based agricultural inputs and investible funds thereof. With the meager capital available one should attempt for judicious investment to realize the maximum efficiency of capital. The present study mainly focuses on different sources and pattern of investment in farm firms, factors influencing farm investment and returns to investment in farm firms.

With this view, this study was attempted to assess the impact of farm finance and investment on profitability of farms in Annur block of Coimbatore district. This block was purposively selected for the study since it has the highest number of borrowers for agriculture purpose from commercial banks and it also has the highest loan amount given for agricultural purposes. From the selected block, four villages were selected randomly for the study.

Ten borrowers and ten non-borrowers were interviewed in each of the selected villages. Thus, the sample design resulted in sample size of fourty each, for borrower and non-borrower categories. The required primary data were collected by personal interview with the selected farmers using pre-tested interview schedule. The secondary data on area, production, cropping pattern and land-use pattern related to the study were collected from Block Development Office and Office of The Assistant Director of Agriculture, Annur. The tools of analysis included conventional percentage analysis, returns to investment, net cash income and three stage least square analysis. The analysis of the primary data revealed the following results.

The cropping pattern of the sample farms showed that in the borrower farms turmeric was largely cultivated and it was followed by banana, curry leaves, maize and onion where as in the case of non-borrower farms fodder sorghum was largely cultivated followed by banana, turmeric, curry leaves and onion. The cropping intensity showed that the borrower farms had higher cropping intensity (130.34 per cent) than that of non-borrower farms (119.24 per cent).

The borrower farms depend more on the Commercial banks (55.00 per cent) to meet their farm investment and it was followed by Regional Rural Banks (15.00 per cent) and Co-operative Banks (15.00 per cent). The contribution of relatives and friends to the total farm investment was 12.50 per cent and the money lenders contributed about 2.50 per cent to the total farm investment in the borrower farm firms.

The total annualized investment per hectare was higher in case of the borrower farms (Rs. 96411.36) than that of the non-borrower farms (Rs. 80665.25). Out of the total investment made the investment made on fixed assets was higher in the borrower farms (Rs. 28774.88) whereas it was lower in case of the non-borrower farms (Rs. 14825.13). Similarly the investment made on the working assets was also higher in borrower farms (Rs. 67636.49) than that of the non-borrower farms (Rs. 52432.30).

The gross income was calculated for the borrower and non-borrower farms, the results revealed that borrowers had higher gross income (Rs. 314301.07) than that of the non-borrowers (Rs. 208116.40). The major contributor of income for the borrowers was crop income (45.04 per cent), which was followed by livestock income (34.90 per cent) and then by non-farm and off farm income (20.06 per cent). In the non-borrowers crop income contributed (57.82 per cent) of

the total income, followed by livestock income (25.62 per cent) and then by non-farm and off farm income (16.56 per cent).

Returns from the investment were higher in case of the borrower farms as the returns from investment ratio was 1.61, whereas in the non-borrowers it was 1.15. The net cash income obtained was also higher in the borrower farms (Rs. 154818.75) than that of the non- borrower farms (Rs. 92980.67).

The three stage least square analysis was taken up for borrower and non-borrower farms with the view to determine the factors influencing farm investment. It was inferred that the coefficients of independent variables such as size of farm holding, institutional credit in borrowers and owned capital in non-borrowers, livestock unit, labour usage in borrowers and family labour utilization in non-borrowers, cropping intensity, lagged net returns, and non-farm income were found to have positive impact on farm investment and also found to be statistically significant. The coefficient of the family size in the borrower farms was found to have a negative impact on farm investment, because as family size increased, the consumption expenditure would also increase and reduced the savings and in turn, the capital investment was also been reduced.

Similarly the three stage least square analysis was taken up for the borrower and non-borrower farms with the view to determine the factors influencing returns to investment. It was inferred that the coefficients of independent variables such as average farm investment, labour usage in borrowers and family labour utilization in non-borrowers, institutional credit in borrowers and owned capital in non-borrowers, cropping intensity, livestock unit and nonfarm income were found to have positive impact on the returns to investment and also found to be statistically significant.

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CHAPTER I

INTRODUCTION

India is mainly an agricultural country. In India about 52 per cent of people are employed in agriculture and share of agriculture to the total Gross Domestic Product accounted for about 17 per cent. Agricultural development in India can be classified into three phases namely, the pre-green revolution phase, the green revolution phase and the post green revolution phase. The pre-green revolution phase was the period wherein any increase in agricultural output was effected only by an expansion in area under cultivation. Green revolution era, however, shifted the focus from increase in production to increase in productivity by enhancing the input usage, in terms of seeds, fertilizers, chemicals and so on, which leads to a greater need for investment to enhance the productivity as well as to gain a greater profit. This approach brought about dramatic structural changes in the agricultural paradigm of the country.

The post green revolution can be described as the period of investment to achieve the required agricultural growth by means of input efficiency and technology adoption as the key factors. According to the Committee on World Food Security (1999), "Investment in agriculture is a necessary, if not sufficient condition for increasing agricultural production and productivity and thereby to ensure the availability and accessibility of food to the population".

Investment in agriculture is vital for millions of the poor. It is widely accepted that agricultural investment, when appropriately structured, can lead to capital deepening, technology transfer, and accelerate broader economic development of the country. "The challenge today is to recast agriculture in the new environment of globalization, rising prices, growing domestic demand and greater private sector involvement. But this will require greater investments to increase farmer's yield and profitability" (World Bank India Newsletter, 2008).

The National Agriculture Policy (2000) and the 11^{th} Five Year Plan envisage an annual growth in agriculture of over 4 per cent. Investment in agriculture, the prime mover, therefore, needs to be accelerated to achieve the desired rate of growth. More importantly, this investment needs to be appropriately structured, timed and well implemented to have the maximum impact.

The less developed countries (Stephen, 1991) in particular, have not been able to absorb technical improvements as rapidly as that of the developed or industrialized countries. The basic

problem of less developed countries is the insufficient capital investment in the agriculture sector. According to the World Bank Report (2008), "Greater investment in agriculture in transforming economies like India is vital to the welfare of 600 million rural poor, mostly in Asia,"

Muhammad *et al.,* (2003) emphasized the importance of investment through three main factors that contribute to agricultural growth namely the increased usage of agricultural inputs, technological change and technical efficiency. Technological change is the result of research and development efforts, while technical efficiency with which new technology is adopted and used more rationally is affected by the flow of information, better infrastructure, availability of funds and farmers' managerial capabilities. Higher use and better mix of inputs also requires funds at the disposal of farmers. These funds could come either from farmer's own savings or through borrowings.

Rosenzweig and Binswanger (1993) found that agricultural investment behaviour of farmers reflects their risk aversion, with poorer farmers accepting lower returns in exchange for lower risk to smooth their consumption. The wealthy are less risk averse; they can afford to accept higher risk in seeking higher returns. Hence, they found that wealthier farmers, particularly those with larger farms and diversified incomes, have higher rates of farm investment on per hectare basis. They suggest that consumption credit and/or crop insurance would increase the overall profitability of agricultural investments.

Roy and Pal (2002), in their study on investment, agricultural productivity and rural poverty, examined the relationship between investment and productivity for the period from 1965-'66 to 1998-'99 based on the Finance Accounts data. Using a simultaneous equation model the authors observed that both public and private investments have positive relationship with agricultural productivity. They also found that the effect of investment on productivity is stronger than the effect of subsidies.

Srinivasan (2007) found that the increasing profitability in agriculture through higher productivity has been an important goal in developing countries like India. It has become more relevant in recent years due to limited scope for expansion of arable land. Increasing yield to their technically highest level may be feasible, through adequate investment in infrastructure and technology *i.e.* irrigation, land development, storage, markets *etc.*

World Development Report on Agriculture and Development (2008) points out that there was "much misspending on agriculture" in India, with investments accounting for only 25 per cent of public expenditure, while subsidies took up to 75 per cent. The return on investment is 5-10 times more than the return on subsidies.

Lewis (1957) attributes low investment to low saving which, in turn, is due to the small ratio of profit to national income. Dearth of entrepreneurship, lack of integration between saving and investment, absence of financial intermediaries to mobilize savings and institutional barriers are the other likely causes of low investment. In spite of low savings and other barriers, the cultivators may undertake investment, if the expected returns are large enough to finance it by borrowing. The investment, therefore, should yield sizeable returns that could be made available for re-investment also (Panikar, 1969).

Binswanger (1989) said that Public investment in agriculture has a potential to enlarge the potential base of agriculture through the stimulation effect. It results in an increase in the farmer's own investment in farm business as the marginal productivity per unit investment is now higher. The capital stock of agriculture therefore becomes even higher. However there is need to get a deeper insight of the specific areas of public investment which result in a greater stimulation effect.

Sriram (2007) argues that it is important to have increasing investments in agriculture, and much of these private investments in agriculture should be desirably funded through formal sources of credit; there could be no causality between investments and productivity, unless they have been directed in a well thought out manner. Thus mere increase in supply of credit is not going to address the problem of productivity, unless it is accompanied by investments in other support services.

Carter (1989) argued that credit affects the performance of agriculture in three ways: (i) it encourages efficient resource allocation by overcoming constraints to purchase inputs and use them optimally, this sort of effect would shift the farmer along a given production surface to a more intensive, and more remunerative, input combination"; (ii) if the agricultural credit is used to buy a new package of technology, say high-yielding seed and other unaffordable expensive inputs, it would help farmers to move not only closer to the production frontier but also shift the entire input-output surface, in this regard it embodies technological change and a tendency to

increase technical efficiency of the farmers; and (iii) credit can also increase the use intensity of fixed inputs like land, family labour, and management. Carter's reasoning implies that agricultural credit not only increases management efficiency but also affects the resource allocation and profitability.

United Nations Conference on Trade and Development Board (2010) comments that agricultural investments seems to hold the promise of raising productivity and welfare and are consistent for economic development and poverty reduction.

Components in Agricultural Investment

Investment in agriculture has two components namely the Gross Fixed Capital Formation (GFCF), which includes primarily the investment in physical assets in agriculture, and the stocks which are presently in the form of inventories but which are not actually used for further production, although they could be used. The two components taken together constitute the Gross Capital Formation (GCF). GFCF takes the following forms,

a) Reproducible tangible fixed assets like residential buildings, construction and alteration to residential buildings/non- residential buildings, construction of irrigation dams, plantation and orchard development, machinery, equipment and transport equipment's.

b) Non-reproducible assets include capital expenditure on farms as well as subsidiary activities, which are land intensive in nature. These are in the form of irrigation, land development, horticulture and plantation crops, land reclamation, animal husbandry, fishery and forestry *etc*.

In the era of globalization, when agriculture is expected to satisfy not only the domestic demand but also to encash on its comparative advantages and contribute substantially to foreign exchange earnings by way of exports, modernization of technology and management practices are crucial. Hence, the need for increasing investment in agriculture is necessary (Reserve Bank of India report, 2005).

Investment Trends in India

The orientation of Indian agriculture is changing from subsistence to market economy and from agriculture to agribusiness. With the gradual opening up of the economy under the World Trade Organization regime, Indian agriculture is exposed to global markets and this will

further strengthen the process of commercialization and diversification of agriculture. Besides the traditional crop production other activities like horticulture, vegetable cultivation, mushroom cultivation, floriculture and cultivation of medicinal and aromatic plants are gaining ground and agro processing is emerging as a major sub system. This calls for a considerable investment of capital in storage, godowns and processing. Thus, scope for investment in agriculture is getting enlarged with shift in focus from mere production to productivity and profitability.

Investment in agriculture is made by both public as well as by private sectors. While public sector investment in agriculture is made for building necessary infrastructure, private investment in agriculture is either for augmenting productivity of natural resources or for undertaking other allied activities which supplement income sources of farmers.

In India private sector investment comprise investments made by private corporates and households. Public sector investment includes investment made by Central and State Governments and investments through their Departmental Commercial undertakings (DCUs) and Non Departmental Commercial Undertakings (NDCUs). DCUs primarily invest in areas like crop husbandry, soil and water conservation and animal husbandry. NDCUs like Irrigation and Water Resource Development Corporation, Tube well corporations, Poultry Boards, Forestry Boards, Tea corporations and Fisheries Corporations owned by central and state Governments also invest in animal husbandry, minor irrigation and other allied activities. The public sector investment to the total investment made in agriculture has increased from 17.28 per cent in 1999-2000 to 28.95 per cent in 2007-08, whereas the private sector investment to the total investment in agriculture has decreased from 82.70 per cent in 1999-2000 to 71.05 per cent in 2007-08.

The role of credit institutions and the flow of institutional credit play a major role on the productive ability of the agriculture sector. Despite the declining public capital formation in agriculture, the flow of institutional credit has played a vital role in boosting private investment in agriculture. The ratio of institutional credit to private gross capital formation has increased from 1.37 in 2000-2001 to 3.11 in 2007-08. Appendix-I shows the ratio of institutional credit to private gross capital formation in agriculture and allied sectors over the years.

Capital formation in agriculture helps in improving the stock of equipment, tools and productivity of natural resources, which in turn enables the farmers to use their resources,

particularly land and labour, more productively. Creation of capital goods, thus, is necessary for raising productivity of existing resources and realizing long term growth potential.

The Gross Capital Formation (GCF) in agriculture as a proportion to the total Gross Domestic Product (GDP) has shown a decline. However, the GCF in agriculture relative to GDP in this sector has shown an improvement from 11.23 per cent in 1999-2000 to 15.24 per cent in 2007-2008. This investment would need to be increased to about 16 per cent of agricultural GDP to achieve 4 per cent agricultural growth target during the Eleventh five year Plan. Appendix-II shows the Gross Capital Formation (GCF) in agriculture and allied sectors over the years.

Agricultural Investment in Tamil Nadu

The credit distribution to agriculture and other allied activities in Tamil Nadu has been increasing over years. Institutional credit contributes higher to the agriculture in Tamil Nadu than from the other sources of credit. As per the statistical report of the Government of Tamil Nadu the public sector banks has disbursed a loan amount of Rs. 18,754 crore to 40,66,318 members directly and Rs. 4,535 crore to about 28,313 beneficiaries indirectly as on March 2008-09.

The farming sector receives the highest amount of loan when compared to nonfarm sector and other priority sectors. The loan amount to agriculture and allied sectors is Rs. 21,007.94 crore compared to the entire loan amount of Rs. 37,859.32 crore rendered to all the other sectors. This is about 55 per cent of the entire loan amount. According to annual credit plan of Tamil Nadu, Coimbatore district, receives the highest loan amount of Rs.1, 810.86 crore followed by Erode and Kanyakumari district with the loan amount of Rs. 1,233 and Rs. 1,168.24 crore respectively out of Rs. 21,007.94 crore earmarked for the entire districts in Tamil Nadu (Statistical Hand Book of Tamil Nadu, 2008-09).

Need of the Study

It is high time to reconsider the potentials of agriculture, which supports the majority of the population, before it is too late. Higher investment in agriculture along with properly implemented land and tenancy reforms would lead to improved purchasing powers in the rural areas, particularly in the hands of the rural poor. An increase in effective demand can revive the growth of the Indian economy, which has recently faced threat from the global economic and financial meltdown. In the current situation of economic recession and inflation, agricultural growth can be achieved only by means of enhancing the investment. With this view in focus, the

present study has attempted to assess the impact of agricultural credit on farm productivity and profitability.

Scope of the Study

The green revolution phase increased the input intensities which increases the crop yields only to a limited extent. The area under agriculture has declined. In the future also, net sown area may tend to decline owing to the pressure for requirement of land for other purposes. These developments together with degradation of already productive lands on one hand, and the increasing demand for food grains and other agricultural commodities in view of the growing population on the other hand have made the sustainability of the momentum a complex task. To sustain the growth of agriculture output, researchers and policy makers have made several strides to increase the agricultural production by increasing the efficiency of inputs along with other innovative technologies which is achieved only by means of enhanced investment. This needs careful study of the farming condition, the pattern of investment, sources of investment and the returns realized. The results of the present study would be useful in providing a clear picture about the needs of investment. This will also explain the pattern and sources of investment now in existence and also the returns realized in the farms and how the agricultural investment has enhanced the productivity and profitability of the farmers.

Problem Focus

The modern agriculture has increased the use of inputs especially for seed, fertilizers, irrigational water, machineries, implements *etc*., which has increased demand for agricultural credit. The adoption of modern technology, which is capital intensive, has commercialized agricultural production in India. Besides, the farmer's income is seasonal while his working expenses are spread over time. In addition, farmer's inadequate savings require the uses of more credit to meet the increasing capital requirements. Furthermore, credit is a unique resource, since it provides the opportunity to use additional inputs and capital items now and to pay for them from future earnings. The farm investment is a complex process owing to many factors such as differences in the types of assets and their gestation period apart from varying lending procedures and recovery methods followed by different lending agencies. In this context, the present study was taken up to evaluate the impact of credit or owned capital on returns to investment and also to the farm investment.

Hypotheses

A set of working hypotheses was developed based on the importance and the objectives of the study. They are:

1. Agricultural investment of the farm firm is directly related with the credit borrowing capacity of the farmer.

2. Agricultural investment is positively related with farm size, number of enterprise, cropping intensity and the extent of institutional credit.

3. Return to agricultural investment per hectare is determined by the availability of credit in farm firms.

Objectives

The overall objective of the study is to analyze the impact of farm finance and investment on profitability of farms in Annur block of Coimbatore District. The specific objectives are as follows:

1. To analyze the factors determining agricultural investment of the farm firms.

2. To analyze the factors influencing the returns to agricultural investment.

3. To analyze the impact of agricultural investment on profitability of the farm firms.

Limitations

The study will cover only a small sample of farmers, due to time and other constraints during the research. So, it has some limitations. First, the study has used the survey method. So the information given by the farmers is based on their recall ability since they are not maintaining any farm records. However, every effort had been taken to minimize the recall bias by including questions that facilitated cross checking. Hence, the findings of the study may be considered appropriate to the similar situation prevailing in the study area and extra care should be taken while making generalizations.

Organization of the Thesis

The thesis is organized into the following chapters.

Chapter I-Introduction:

This part contains the introduction on agricultural investment, the problem focus, hypothesis, objectives, scope and limitations of the study.

Chapter II-Concepts and Review:

It presents a review of various concepts, findings and suggestions of the past studies.

Chapter III-Design of the Study:

It specifies the sampling design, method of investigation and tools of analysis used in the conduct of research and analyzing the data.

Chapter IV-Description of the Study Area:

The distinct physical, geographical, agricultural, climatic and infrastructure character of the study region are described in this section of the study.

Chapter V-Results and Discussion:

The results obtained using the analytical tools described in chapter III are presented in this chapter and discussed for their relevance and significance.

Chapter VI-Summary and Conclusion:

The study results are summarized and conclusions are drawn to make necessary policy suggestions for large-scale adoption by the end users.

CHAPTER II

CONCEPTS AND REVIEW

An in depth understanding of various concepts relating to the identified research problem is pre-requisite for any research work. Knowledge of past research work done on the related aspects will be useful not only for having a clear understanding of the research problem but also for explaining the concepts and tools of analysis as applicable to the present study. Hence, in this chapter, an attempt has been made to present various concepts used in the present study and a brief review of results of the related past studies for clear understanding of the terminologies.

2.1 Review of Concepts

2.1.1 Investment

2.1.2 Agricultural credit

2.1.3 Returns to investment

2.1.4 Costs

2.1.5 Farm income

2.1.6 Net Returns

2.1.7 Production function

2.2 Review of Past Studies

2.2.1 Credit Demand and Requirement

2.2.2 Utilization of Credit

2.2.3 Impact of Credit on Agriculture

2.2.4 Importance of Credit

2.2.5 Factors affecting choice of credit

2.2.6 Impact of credit on technology adoption, Employment, Profit

2.2.7 Production Function Analysis

CONCEPTS

2.1.1 Investment

John Maynard Keynes (1939) gave clear definition of investment. His definition is widely accepted and followed by the economist. In his famous book, "The General theory of Employment, Interest and Money" he explained the terms income, saving and investment. He defined saving is the excess of income over expenditure on consumption. His definition of income as the excess of value of output sold during the period over the cost, led at once the definition of current investment, which implied the current addition to the value of the capital equipment which would result from the productive activity of the period.

Muniraj (1970) compared credit to sharp edged knife; proper utilization of it usually generated higher productivity and finally resulted in better prosperity. Mis-utilization of it would not only belittle prosperity but also ruin the farmers.

According to Dhawan and Yadav (1995), fixed investments in agriculture included reclamation of land, bunding and other land improvements, orchards and plantations, wells, other irrigation sources, agricultural implements, machinery and transport equipments, farm houses, barns and animal sheds and other capital expenditure.

According to the Food and Agricultural Organisation report (2001), Investment is the change in fixed inputs used in a production process. In the most, narrow definition, investment is the change in the physical capital stock, that is, physical inputs that have a useful life of one year or longer (land, equipment, machinery, storage facilities, livestock).

Investment in agriculture is of two types (Subba Reddy and Raghu Ram, 2005). The first involves operating investment such as seed, fertilizers, *etc*. and the second one is concerned with capital assets such as land, machines, farm equipments *etc*.

In the present study investment is considered as a vital input among all the inputs for agriculture. Here both working capital investment and annualized fixed capital investment were added to arrive at the total investment. It aims at enhancing the productivity and profitability of the firms and also plays a key role in economic development of the farmer.

2.1.2 Agricultural Credit

Puhazhendi (1973) considered agricultural credit as investment fund used on the farm other than the farm liquidity and obtained from off farm sources repayable in future with an interest agreed to either explicitly or implicitly.

In view of the vicious circle of poverty and low capital formation in agriculture, the farmers must borrow to meet their production and consumption needs (Jain, 1981).

Resome (1987) defined agricultural credit as the amount either in cash or in kind or in both forms, received from external sources *i.e*., institutional and non-institutional, to be repaid in the specified period of time to the lender with some interest for the use of the funds by the borrower.

Feder *et al.,* (1991) considered credit as an important element in agricultural production systems. It allows producers to satisfy the cash needs induced by the production cycle which characterizes agriculture. The availability of credit allows both greater consumption and greater purchased input usage, and thus increases welfare of the farmers.

Singh *et al*., (2001) defined that the agricultural credit structure in the developing countries is characterized by dualism, that is, the co-existence of institutional (formal) and non-institutional (informal) credit agencies.

According to Rajiv (2005), credit is a financial facility which enables a person or business to borrow money so as to purchase products, raw materials and components *etc*. Credit facilities come in a variety of forms, including bank loans and overdraft, installment credit, credit cards and trade credit. Interest charges on credit may be fixed or variables according to the type of facility offered by the institutions.

According to State Bank of India (2008), agricultural credit is a contractual agreement in which a borrower receives something of value or kind and agrees to repay the lenders at a later time.

In the present study agricultural credit is defined as credit encompassing all loans and advances granted to borrowers to finance production service activities relating to agriculture, horticulture, animal husbandry and other allied activities. Credit availability is thus one of the pre-requisites for agricultural productivity.

2.1.3 Returns to Investment

Randhawa (1960) while discussing the return to scale in co-operative farming had pointed out that return to capital investment measure the 'pay off' rate of investment. He calculated the return to capital investment as follows:

Returns to capital investment = (Farm investment income)/(Capital investment)

The farm investment income was calculated by deducting the out-of-pocket expenses and imputed values of owned resources except interest on capital investment and rental value of land, from gross output.

Tanov (1964) made a study on the methodology of estimating the profitability of capital investment in agriculture. In that, he pointed out that it was not correct to consider the results obtained in production after new capital investment was made as the sole effect of these investments. The increase or decrease in the production efficiency might also depend on circulating capital investment and labour force. He recommended the following indicators to determine the profitability of capital investment in agriculture. They are: i) production growth in volume and per unit of material and labour inputs, ii) profitability of production expressed as the ratio between net income and total investment, iii) period of repayment of capital invested, and iv) growth of net produce in relation to growth of all basic and circulating investments.

Pytkowski (1965) while studying the level of investment efficiency, *i.e*., the rate of return realized per unit of money invested, presented a mathematical measure to measure the utilization of investment. That is:

$$U = X (x/y- 1)$$

Where, U – Coefficient of investment utilization,

X – Gross income

x - Gross income per unit area and

y – Capital investment per unit area.

Thus, farms which had higher production and profitability would show the highest coefficient of investment utilization when the gross return per unit area increased keeping the investment per unit area constant. This index would be decidedly smaller, when there was an

increase in investment per unit area without corresponding increase in gross income per unit area.

Subba Reddy and Raghu Ram (2005) has defined the returns to investment as the net earnings of the farm plus interest on owned capital. Thus the present rate of returns to the investment or the capital turnover was calculated as follows

$$R = I/C \quad X\ 100$$

Where,

R - Rate of returns to capital investment

I - Returns to investment, and

C - Capital investment.

Johl and Kapur (2006) have defined returns as fixed farm resources which are equal to gross returns minus variable cost. These are also called as returns over the variable cost. Net returns are equal to gross returns minus all costs (fixed and variable; cash and kind).

In the present study Returns to investment or return on investment (ROI) or Rate of profit is represented as the ratio of money gained or lost (whether realized or unrealized) on an investment relative to the amount of money invested. The amount of money gained or lost may be referred to as interest, profit/loss, gain/loss, or net income/loss. The money invested may be referred to as the asset, capital, principal, or the cost basis of the investment. ROI is usually expressed as a percentage rather than a fraction.

2.1.4 Costs

According to Sumathi (1992), cost of cultivation referred to the expenditure incurred by the farmers on variable inputs to obtain the final produce. There were two kinds of costs, *viz.*, fixed cost and variable cost. Fixed cost included rent, interest on fixed capital, depreciation of implements and machinery, taxes, insurance premium *etc*. variable cost included the expenditure incurred towards seeds, human labour, bullock and machine power, manures and fertilizers, interest on working capital, *etc*.

Raju and Rao (1998) divided costs into two major categories *i.e*. fixed cost and variable cost. Fixed costs were defined as those which would be incurred even if no output were produced and variable cost were defined as those costs incurred only when production was carried on.

Maheshwarappa *et al.,* (1998) while studying economics of production and marketing of sugarcane referred variable cost in terms of human labour, bullock labour, tractor power, seed, manures and fertilizers, plant protection chemicals, irrigation, repair and maintenance cost and interest on working capital.

Jeyakumar (1999) conceptualized income as the sum total of income received by all members of the family working in different categories or the same kind of work. The source of income included farm, non-farm and any assistance from government programme.

According to Sethulakshmy (2001) the costs were divided into direct cost and indirect cost. Direct cost included the annual operational and maintenance cost, which consists of cost of manures and manuring, plant protection chemicals, pruning and training, after cultivation, irrigation and harvesting whereas the indirect cost included the annual share of establishment cost, interest on fixed capital, interest on working capital and depreciation.

Barnard and Nix (2002) classified cost in farming into fixed cost and variable cost. Direct cost included both cost of cultivation and marketing cost and indirect cost covered rent equivalent for the crop land, depreciation assigned proportionally to area under the crop, interest on fixed capital apportioned in proportion to the crop area and interest on working capital employed in the production of the crop.

Gurjar and Varghese (2005) while studying cost of cultivation of *rabi* crops in Rajasthan defined operational cost as sum of cost of hired human labour, family labour, bullock labour, machine labour, seed, farm yard manure, fertilizers, insecticides, irrigation charges and interest on working capital. They defined fixed cost as cost of land revenue and taxes, depreciation on implements and buildings, rent paid for leased in land, rental value of owned land, interest on fixed investment, and they also defined total cost as sum of operational cost and fixed cost.

Thakur and Sharma (2005) while studying the organic farming for sustainable agriculture, classified the cost as cost A1, cost A2, cost B, cost C and cost D. Cost A1 included cost of seeds, value of FYM, compost, fertilizers, pesticides, other chemicals used, bullock

labour, hired human labour, hired machinery, interest on working capital, depreciation and repairs of farm tools and machinery. Cost A2 included cost A1 plus rent paid on leased in land. Cost B consisted of cost A2 plus imputed rental value of owned land less rent paid on leased in land plus interest on fixed capital. Cost C consisted of Cost B and imputed value of family labour. Cost D consisted of cost C and management cost at the rate of 10 per cent of cost C.

Radha and Chowdary (2005) while studying the economics of seed production in cotton defined net income as gross income minus cost C3.

Johl and Kapur (2006) defined cost as the 'total amount of funds used in production'. They divided the cost into cash and non-cash costs. Cash cost included the resources that are produced and used immediately in the production process. In general, the cash costs are incurred while purchasing inputs like fertilizers, casual labour, fuel, and oils *etc*., which do not last for more than one production period. Non-cash cost consisted of depreciation and payments to resources owned by the farmers such as depreciation of tractor, equipments, buildings, and interest for owned capital.

In the present study variable cost is considered as the cost for labour, seed, farm yard manure, fertilizers and other inputs and also for the interest on working capital. Fixed cost is taken as the sum of cost for land revenue and taxes, depreciation on implements and buildings, rent paid for leased in land, rental value of owned land, interest on fixed investment.

2.1.5 Farm Income

Sharma (1972) defined the gross income as the income from the crops grown. The value of both main products and by-products were considered in estimating gross income. It was what the operator received for his own labour and family labour for the year and for the use of capital invested by them.

Forster (1973) defined net income of the farm as the gross income less variable costs of the farm business as a whole.

Shukla and Misra (1974) claimed that the net income equaled the gross income minus total cost and farm business income equaled gross income minus cost A1 in owner operated farms and cost A2 in tenant operated farms.

Kaul and Mehta (1977) defined gross income as the value of farm produce that consisted of cash value of produce actually sold and the value of the remaining produce evaluated at the prevailing price.

Kannan (1981) revealed that gross income included on-farm income and off-farm income consisting of hiring out of family labour, bullock pair, machinery and equipment and non-farm income including income from services, trade, profession, shop keeping, *etc*., emanated from all the members of the family. He also described the gross income as the sum of income of the family from all sources accessible to all its members.

Veerapandian (1983) defined gross income as the sum of income received from crop (both main and by-products), livestock products, hiring of farm labour, bullock power and non-farm income.

Gurjar and Varghese (2005) while studying cost of cultivation of major *rabi* crops in Rajasthan defined gross returns as sum of value of main product and value of byproduct of crop and also defined net income as gross income minus total cost.

In the present study, farm income is defined as the income from the gross value of agricultural produce plus income from other subsidiary occupations. Farm income was the difference between receipts and expenses.

2.1.6 Net Returns

Waghmane and Mandal (1972) defined net income as either net profit or net loss to the operator of land after (both in kind and cash) making provision for the depreciation charges, land rent, interest on working capital imputed wage on family labour from the total income of the farm.

Singh *et al., (*1973) defined net income of the farm, as the gross income less variable cost of farm business as a whole.

According to Maurya *et al.,* (1996) the net income would indicate the difference between input and output cost.

Mandal (1996) arrived at the net return by deducting from the value of output all costs with the exception of family labour imputed at the market wage.

Singh *et al.*, (2000) stated that the net income was the return pertaining to all factors of production over and above all charges for such factors in the cost analysis.

Madan lal and Varghese (2005) defined net return as gross return minus cost C3.

Thakur and Sharma (2005), while studying organic farming for sustainable agriculture, defined net activities income/profit as gross income minus total cost.

Smitha (2006) stated that net return as gross return minus total cost incurred in the production process.

For the present study, the net income is conceptualized as the gross income minus total cost incurred in production. The total cost included both fixed costs and variable costs.

2.1.7 Production Function

According to Koutsoyiannis (1983) production would indicate combination of factor inputs required for the production of one unit of output.

Sadhu and Singh (1985) observed production as a process wherein certain goods and/or services were caused to create goods and/or services of different nature.

Johl and Kapoor (2006) defined production function as a mathematical relationship describing the manner and extent to which a particular product would depend on the quantities or services of inputs used.

Dewett and Varma (2008) defined production as the transformation of inputs into outputs.

In the present study, production function be defined as the maximum amount of output capable of being produced by each and every set of specified input.

2.2 Review of Past Studies

2.2.1 Credit Demand and Requirement

Garg *et al.*, (1971) while making an attempt to estimate the credit requirements for changing agriculture concluded that provision of credit not only helped in increasing the farm production and income but also in increasing the growth of the national economy.

Credit plays a vital role in agricultural development External sources of finance is an integral part of investment in rural oriented development activities. Dhawan and Kahlon (1978) opined that with the technological changes, the need for credit in the case of majority of cultivator's arose from the fact that their own savings were normally not adequate to finance various activities in their farms. Moreover, while their income accrued during limited period of the year, and their expenses were spread throughout the year.

Mishra *et al.,* (1980) say that credit plays an important role in promoting rural development with equity and social justice and more particularly as a part of general objective to increase agricultural production and income and to improve the level of living in rural population.

Manmohan (1981) studied integrated credit and small farmers. He revealed that credit has the pivot around which the subsistence economy of small farmers of India sustained and grows and credit accelerated the process of farm development. Credit becomes increasingly important especially when the cultivation use modern technology which requires more finance than the traditional method of farming.

Bankole and Ogunbamurn (1981) analyzed the Boromo state cooperative financing agency: its credit extension service towards the state agricultural development. He defined agricultural credit as encompassing all loans and advances granted to borrowers to finance production service activities relating to agriculture, fisheries, marketing storage and distribution of products resulting from these activities. Credit availability is thus one of the pre requisite for agricultural development through increased agriculture productivity.

Feder *et al.,* (1991) estimated credit effect on productivity in Chinese agriculture. They recognized credit as an important element in agricultural production system; it allows producers to satisfy the cash needs induced by the production cycle which characterizes agriculture.

Bilgrami (1995) employed the Cobb-Douglas production function to assess the factors contributing to credit demand. The gross value of the crop output was taken as the dependent variable. The independent variables were investment on irrigation, investment on cattle, expenditure on fertilizer and area cultivated. The co-efficient that showed positive relationship with demand for credit were area cultivated, investment on irrigation and expenditure on fertilizer.

The development of agriculture depends on the adoption of new technologies and the adoption of new technology demands agricultural credit (Aroutselvam and Zeaudeen, 2000).

Sharma and Sonika Gupta (2005) employed the multiple regression analysis on credit demand showed that the age of the head of family did not have an effect on the probability of being a borrower. It was mainly due to small holdings. The higher non-farm income was due to higher education and thus better access to the financial institutions was possible. The overdue was higher due to more expenditure incurred on social ceremonies and house construction.

Golait (2007) attempted to analyse the issues in agricultural credit in India. The analysis revealed that the credit delivery to the agriculture sector continues to be inadequate. It appeared that the banking system is still hesitant on various grounds to purvey credit to small and marginal farmers. It was suggested that concerted efforts were required to augment the flow of credit to agriculture, alongside exploring new innovations in product design and methods of delivery, through better use of technology and related processes. Facilitating credit through processors, input dealers, NGOs, *etc*., that were vertically integrated with the farmers, including through contract farming, for providing them critical inputs or processing their produce, could increase the credit flow to agriculture significantly.

2.2.2 Utilization of Credit

` Gadewar and Prasasd (1982) analyzed farmer's preference and utilization of cooperative credit in western Rajasthan village. They have concluded that the diversion in loan utilization was mainly due to single enterprise, poor management of traditional occupations, seasonal work, poor harvest, increasing unemployment and large number of family members. Diversion of credit from the main purpose to that of other leads to inflationary measures in economy and also adversely affects the repaying capacity of the borrowers.

Bansal and Narwal (1987) studied borrower's differential utilization pattern of farm credit. They argue that the proper utilization is found only in such cases where investment was heavy, provision of mortgage of property and no attraction of subsidy. Regarding misutilization it was maximum in cases requiring low investment, no mortgage of property and provision of subsidy.

2.2.3 Impact of Credit on Agriculture

Desai and Naik (1971) inferred that the impact of green revolution has changed the demand for agricultural credit. They observed that while the prices of food grains have been gradually falling, input prices have been increasing and if this trend persists, this may tend to keep the demand for production credit for High Yielding Varieties of food grains low.

In a study by Agarwal *et al.*, (1974) on potentialities of increasing farm income through credit and new technology, it could be observed that provision of credit has increased the farm income by 41 percent even at the existing technology. Provision of credit increased the area under high yielding variety. Net income and overall output is such that input output ratio for borrowers was 1:1.69 and for non-borrowers 1:1.49 and overall income generation in case of small farmers was 1:2.50. Thus availability of credit helped farmers of all size groups to increase net farm income and small farmers were benefitted most and in general the availed farmer's credit had a surplus income. But in case of divergence between the purposes for which they were utilized the income increase was insignificant.

Ramadoss (1976) analyzed credit needs of small farmers, implication and solution. He observed that 52 per cent of the credit was spent on to adopt new technology in terms of fertilizer, chemical and high yielding varieties in small farms and 40 per cent of the credit was utilized in purchasing seeds and fertilizers in the farms.

Subramanian (1976) studied that impact of bank credit and technology on net return of farmers in Coimbatore taluk, TamilNadu. He stated that wholly owned funds were inadequate to realize maximum returns and showed that proper use of credit with the adoption of improved technology and suitable cropping pattern brought a two fold increase in net return.

Jain and Sarawgi (1981) assessed the impact of institutional credit on tribal and non-tribal farms in Mandla district of Madhya Pradesh through increase in production and employment. The findings of the study revealed that the percentage increase in crop output in the case of tribal borrower farmers was about 43 per cent as compared to about 18 per cent for other non-borrower tribal farmers. The comparison of human labour requirements on pre-loan/post-loan periods between the borrower and non-borrower tribal farmers in crop production and allied activities also showed significant increase in labour days of family and hired laborers in the case of tribal borrower farmers as compared to that of tribal non-borrower farmers.

Yadav *et al.,* (1978) studied production credit vis-à-vis income investment and employment in agriculture in Jainpur, U.P. They found out that the utilization of human labour hours per ha on borrowers farms came to 1565.27 has as against 1155.26 hours on non-borrowers farms, because of the fact that the borrowers adopted more intensive agriculture and put more area under high yielding varieties with the help of borrowings which in turn required higher amount of human labour.

Nayak *et al.,* (1985) analysed that the impact of credit on the cropping pattern in irrigated area of Karnataka - in Malaprabha command area. In this study they observed that the provision of credit both short and long term is expected to induce shifts in the cropping pattern towards more remunerative crops besides facilitating more intensive use of cultivated land and the adoption of modern technology.

Gadgil (1986) while reviewing the performance and policies of agricultural credit in India found that there was a 3.72 percent and 8.22 percent real compound growth rate for production credit and investment credit, respectively for the period 1973-74 to 1982-83. He further indicated that the states with the highest food grain yield happened to be the states with the highest availability of formal credit and conversely those with the lowest yield happen to have low credit availability. The correlation coefficient between credit and fertilizer consumption and food grains production was high in states like Punjab and Haryana and low in case of Assam suggesting low marginal productivity of credit and its low contribution to agricultural growth. He concluded that commercial banks and cooperatives becoming important source for institutional investment credit and for production credit, respectively.

Bolnick *et al.,* (1990) evaluated the economic impact of the specialized term credit programme in Indonesia. They combined before or after method and with or without approach to find out the real additionality of credit. They found that the credit programme in Indonesia had a positive effect in terms on fixed assets created, employment and value added for small enterprises which were typically small, labour intensive and growing in nature.

Suryakumary (1992) analysed the economic impact of credit on agricultural output among scheduled tribes. She used primary data and production function analysis. She revealed that the production function fitted for the two regions and for the three land holding groups. The coefficient of variables expenditure on fertilizer, area under commercial crops, area irrigated, and

land operated and working capital expenditure were statistically significant. Productive use of borrowed funds was not able to explain significant variations in gross output in the regions and amount borrowed was significant in the less developed regions. The study had clearly showed that provision of adequate funds will greatly help the tribal to improve their level of living.

Olodele and Adepoe (2004) examine how Farmers Development Union (FADU) and Non- Governmental Organization are helping small scale farmers to solve the problem of lack of credit. They revealed that there has been an impact on the productivity of the farmers due to credit supplied by FADU. Farmer's productivity levels increased as a result of credit supply with no constraints to the farmers. The farm size, educational level and repayment pattern were significantly related to the credit supplied. The preferred repayment pattern of majority of farmers was monthly by 93.3 percent. The government should also adopt the FADU technique of channeling credit to small farmers to make government credit available to the farmers.

Patel (2007) evaluated the trends in agricultural finance to farmers in Gujarat state after setting up of the norms by National Bank for Agriculture and Rural Development. It aimed to eliminate the money lenders' lending for agriculture in Gujarat. As compared to the percentage share of the co-operative banks from 38.67 to 41.93 per cent, the share of RRBs increased from 4.70 to 7.53 per cent during the periods from 1995-96 to 2003-04. Overall, in Gujarat the trend in agricultural credit had an uptrend. The crop loan was increased from 72 to 78 per cent of the total agricultural credit in the years from 1995-96 to 2003-04. The production and productivity of the agricultural sector also increased. Intensive agriculture and change in cropping pattern became possible, because of this increase in credit.

Subrata (2007) revealed that the credit availability from both institutional and non-institutional sources made a significant change in cropping pattern. The closer supervision for cultivation, exclusive of cost of family inputs, family labour, availability of credit *etc*., were the factors behind this higher profitability. The profit per acre from non-food grains cultivation was larger than that from food grains cultivation.

Misra and Maurya (2007) attempted to assess income and employment of the farmers who borrowed from commercial banks and detailed on repayment performance and problem of overdues. The capital formation in agriculture as well as modern input use was largely depending on credit. The maximum amount of crop loan repayment was found in medium farms and highest

amount of overdues was found in large farms. High income and employment generation both on per hectare and per farm basis was due to the borrowings.

Awasthi (2007) evaluated production and investment credit of scheduled commercial banks in India. This study revealed the value of agricultural output per hectare had responded to crop loan as well as to term loan per hectare. Regression coefficient analysis was used. He found that there is a dire need for raising investment credit along with production credit such that term loan should be in the range of two third to three fourth of crop loans failing which Indian agriculture may face intermittent period of crisis and agricultural growth will continue to remain depressed.

Adinew *et al.,* (2007) studied significance and efficiency of agricultural credit in Karnataka's agricultural economy by using secondary data for 1984-85 to 1998-99. Here incremental capital output ratio and regression model were used. State domestic product and agricultural credit, irrigated area, area under commercial crops, HYV, fertilizer uses, rainfall, land holding were considered as the variables. The incremental capital output ratio had shown positive trend of efficiency of agricultural credit. The analysis of the marginal value product of credit along with other factors using the principle component regression showed that the credit significantly contributed to the agricultural state domestic product. Even though efficiency of agricultural credit in the state from the point of its contribution to the agricultural state domestic product was found to be promising its allocation had not reached the optimum level. Financing institution should increase their agricultural lending without significant increment in the cost of credit but curbing down the transaction costs and raising the level of banking efficiency.

Mahadeva and Venna (2008) studied impact of agricultural credit distributed through Primary Cooperative Agriculture and Rural Development Bank (PCARDBs) of Chamarajanagar district in Karnataka. The results revealed that timely receipt and utilization of loans was a significant variable in assessing the concrete benefits of loans. The study depicted that 85.9 per cent of the borrowers secured their loans with in a period of four weeks. Also, 75.8 per cent borrowers utilized the loan amount properly for production activities. Seventy per cent of total loans went to those borrowers who had a size of land holdings of below four acres, 19.3 per cent of total loan was taken by farms with four acres to eight acres and 10.7 per cent of the total loans were taken by the borrowers having the largest land holding of eight acres and above.

2.2.4 Importance of Credit

Singh *et al*., (1971) estimated a normative analysis of the impact of credit availability on farm income and demand for short term credit on farms in Delhi. They felt that inadequate capital was the greatest bottleneck in fully exploiting the potential productivity of available resources.

Singh *et al.,* (1971) studied institutional credit and farm productivity. They contended that when agricultural modernization was attempted in a large scale, institutional credit became important for promoting agricultural development and farm productivity.

Kamajou *et al.,* (1980) analyzed reforming Cameroon's government credit programme, effects of liquidity management by small farmer borrowers. They concluded that, the small farmer benefits can be increased by increasing credit limits and flexibility in the use of loan proceeds while reducing default rates and expanding programme of out reach.

Singh (1981) inferred that credit became increasingly important especially when the cultivators used modern technology, which required more finance than the traditional method of farming.

Singh and Ramanna (1981) studied the role of credit and technology in increasing income and employment in Western region of Hyderabad district of Andhra Pradesh. The study focused on the need to explore possibilities of increasing income and employment under irrigated and unirrigated conditions at existing and improved technology levels. They concluded that the adoption of improved technology coupled with adequate credit facility dynamised the entire gamut of income potential and offered the single best measure to solve the chronic problem of under-employment of family labour on small holdings. The results as such emphasized the need for strengthening the close co-ordination between credit and extension institutions.

Jain and Dan (1981) found that credit was inevitable in the present day agriculture, particularly in tribal area. Farm credit assumed a great significance in modernization of present day tribal agriculture. They stated that it was essential to provide needed inputs to the tribal farmers, who otherwise cannot afford to invest money for improved agriculture. They concluded that farm credit had a positive impact in raising the farm production, income and employment of tribal areas.

Mishra *et al.,* (1982) claimed that credit played an important role in promoting rural development with equity and social justice. It also promoted increase in agricultural production, income and improvement in the standard of living of rural population.

Tripathi *et al.,* (1994) studied variation in productivity of short term credit used for wheat production in different zones of Uttar Pradesh. The concept of costs was used to analyze the cost and returns; multiple regression equation was adopted to estimate productivity of short term crop credit and other important variables. They revealed that the impact of the short term crop credit is encouraging and provision of short term crop credit is an effective way to increase the farm return in the rainfed hilly conditions. The study also suggested that there was tremendous scope to raise the crop return at farm level through increased use of crop credit at the prevalent resource use pattern and the existing level of technology adoption in different hill zone of Uttarpradesh.

Mishra and Pattanaik (2005) examined the impact of institutional finance on farm income and productivity in selected farms in Khurda District of Orissa. Multiple regression analysis was employed to study the impact of institutional credit on agricultural output. The results showed that 20.38 per cent of the crop loan was diverted for unproductive purposes. The large farmers borrowed less of short term loan and more of term credit per ha as compared to that of marginal and small farmers. The study suggested lending more to marginal and small farmers and following up of convenient repayment schedule to improve their livelihoods.

Lenka and Jagannath (2005) highlighted the incidence of debt of the rural farmer households and the relative role of the institutional and non-institutional agencies in financing the rural indebtedness across major states of India. Nearly, half of the rural farmer households in the country were indebted in various degrees. The most important finding was that even after a decade of economic reforms, the professional money lenders were the predominant source of lending to the farmers.

Kamalakannan and Namasivayam (2007) analyzed the institutional agricultural credit in post reform period. The study concluded that agricultural credit was one of the most crucial inputs in all agricultural development programmes after nationalization of commercial banks, banking sector played an important role in providing assistance to agriculture and allied activities.

Awasti (2007) studied the production and investment credit of commercial banks in India and highlighted the importance of 'Investment Credit' and 'Production Credit' with functional relation between the capital and labour (Y=f (K,L)). He indicated that if the ratio of investment to production credit decreases over time, then the value of agricultural output per unit of crop loan also declines. So there is a positive association between these two. The author concluded that there was a need for raising investment credit along with production credit such that term loan should be in the range of two-third to three-fourth of crop loans failing which Indian agriculture may face intermittent period of crisis and agriculture growth will continue to remain depressed.

2.2.5 Factors affecting choice of credit.

Gagan Bihari Sahu (2007) analysed inter-state disparities in the flow of agricultural credit. The results revealed that the growth rate of agricultural credit was higher in pre-reform period when compared to that of reform period in most of the states. The determinants of flow of credit to agriculture were credit-deposit ratio, land-man ratio and proportion of irrigated area to gross cropped area.

Anjani *et al.,* (2007) identified the factors that influenced the choice of credit outlets and the possession of Kisan Credit Cards by the rural households. They employed the multinomial logit regression function with the factors like age, sex, education of the household head, household type, operational land holding, household size, social group and agro climatic zone and the results revealed that small and marginal holdings opted for non-institutional finance agencies paying high interest rate. The proportionately higher use of KCCs indicated that if procedures were made simple, the access of institutional credit would be more.

Naidu and Siva Sankar (2007) analysed the influence of various inputs on the credit requirement, with Cobb-Douglas function. The amount of credit was taken as the dependent variable. The independent variables were consumption expenditure, current farm expenditure and capital expenditure. The elasticities of the variables like consumption expenditure (0.2358 at one percent significant level), current farm expenditure (0.5192 at one percent significant level) and capital expenditure (0.2620 at five percent significant level) were obtained.

2.2.6 Impact of Credit on Technology Adoption, Employment, Profit

Satheesh *et al.,* (1985) studied the impact of diversification and liberal credit policy on income and employment of farmers below poverty line in Pithapuram block of East Godavari district. The study suggested the diversification of agricultural production on small farms to be a plausible means for increasing income and employment to a considerable extent. The study showed that the adoption of technology as recommended by the state universities coupled with adequate credit facility under crop-dairy-sericulture farming system dynamited the entire gamut of income potential and offered economically viable and practically feasible solutions to low-income problems of the farmers.

Roy and Pal (2002), in their study on investment, agricultural productivity and rural poverty, examined the relationship between investment and productivity for the period from 1965-'66 to 1998-'99 based on the Finance Accounts data. Using a simultaneous equation model the authors observed that both public and private investments have positive relationship with agricultural productivity. They also found that the effect of investment on productivity is stronger than the effect of subsidies.

Sriram (2007) in his study on productivity of rural credit argued that increased supply and administered pricing of credit help in the increase in agricultural productivity and the wellbeing of agriculturists as credit is a sub-component of the total investments made in agriculture. Borrowings could in fact be from multiple sources in the formal and informal space. He argued that mere increase in supply of credit is not going to address the problem of productivity, unless it is accompanied by investments in other support services.

2.2.7 Production Function Analysis

Suryanarayana (1958) worked out a whole farm production function to estimate the returns in Telangana farms and single production function for combined holdings of all types and with separate functions for wet, dry and mixed types of farms. The gross returns were treated as a function of land-fertility, labour and capital per acre and these factors were found to be highly significant.

Ramamurthy *et al.,* (1973) studied the effect of farm size on resource productivity through the Cobb-Douglas production function. They found that all the variables viz. labour, manures

and fertilizers, seeds, plant protection and management, significantly influenced gross income in all the size groups of farms.

Salikram (1977) used the concept of marginal productivity of resource, which he defined as the measure of increase in total product with an addition of one unit of a particular resource above its mean level, while other resources were held constant at their respective mean levels.

Salikram and Gupta (1978) used Cobb-Douglas production function to examine the resource productivity and efficiency of resources on paddy farms. Cobb-Douglas production function was chosen to measure the resource-use efficiency of beneficiary and non –beneficiary farmers after careful examination of data pattern and scatter diagram which showed the relationship between yield of paddy and other relevant variables.

Shyjan (2003) in the study on Public Investment and Agricultural Productivity used Koyck's Autoregressive Distributed Lag model (ADL) to examine the long-run impact of public investment (explanatory variable) on food grain productivity (dependent variable) . The major conclusion of the study is the existence of a positive but lagged effect of public investment on productivity. The existence of the lag, the study argues, might point to the need for sustained public investment as a means to raise food grain productivity in the future.

Muhammad *et al.,* (2003), in the study to investigate the impact of institutional credit on agricultural production in Pakistan, used a linear production function relating agricultural output with institutional credit. As agriculture is a multi-product industry Agricultural Gross Domestic Product (AGDP) was used as the dependent variable and agricultural production is assumed to be the function of water availability, agricultural labour force, cropped area, and agricultural credit. In order to avoid the problem of multicolinearity, the dependent and all the explanatory variables were transformed to per cultivated hectare. The results revealed that these factors were found to be highly significant.

Sharma and Sonika Gupta (2005) employed the multiple regression analysis on credit demand showed that the age of the head of family did not have an effect on the probability of being a borrower. It was mainly due to small holdings. The higher non-farm income was due to higher education and thus better access to the financial institutions was possible. The overdue was higher due to more expenditure incurred on social ceremonies and house construction.

Gandhimathi and Vanitha (2010) in their study on Determinants of Borrowing Behaviour of Farmers – A Comparative Study of Commercial and Co-operative Banks, to identify the socio-economic factors, which affected the borrowings from commercial and co-operative banks used the discriminant analysis by taking into account nine socio-economic characteristics namely education, landholding size, crop loan amount, family size, non-farm income, household expenditure per annum, utilization of credit, cost of production, and family labour. Using a linear multiple discriminant function which has revealed that the borrowers from commercial banks possessed bigger size of landholdings, had higher non-farm income, and more farm and household expenditure per annum, whereas the borrowers from co-operative banks had taken higher amount of loan, and possessed higher value of family labour and education.

CHAPTER III

DESIGN OF THE STUDY

The design of the study helps in systematic approach for any research. In order to fulfill the objectives of the study, an appropriate methodology for conducting the study is inevitable. Therefore, in this chapter, the methodology adopted for the present study including the selection of study area, sampling design, the method of data collection and the different tools of analysis are discussed.

3.1 Sampling Design

3.1.1 Choice of Study Area

The research study is to analyze the impact of farm finance and investment on profitability of farms in Annur block of Coimbatore district is purposely selected for the study since it has the highest number of borrowers for agriculture purpose from commercial banks and it has the highest loan amount given for agricultural purposes in the financial year of 2010-2011. Annur is also highly developed in agriculture sector.

3.1.2 Selection of Sample

The present study was to analyze the impact of farm finance and investment on profitability of the farms. Hence, to enable the study to deal with the impact of investment, the sampling design was carefully formulated. The total number of respondents was fixed at eighty farm households. The sample size of the borrowers and non-borrowers were fixed at forty each.

The sample farmers who borrowed credit for crop production purposes and for other farm investment purposes for the year 2010-11 from institutional sources of credit were classified as borrower farm households and the sample farmers who did not borrow credit from any source and who used up their own savings were classified as non-borrower farm households. The block consisted of 22 villages. Four villages were selected randomly for the study. Ten borrowers and ten non-borrowers were selected randomly and interviewed in each of the selected villages. Thus, the sample design resulted in sample size of eighty farm households, constituting forty each from borrower and non-borrower categories.

Table.3.1 Details of Selection of Sample Farmers Selected from Annur Block

SI. No.	Village selected	Sample farm household		Total
		Borrower	Non Borrower	
1.	Allapalayam	10	10	20
2.	Kunnathur	10	10	20
3.	Pasur	10	10	20
4.	Pogalur	10	10	20
	Total	**40**	**40**	**80**

3.2 Methods of Data Collection

Primary data from the sample farms were collected with the help of a pre-tested interview schedule through personal interview. The information regarding the basic details of the farmer, family size, resource availability, land use, crop enterprise, cost of cultivation, maintenance cost of machineries and equipments, maintenance cost of livestock, income generated from crop, livestock, off-farm and non-farm enterprises, farmer's cash expenses, borrowings, repayments, investment details and problems in borrowing were collected from the borrowers and non-borrowers.

Secondary data like location of the study area, land use pattern, soil type, cropping pattern, climate, rainfall pattern, irrigation pattern, demography and financial institutions *etc.*, were obtained from Block Development Office and office of the Assistant Director of Agriculture and loan details were collected from lead bank and other lending institutions functioning in Coimbatore District and Annur Block.

3.3 Period of Study

The reference period for the study was the agricultural year of 2010-2011 and the collection of data from the sample respondents was taken up during the months of July 2011 to March 2011.

3.4 Tools of Analysis

Keeping in view the specific objectives of the study, the data collected were analyzed and subjected to the following economic tools.

3.4.1 Conventional analysis

3.4.2 Cropping intensity

3.4.3 Cost Concepts

3.4.4 Depreciation

3.4.5 Livestock Unit

3.4.6 Investment

3.4.7 Returns to Investment

3.4.8 Net Cash Income

3.4.9 Three Stage Least Squares

3.4.1 Conventional Analysis

Percentage and averages were worked out to interpret the data related to cost, returns, input usage, general characteristics of sample farmers, size and distribution of farm holdings, agro-climatic conditions and land utilization pattern in the study area.

3.4.2 Cropping Intensity

Cropping intensity is the ratio of sum of area planted under different crops and harvested in a single year, to the net cultivated area. The cropping intensity was expressed in percentage. The formula of cropping intensity is given below (Raju and Rao, 2007)

$$\text{Cropping Intensity (CI)} = \frac{\text{Gross cropped area}}{\text{Net cropped area}} \text{ X } 100$$

3.4.3 Cost Concepts

The technique of tabular presentation was used to assess the cost, returns and profits of crops in the study area. The percentages and averages of variable costs and fixed costs were computed based on the methodology followed by Commission on Agricultural Costs and Prices (CACP). The cost concepts like Cost A, Cost B and Cost C listed below were used for the study.

Cost A_1: It includes the value of hired human labour, value of bullock labour (owned and hired), machine power (owned and hired), value of seeds (farm produced/purchased), value of manures (owned/purchased), value of fertilizers, value of plant protection chemicals, irrigation charges, interest on working capital, depreciation of implements and farm buildings, payments (land revenue, cess and other taxes) and miscellaneous expenses (electricity charges).

Cost A_2 = Cost A_1 + rent paid for leased in land

Cost B_1 = Cost A_2 + interest on owned fixed capital (excluding land)

Cost B_2 = Cost B_1 + imputed rental value of owned land

Cost C_1 = Cost B_1 + imputed value of family labour

Cost C_2 = Cost B_2 + imputed value of family labour

Cost C_3 = Cost C_2 X 1.10 (10 % of cost C_2 added to Cost C_2)

Gross return = Quantity per ha x Value of Product (Rs)

Net return = Gross return - Cost C_3

3.4.3.1 Measurement of Variables

The variables used in the analysis were measured as given below in the Table.3.2.

Table.3.2 Measurement of Variables

Variables	Measurement
Seeds	The cost of the seed was calculated at the local market price for the farm produced seeds and actual expenditure incurred in the case of purchased seeds.
Human labour	Human labour was estimated in terms of eight hours of work per day. The women labour days were converted into man days on the criterion that one woman day is equal to 0.60 man days on the basis of wage rate equivalent.
Bullock labour	Bullock labour is estimated in terms of bullock pair days. Both owned and hired bullock labours were charged at the prevailing rate paid per day of 8 hours in the study area.
Machine power	The cost of machine power both owned and hired was calculated at different rates for the different type of operations prevailed in the study area.

Farm Yard Manure	The quantity of FYM used in the cultivation of crops was measured in terms of tractor load. The cost was imputed at the market price in the village including cost of transportation and other incidental charges.
Fertilizers and plant Protection chemicals	Cost of fertilizers and plant protection chemicals were based on the actual prices paid including the cost of transportation and other incidental charges.
Irrigation charge	Total wages paid to farm labourers and charges for irrigating the crop during entire crop period was considered.
Rental value of land	It was imputed by taking the local average rental value at the rate of Rs 10,000/ ha for one year period.
Interest on Working capital	Interest on working capital was calculated at the rate at which banks were advancing short-term loans. The prime lending rate during the agriculture year was 7 per cent for crop loan. It was charged for a period of duration of a particular crop.
Interest on fixed capital	Interest charges on fixed capital were calculated at the rate of 11 per cent per annum as it was the rate of interest charged on long-term loans by commercial banks. This interest was worked out on the values of fixed assets, after deducting depreciation for the year. It was apportioned on the basis of the area of land under each crop grown by the farmer during the study period.
Depreciation	Depreciation was calculated by the straight line method. The charges on account of minor repairs of implements and machinery during the year were added to the depreciation charges. It was apportioned on the basis of area of land under each crop grown during the year.
Total cost of cultivation	Cost of cultivation included variable and fixed costs. Variable costs included the cost of human labour, bullock labour, machine power, seeds, farmyard manure, plant protection chemicals, irrigation charge and interest on working capital. Fixed costs comprised of depreciation, land revenue, rental value of land and interest on fixed capital.
Gross return	Gross return was computed by multiplying the quantity of main product and by-product obtained with their respective prices received.

3.4.4 Depreciation

Depreciation is the decline in the value of capital equipment due to wear and tear. It is caused by two factors - time and use. As depreciation continues, the service ability and value of the asset diminishes. There are different methods to find depreciation; among this straight line

method was used to find the depreciation of farm equipment's in the present study (Raju and Rao, 2007).

$$\text{Depreciation} = \frac{\text{Original Cost - Junk Value}}{\text{Expected life of the asset}}$$

3.4.5 Livestock Unit (LU)

The livestock units (LUs) were determined by taking

Breedable buffalo - 1 LU

Cattle - 0.80 LU

Sheep and goat - 0.1 LU

Poultry – 0.01

Pig – 0.2 LU

Non-breedable population in each category was uniformly taken as 25 per cent and their LU was counted as 50 per cent of breedable LU (Chandel and Ravinder Malhotra, 2006). In the present study above mentioned conversion factors are used to convert total livestock animals in a farm into livestock units.

3.4.6 Investment

In the present study, investment includes the investment made on fixed capital and working capital. The fixed capital investment includes, the investment made on farm buildings, machineries like tractor, power tiller and sprayer, livestock and other equipment's like bullock cart and minor tools used for farming purposes. The working capital investment includes, the investment made for purchase of seed, farm yard manure, fertilizer, plant protection chemicals and expenditure made on human labour, machine power, bullock power, irrigation charges, livestock maintenance charges and miscellaneous charges. The working capital investment is taken as such for the analysis, whereas the fixed capital investment is annualized depending upon the life period of the fixed asset and the period of investment. Both working capital investment and annualized fixed capital investment were added to arrive the total investment. (Subba Reddy *et al.,* 2004)

Total capital invested = Fixed capital investment + Working capital investment.

3.4.7 Returns on Investment (ROI)

Returns on investment is a performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. To calculate ROI, the benefit (return) of an investment is divided by the cost of the investment; the result is expressed as a percentage or a ratio.

The return on investment formula:

$$\text{ROI} = \frac{(\text{Gain from investment} - \text{Cost of investment})}{\text{Cost of investment}}$$

Return on investment is a very popular measure because of its versatility and simplicity. Investment with a positive ROI, or with a higher ROI should be undertaken (Subba Reddy *et al., 2004*).

3.4.8 Net Cash Income

The surplus of cash income over cash operating expenses indicates net cash income. This is the amount available with the farmer for future investment as well as for other family purposes (Subba Reddy *et al.*, 2004).

Net Cash Income = Gross Cash income – Cash expenses

3.4.9 Three Stage Least Squares (3SLS)

Three Stage Least Squares (3SLS) is asymptotically equivalent to two Stage Least Squares (2SLS). 3SLS is generally consistent and more efficient than 2SLS asymptotically. It applies generalized least squares to the large equation of all the identified equations of the system. 3SLS is used when there is error correlation in different structural form equations and also for over-identified equations. In the present study Three Stage least Squares method is used. 3SLS is applied to the borrower farm firms and non-borrower farm firms separately. Each borrower farms and non-borrower farms has two equations namely determinants of farm investment and returns to investment.

3.4.9.1 Borrower Farm Firms

Determinants of Farm Investment

Average farm investment function for borrower farms is defined as

$$Y_{11} = f \{X_{11}, X_{12}, X_{13}, X_{14}, X_{15}, X_{16}, X_{17}, X_{18}\}$$

Assuming a linear functional form and adding the random error tem, the estimable form of the linear function is specified as below:

$$Y_{11} = \alpha_0 + \alpha_1 X_{11} + \alpha_2 X_{12} + \alpha_3 X_{13} + \alpha_4 X_{14} + \alpha_5 X_{15} + \alpha_6 X_{16} + \alpha_7 X_{17} + \alpha_8 X_{18} + u_1$$

Where,

Y_{11}	=	Average Farm Investment (rupees/ annum)
X_{11}	=	Size of Farm Holdings (hectares)
X_{12}	=	Institutional Credit (rupees/ annum)
X_{13}	=	Cropping Intensity (per cent)
X_{14}	=	Family Size (numbers)
X_{15}	=	Livestock Unit
X_{16}	=	Lagged Returns to Investment (lag by one year) (rupees / annum)
X_{17}	=	Labour Usage (man days/annum)
X_{18}	=	Non-Farm Income (rupees/ annum)
α_0	=	Regression constant
$\alpha_1, \alpha_2, \ldots\ldots \alpha_8$	=	Regression coeffcients
u_1	=	Random error term

Determinants of Returns to Investment

To analyze factors influencing returns to investment or determinants of returns to investment in farm firms, a linear functional form is to be used.

A returns to investment function for borrowers farms is defined as

$$Y_{12} = f \{Y_{11}, X_{12}, X_{13}, X_{15}, X_{17}, X_{18}\}$$

The estimable form of linear function for borrower farms is given below:

$$Y_{12} = \alpha_0 + \alpha_1 Y_{11} + \alpha_2 X_{12} + \alpha_3 X_{13} + \alpha_4 X_{15} + \alpha_5 X_{17} + \alpha_6 X_{18+} u_2$$

Where,

Y_{12}	=	Returns to investment (rupees / annum)
Y_{11}	=	Average farm investment (rupees / annum)
X_{12}	=	Institutional credit (rupees)
X_{13}	=	Cropping intensity (per cent)
X_{15}	=	Livestock unit
X_{17}	=	Labour usage (Man days / annum)
X_{18}	=	Non-Farm Income (rupees / annum)
α_0	=	Regression constant
$\alpha_1, \alpha_2, \ldots\ldots \alpha_6$	=	Regression coeffcients
u_2	=	Random error term

Exogenous and Endogenous Variables in 3SLS Analysis of Borrower Farm Firms

The exogenous and endogenous variables in 3SLS analysis of borrower farm firms are presented below in the Table 3.3.

Table 3.3. Exogenous and Endogenous Variables in 3SLS Analysis of Borrower Farm Firms

Variable	Description
Endogenous variable	Y_{11} , Y_{12}
Exogenous variable	X_{11}, X_{12} , X_{13}, X_{14}, X_{15}, X_{16} ,X_{17}, X_{18}

Three stage least squares is applied to estimate the two equations simultaneously.

$$Y_{11} = \alpha_0 + \alpha_1 X_{11} + \alpha_2 X_{12} + \alpha_3 X_{13} + \alpha_4 X_{14} + \alpha_5 X_{15} + \alpha_6 X_{16} + \alpha_7 X_{17} + \alpha_8 X_{18} + u_1$$

$$Y_{12} = \alpha_0 + \alpha_1 Y_{11} + \alpha_2 X_{12} + \alpha_3 X_{13} + \alpha_4 X_{15} + \alpha_5 X_{17} + \alpha_6 X_{18+} u_2$$

3.4.9.2 Non Borrower Farm Firms

Determinants of Farm Investment

Average farm investment function for non-borrowers farms is defined as

$$Y_{21} = f \{X_{11}, X_{12}, X_{13}, X_{14}, X_{15}, X_{16}, X_{17}\}$$

Assuming a linear functional form and adding the random error term, the estimable form of the function is specified as below,

$$Y_{21} = \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \beta_3 X_{13} + \beta_4 X_{14} + \beta_5 X_{15} + \beta_6 X_{16} + \beta_7 X_{17} + u_1$$

Where,

Y_{21}	=	Average Farm Investment (rupees / annum)
X_{11}	=	Size of Farm Holdings (hectares)
X_{12}	=	Owned Capital (rupees / annum)
X_{13}	=	Cropping Intensity (per cent)
X_{14}	=	Family Labour Utilization (man days / annum)
X_{15}	=	Livestock Unit
X_{16}	=	Lagged Returns to Investment (lag by one year) (rupees /annum)
X_{17}	=	Non-Farm Income (rupees / annum)
β_0	=	Regression constant
$\beta_1, \beta_2, \ldots\ldots \beta_7$	=	Regression coeffcients
u_1	=	Random error term

Determinants of Returns to Investment

A returns to investment function for non-borrower farms was formally defined as

$$Y_{22} = f \{Y_{21}, X_{12}, X_{13}, X_{14}, X_{15}, X_{17}\}$$

The estimable form of linear function for non-borrower farms was given below:

$$Y_{22} = \beta_0 + \beta_1 Y_{21} + \beta_2 X_{12} + \beta_3 X_{13} + \beta_4 X_{14} + \beta_5 X_{15} + \beta_6 X_{17} + u_2$$

Where,

Y_{22} = Returns to Investment (rupees / annum)

Y_{21} = Average Farm Investment (rupees / annum)

X_{12} = Owned Capital (rupees / annum)

X_{13} = Cropping Intensity (per cent)

X_{14} = Family Labour Utilization (man days / annum)

X_{15} = Livestock Unit

X_{17} = Non-Farm Income (rupees / annum)

β_0 = Regression constant

$\beta_1, \beta_2, \ldots\ldots \beta_6$ = Regression coeffcients

u_2 = Random error term

Exogenous and Endogenous Variables in 3SLS Analysis of Non-borrower Farm Firms

The exogenous and endogenous variables in 3SLS analysis of non-borrower farm firms are presented in the Table 3.4.

Table 3.4 Exogenous and Endogenous Variables in 3SLS Analysis of Non-borrower Farm Firms

Variable	Description
Endogenous variable	Y_{21} , Y_{22}
Exogenous variable	X_{11},X_{12}, X_{13} , X_{14}, X_{15}, X_{16}, X_{17}

Three stage least squares is applied to estimate the two equations simultaneously.

$$Y_{21} = \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \beta_3 X_{13} + \beta_4 X_{14} + \beta_5 X_{15} + \beta_6 X_{16} + \beta_7 X_{17} + u_1$$

$$Y_{22} = \beta_0 + \beta_1 Y_{21} + \beta_2 X_{12} + \beta_3 X_{13} + \beta_4 X_{14} + \beta_5 X_{15} + \beta_6 X_{17} + u_2$$

As far as the 3SLS is concerned, we have the following three stages of estimation.

Stage 1:

In the first stage the reduced form of all the equations of the system is estimated

$$Y_{11} = \alpha_0 + \alpha_1 X_{11} + \alpha_2 X_{12} + \alpha_3 X_{13} + \alpha_4 X_{14} + \alpha_5 X_{15} + \alpha_6 X_{16} + \alpha_7 X_{17} + \alpha_8 X_{18} + u_1$$

$$Y_{12} = \alpha_0 + \alpha_1 Y_{11} + \alpha_2 X_{12} + \alpha_3 X_{13} + \alpha_4 X_{15} + \alpha_5 X_{17} + \alpha_6 X_{18+} u_2$$

$$Y_{21} = \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \beta_3 X_{13} + \beta_4 X_{14} + \beta_5 X_{15} + \beta_6 X_{16} + \beta_7 X_{17} + u_1$$

$$Y_{22} = \beta_0 + \beta_1 Y_{21} + \beta_2 X_{12} + \beta_3 X_{13} + \beta_4 X_{14} + \beta_5 X_{15} + \beta_6 X_{17} + u_2$$

Where,

Y_{11} = Average farm investment of borrowed farms (rupees per annum)

Y_{12} = Returns to investment of borrowed farms (rupees per annum)

Y_{21} = Average farm investment of non-borrowed farms (rupees per annum)

Y_{22} = Returns to investment of non-borrowed farms (rupees per annum)

We thus obtain estimated values of the endogenous variables of $Y_{11,}$ $Y_{12,}$ $Y_{21,}$ and Y_{22}.

Stage 2:

The above calculated values of the endogenous variable are substituted in the RHS of the structural equations and least squares are applied to the transformed equation. We thus obtain the co efficient of the RHS, which in turn is used for the estimation of the error terms for the various equations.The variance and co variances of the estimated error terms may easily be computed by the formula of the co-variances.

$$\sigma e_1 e_2 = \frac{\Sigma e_{1i} e_{2i}}{n} \quad \text{and so on}$$

Where,

n= Number of observations

Stage 3:

The above variances and co variances of the error terms is used in order to obtain the transformation of the original variables for the application of generalized least squares. (Koutsoyiannis, 2000).

3.4.9.3 Purpose of using Three Stage Least Square Method over the Single Equation Model

Purpose of using three stage least square method in the present study over the single equation model is that there is more than one dependent variable and more than one equation in

contrast to the single equation model relating a single dependent variable to a set of explanatory variables which are either non-stochastic or if stochastic are assumed to be distributed independently of the stochastic disturbance term.

A unique picture of the three stage least square analysis is that the dependent variable in one equation may appears as an explanatory variable in a another equation of the analysis. In the present analysis average farm investment (Y_{11}) appears as a dependent variable in the first equation of the borrower farm firm analysis whereas the same variable appears as an explanatory variable in the second equation. Similarly in the non-borrower farm firm analysis average farm investment (Y_{21}) appears as a dependent variable in the first equation and the same variable appears as an explanatory variable in the second equation of the analysis. Hence Y_{11} and Y_{21} are endogenous variables for borrower farms and non-borrower farms respectively. Therefore such a dependent explanatory variable becomes stochastic and is usually related with the disturbance term of the equation in which it appears as an explanatory variable. In this situation the classical least square method may not be applied because the estimators thus obtained are inconsistent, that is, they do not converge to their true values no matter how large the sample. Thus three stage least square method is used in the present analysis.

CHAPTER IV

DESCRIPTION OF THE STUDY AREA

Agriculture in any region depends largely on the agro-climatic factors such as rainfall, topography, soil, irrigation and other socio-economic and institutional factors prevailing in that region. A general understanding of the resource base, demographic features, climatic condition, rainfall, soil type, land use pattern, sources of irrigation, infrastructural facilities, financial institutions which would directly or indirectly influence the private capital investment on farm firms of Annur block is briefly outlined in this chapter.

4.1 Geographical Location

4.1.1 Coimbatore District

Coimbatore district lies in the western part of Tamil Nadu bordering the Western Ghats between 10º 10' and 11º 30’ northern latitudes and 76º 40' and 77 º 30’ eastern longitudes. It is surrounded by Nilgiris in its western and south western side; Erode district in its northern and Dindigul district in its eastern side. It shares majority of its boundary with the neighboring state of Kerala. This district benefits from the south west monsoon due to the presence of mountain pass namely ‘Palaghat gap’. It also helps to promote trade and transport in and around Coimbatore city. The district is filled with naturally diverse ecosystem such as hills, plains, forests, evergreen fields, river bodies and tanks. The total geographical area is 4850 Square kilometers. The district has six taluks namely Mettupalayam, Coimbatore North, Coimbatore South, Sulur, Pollachi and Valparai. Coimbatore South taluk has 11 blocks namely Karamadai, Annur, Periyanayyakkanpalayam, Sulur, Thondamuthur, Madukkarai, Sultanpet, Kinathukadavu, Pollachi North, Pollachi South and Anamalai.

4.1.2 Annur Block

Annur block is a suburb of Coimbatore situated 29 km north of the city. It lies on the Dindugul – Bangalore National highway. It is surrounded by Punjai Pulliampatti Block in the northern side, S.S.kulam in the southern side, Karamadi in the Western side and Avinashi in the eastern side. Annur block lies between 11.8’ North latitude and 76.59’East longitude. Annur lies at an altitude of 411metre above MSL (Mean Sea Level). The total geographical area is 29,s060 hectares and the total agricultural lands have accounted for 14,400 hectares which accounts for about

49 % of the total area. Annur block has 2 firka namely Annur north and Annur south comprising of 22 revenue villages.

The majority of the populations in Annur block have Tamil as their primary language. Apart from this, a considerable number of people speak Kannada as their secondary language. A huge number of the youth from this town are employed either at Coimbatore or at Tiruppur. Annur is very rich with respect to Tamil culture especially with Kongu Nadu traditions. Annur is well connected to cities like Sathyamangalam, Avinashi, Tiruppur and Mettupalayam and to nearby states like Karnataka and Kerala.

4.2 Etymology

4.2.1 Coimbatore

The name of the city is a derivation of Koyanputhur, after the 12th Century Irula chieftain Kovan or Koyan, who ruled the region around the city, during the reign of Kulothunga Chola I. Kovanpudur or Koyanputhur evolved and became Koyambuthur or Koyamuthur; it was anglicized as Coimbatore.

4.2.2 Annur

The name Annur is believed to have been come from "Vanniyur. The myth behind the name says that, over 1000 years ago, when a small hunter hit a stone under a "Vanni" tree and it has started bleeding. He was astonished and called the village people to look after this issue. Later they found a "Suyambu" Lord Shiva Idol there and built a temple. From then onwards the place is called as Vanniyur, later transformed into Anniyur and now named as Annur.

4.3 Land Use Pattern in the Study Area

Studying the land use pattern of the study area is very important to know the usage of land for various agricultural and economic purposes. It is very useful to plan the use of land resource. Land use pattern in Coimbatore district and Annur block is presented in the Table 4.1.

Table 4.1 Nine Fold Land Classification of Annur Block (2010)

SI. No	Land classification	Coimbatore district (in hectares)	Annur block (in hectares)
a.	Forest	158801 (21.26)	0 (0)
b.	Uncultivable waste	7475 (1.01)	46.220 (0.16)
c.	Non agri uses	108064 (14.47)	4115.000 (14.17)
d.	Cultivable waste land	13464 (1.81)	36.150 (0.13)
e.	Permanent pasture & Grass Land	85 (0.02)	6.000 (0.03)
f.	Misc. Tree crops & Groves	3413 (0.46)	40.000 (0.14)
g.	Currant Fallows	89326 (11.96)	7851.330 (27.02)
h.	Other fallows	53552 (7.17)	1050.040 (3.62)
i.	Net Cultivated Area	312899 (41.89)	15914.000 (54.77)
	Total	**747079** **(100.00)**	**29058.740** **(100.00)**

(Figures in parentheses are percentages to total)

Source: Coimbatore District statistical Handbook, Government of Tamil Nadu, Assistant Director of Agriculture, Annur block.

It could be seen from the table that the net sown area is 41.89 per cent of the total geographical area in Coimbatore district. It is followed by area under forest (21.26 per cent), the land put to non-agricultural uses (14.47 per cent), current fallow lands (11.96 per cent), other fallow lands (7.17 per cent), cultivable wastes (2.61 per cent), uncultivated land (1.01 per cent), land under permanent pasture and other grazing lands (0.58 per cent) and land under

miscellaneous tree crops & grooves are very less (0.46 per cent) as compared to other uses of lands.

In Annur block, the net area sown accounted for 54.77 per cent of the geographical area. It was followed by the land under current fallow (27.02 per cent), land put to non-agricultural uses (14.17 per cent), other fallow lands (3.62 per cent), uncultivable waste lands (0.16 per cent), area under miscellaneous tree crops and grooves (0.14 percent), cultivatable waste land (0.13 per cent) and land under permanent pastures and other grazing lands is very low (0.03 per cent).

4.4 Soil Type in the Study Area

The major soil type prevailing in the study area is Sandy loam, which is present in twenty villages of Annur block namely Akkaraisengappalli, Ambothi, Annur, Kanjappalli, Kanuvakkarai, Karegoundanpalayam, Kariyampalayam, Kattampatti, Kunnathur, Kuppanur, Kuppepalayam, Masagoundanchettipalayam, Naranapuram, Odderpalayam, Pachapalayam, Pasur, Pillaiappanpalayam, Pogalur, Vadakkalur and Vadavalli. Sandy clay loam is prevalent in the other two villages namely Allappalayam and Annurmettuppalayam.

4.5 Crop Coverage of Annur Block

Annur is known for growing a variety of crops. Studying the cropping pattern of the study area is very important to know the major crops and the cultivation practices followed so that better management of available resources can be identified. Cropping pattern in Annur block is presented in the Table 4.2. The important crops of Annur block are Cholam, banana, Curry leaves, Red gram, Onion, sugarcane, coconut, vegetables and flowers. Total cereals constituted 54.47 per cent of gross cropped area, Pulses also accounted for 9.61 per cent, Oil seeds including coconut occupied 9.85 per cent of area, Fruits (15.54 percent), Spices (3.52 percent), Vegetables (2.67 percent) and other crops accounted for 4.34 percent. All these indicate the agriculture diversity of the block. This should be capitalized to make the district prosperous with agricultural base. The district also has an excellent scope for agri business.

Table 4.2. Crop Coverage in Annur Block during 2009-2010

Crop	Annur South (in hectares)	Annur North (in hectares)	Total (in hectares)	Percentage to the total area
Paddy	10	5	15	0.09
Cholam	3,400	3250	6650	41.78
Cumbu	5	5	10	0.06
Maize	1065	1090	2155	13.54
Pulses Total	850	680	1530	9.61
Oil Seeds Total	110	310	420	2.63
Cotton	50	75	125	0.78
Sugarcane	150	200	350	2.19
Coconut	800	350	1150	7.22
Fruits	1126	1348	2474	15.54
Vegetables	205	221	426	2.67
Species and condiments	225	336	561	3.52
Flowers	24	24	48	0.30
Total Cropped Area			**15,914**	**100.00**

Source: Assistant Director of Agriculture, Annur block

4.6 Climate and Rainfall

Coimbatore has a pleasant, salubrious climate all the year round, aided by the fresh breeze that flows through the 25 km's long Palakkad gap. Coimbatore is located at an elevation of about 398 meters. The mean maximum and minimum temperatures during summer and winter varies between 35°C to 18°C.

Annur block receives the highest amount of rainfall from the North East monsoon *i.e.,* during the months of October to November which accounts for about 47% of the total rainfall received followed by the South West Monsoon from June to September accounting for 33 %, Hot weather season in the months of March to May receives about 18 % of the total rainfall and the winter season from January to February receives a negligible amount of 0.67% out of the total rainfall received. There

is an automatic weather station at Kuppepalayam where all the weather parameters are recorded. The average rainfall data is represented in the Table 4.3.

Table 4.3. Distribution of Rainfall in Annur Block during 2010

Season	Rainfall (in mm)	(Percentage to the total)
Winter Total	3.00	0.67
Hot-Weather Total	83.50	18.83
SW-Monsoon Total	148.00	33.37
NE-Monsoon Total	208.90	47.12
Total	**443.40**	**100.00**

Source: Assistant Director of Agriculture, Annur block

4.7 Irrigation

The main source of irrigation in Annur block is the bore well. Areas irrigated by various sources of water supply in Annur block are presented in the Table 4.4.

Table 4.4. Area Irrigated by Sources of Water Supply in Annur Block (2009-2010)

Sources	Area irrigated (in hectares)		
	Annur North	Annur South	Total
Canals	0	0	0
Tanks	4	3	7
Bore well	2160	1980	4140
Other sources	130	120	250
Total	**2290**	**2100**	**4390**

Source: Assistant Director of Agriculture, Annur block

The main irrigation source is the borewell which accounted for about 94 % of the total area irrigated and the remaining 6 % of the area is irrigated from other sources. As all the seven water tanks have dried up, there is no tank or canal irrigation in Annur. There are 2484 bore wells in Annur out of which nearly 60 % of the bore wells are dry.

Farmers of Annur block are well equipped with necessary machines and equipment's to carry out their agricultural operations. Since the main source of irrigation is from the bore well, there is a huge demand for electric motors whose details are furnished in the Table 4.5.

Table 4.5. Machines and Equipment's available in Annur Block (2009-2010)

SI. No.	Particulars	Annur north (in numbers)	Annur south (in numbers)	Total (in numbers)
1.	Electric motors	1985	2100	4085
2.	Oil engine	13	16	29
3.	Tractor	96	85	181
4.	Power tiller	15	29	44
5.	Roto weeder	33	42	75
6.	Sprayers	290	235	525
7.	Drip unit	320	295	615
8.	Sprinkler unit	8	6	14
9.	Pipe line	210	195	405
10.	Storage go down	2	0	2
11.	Trashing yards	4	3	7
12.	Processing units	1	0	1
	Total	**2977**	**3006**	**5983**

Source: Assistant Director of Agriculture, Annur block

4.8 Status of Farmers

Annur has a total of 9,871 farmers of which nearly 50 % of the farmers belong to the category of small farmers (referred as SF) and out of the remaining 50 % farmers, marginal farmers (referred as MF) accounts for 42% and the remaining 7 % by the big farmers (referred as

BF). There are about 18,205 agricultural labourers (referred as AL).The status of the farmers in Annur block is presented in the Table 4.6.

Table 4.6. Status of the Farmers in Annur Block (2009-2010)

Firka	General Category (in numbers)				SC/ST Category (in numbers)				Total (in numbers)			
	SF	MF	BF	AL	SF	MF	BF	AL	SF	MF	BF	AL
Annur south	1965	2019	311	4200	55	15	0	4305	2020	2034	311	8505
Annur north	2970	2146	315	4100	60	14	1	5600	3030	2160	316	9700
Total	**4935**	**4165**	**626**	**8300**	**115**	**29**	**1**	**9905**	**5050**	**4194**	**627**	**18205**

Source: Assistant Director of Agriculture, Annur block

4.9 Demographic Details

The population of Annur Block is furnished in the Table 4.7 as per the 2001 census.

Table 4.7. Demographic Details of Annur Block (2009-2010)

SI.No.	Sex	Population (in numbers)	Agricultural labourers (in numbers)
1.	Male	51,051 (50.51)	8,727 (54.00)
2.	Female	50,017 (49.49)	7,395 (45.86)
	Total	**1,01,068 (100.00)**	**16,122 (100.00)**

(Figures in parentheses are percentages to total)

Source: Assistant Director of Agriculture, Annur block

Annur has nearly equal share of male and female population which is about 50.51 % and 45.49 % respectively. Among the agricultural labourers, male labour accounted for 54.50% and the female labourers accounted for 45.50 %.

4.10 Credit Institution

Annur is very rich with respect to the banking services. Credit institutions in Annur block are furnished in the Table 4.8.

Table 4.8. Credit Institutions in Annur Block (2009-2010)

SI. No.	Banks	Total (in numbers)
1.	Nationalized Banks	7
2.	Scheduled Bank	1
3.	Primary Agricultural Cooperative Banks	17
	Total	**25**

Source: Assistant Director of Agriculture, Annur block

Indian Overseas Bank was the first bank to be opened in Annur. Later Indian Bank and Union Bank of India opened their branches, as one bank was not able to cater for the financial needs of this fast growing town and many more banks later. People in this town welcome private banks and nationalized banks to open their branches to meet out their financial transaction. Indian Bank has set up the first ATM in Annur followed by Axis Bank. Later Syndicate Bank has opened its branch with an ATM and Core banking facility. Presently, all the bank branches operating in Annur have installed their own ATMs. Annur block has a total of 25 financial institutions out of which there are 17 Primary agricultural co-operative banks contributing the major share followed by nationalized banks and one scheduled Bank. Since agricultural and allied industries have a major share in the economy of the block, the role of co-operative institutions in agricultural and allied industries are considerably high.

CHAPTER V

RESULTS AND DISCUSSION

In the earlier chapters, a brief review of the past studies, relevant methodology adopted and the general description of the study area were presented. With that background, the primary data collected from the sample households were analyzed using the tools of analysis specified for the study. In this chapter, the results obtained were discussed with respect to the objectives in the following manner.

5.1 General characteristics of the sample respondents.

5.2 Sources and pattern of investment in farm firms.

5.3 Conventional farm business analysis of borrower and non-borrower farm firms.

5.4 Factors influencing farm investment in borrower and non-borrower farm firms.

5.5 Factors influencing returns to investment in borrower and non-borrower farm firms.

5.6 Three Stage Least Square analysis on borrower farm firms.

5.7 Three Stage Least Square analysis on non-borrower farm firms**.**

5.1. General Characteristics of the Sample Farmers

This study was based largely on the primary data collected from the sample farms. Hence, general characteristics of the sample respondents would help to know more about the socio-economic factors that influence the decisions of the sample farmers and hence they are discussed below.

5.1.1. Age distribution of the head of the sample farm households

5.1.2. Educational status of head of the farm households in borrower and non-borrower categories.

5.1.3. Family size of respondent farm households

5.1.4. Farming experience of the head of the sample households

5.1.5. Land holding pattern

5.1.6. Assets position

5.1.6.1. Land value

5.1.6.2. Livestock position

5.1.6.3. Value of farm buildings, machineries and equipments

5.1.7. Cropping pattern in the sample farms

5.1.1 Age of the Head of Sample Farm Households

Age of the head of the sample respondents was one of the essential determinants and in general was positively related to the level of adoption of technologies. Hence, the same has been analyzed and presented in Table 5.1. Fig 5.1 gives the age of the family head of sample farm firms.

Table 5.1. Age of the Head of the Sample Farms

SI. No.	Age of the heads in sample farmers (years)	No of farmers (in numbers)	
		Borrowers	**Non-Borrowers**
1.	30-45	10 (25.00)	2 (5.00)
2.	45-60	22 (55.00)	20 (50.00)
3.	>60	8 (20.00)	18 (45.00)
	Total	**40 (100.00)**	**40 (100.00)**

(Figures in parentheses indicate percentage to the total)

From the table it could be observed that 55.00 per cent of respondents in borrower farms belonged to the age group of 45-60 years followed by the age group of 30-45 years, accounting for 25.00 and the age group of above 60 years accounted for 20.00 per cent of the total. In the case of the non-borrowers the age group of 45-60 years accounted for 50.00 percent followed by the age group of above 60 years accounted for 45.00 percent and the age group of 30-45 years accounted for 5.00 percent.

The percentage analysis revealed that the proportion of respondents in the below 45 years age group was higher in the borrowers than that of non-borrower farms by 20.00 per cent.

Further, when the age group of above 60 years was considered, it was observed that borrowers had a lower share of 20.00 percent when compared to that of non-borrowers share of 45.00 percent. Thus, this reason could also be attributed to increased access to credit and technology by the borrowers.

Similarly in Giwa district of kaduna state, Nigeria, Bogunjaka (1983) found a significant relationship between the use of various technological information and factors such as age of the farmer, education and length of farming experience.

5.1.2 Educational Status of the Head of Sample Households

The level of education of the rural households determined the awareness and adoption of technologies and also the extent of awareness and utilization of credit facilities in the study area. The educated farmers are expected to understand better the lending procedure followed by various lending agencies and helps in taking rational decisions on borrowing. Hence, the educational status of the sample respondents was analyzed and the results are depicted in Table 5.2. Fig 5.2 shows the literacy level of the sample farmers.

Table 5.2. Educational Status of the Head of Sample Households

Sl. No.	Literacy level	Number of farmers (in numbers)	
		Borrowers	Non-Borrowers
1.	Illiterate	2 (5.00)	6 (15.00)
2.	Primary	17 (42.50)	9 (22.50)
3.	High school	13 (32.50)	23 (57.50)
4.	Higher Secondary	3 (7.50)	1 (2.50)
5.	Collegiate	5 (12.50)	1 (2.50)
	Total	**40 (100.00)**	**40 (100.00)**

(Figures in parentheses indicate percentage to the total)

It could be visualized from the table that among the sample farmers, the total literacy level was higher in borrower farm households (95.00 per cent) than that of the non-borrower

farm households (85.00 per cent). This was accounted by increased educational levels at primary, high school, higher secondary and collegiate levels. It is to be noted that the degree holders are higher in the borrower households (12.50 percent) than the non-borrower households (2.50 percent).

However it was observed that the high school education was found to be predominant in non-borrowers category (57.50 per cent), whereas it was lower in the borrower's farm households (32.50 percent). The higher literacy rate could be attributed as a reason for increased access to credit and for the adoption of new technologies.

5.1.3 Family Size of Respondent – Farm Households

The size of the family had important implications with respect to income realization of the sample households and to determine the extent of consumption expenditure which determined the potential for saving and, in turn, the extent of farm investment. Hence, the family size was discussed to study the comparative performances of borrower and non-borrower household categories. The groups on family size were categorized according to the nature of the data collected. The details of the family size particulars are represented in Table 5.3. Fig 5.3 shows the family size of the sample farmers.

Table 5.3. Distribution of Family Size in Sample Households

SI. No.	Family Size	Number of farmers	
		Borrowers	**Non-Borrowers**
1.	Up to 3	15 (37.50)	8 (20.00)
2.	4 and 5	19 (47.50)	22 (55.00)
3.	6 to 8	6 (15.00)	10 (25.00)
	Total	40 (100.00)	40 (100.00)
	Average family size	**4.025**	**4.15**

(Figures in parentheses indicate percentage to the total)

From the table it could be inferred that in the borrower households, the family size group of 4 to 5 accounted for 47.50 per cent of total households, followed by family size group of less than 3 which accounted for 37.50 per cent and the family size group of 6 to 8 categories, accounted for 15.00 per cent.

In the non-borrower households, it was observed that the family size group of 4 to 5 accounted for 55.00 per cent of the total, followed by 6 to 8 size group which accounted for 25.00 per cent of the total and 20.00 percent of the households belonged to less than 3 family size groups. The average size of the farm family was larger in the non-borrowers (4.15) than the borrowers (4.025).

The relative large size of the family of non-borrowers was a cause for non-borrowing, because it increased the family expenditure and reduced the credit worthiness. The reason for the relatively smaller family size of borrowers when compared with that of non-borrowers could be attributed to increased educational status of the borrower households than the non-borrower households.

5.1.4 Farming Experience of the Head of the Sample Households

The years of farming experience of the head of the sample farms were assessed and the results are furnished in the Table 5.4. Fig 5.4 shows the farming experience of the sample farmers.

Table 5.4. Farming Experience of the Sample Farmers

SI. No.	Family Size	Number of farmers	
		Borrowers	Non-Borrowers
1.	<20	4 (10.00)	1 (2.50)
2.	20 to 40	27 (67.50)	15 (37.50)
3.	> 40	9 (22.50)	24 (60.00)
	Total	**40 (100.00)**	**40 (100.00)**

(Figures in parentheses indicate percentage to the total)

From the table it could be discerned that out of the fourty farmers in the borrowers, 67.50 percent of the farmers had 20 to 40 years of farming experience, followed by 22.50 percent of the farmers who had above fourty years of farming experience and 10.00 per cent of the farmers had less than 20 years of farming experience. In the non-borrowers category 60.00 percent of the farmers had above fourty years of farming experience, followed by 37.50 percent

of the farmers who had 20 to 40 years of farming experience and 2.50 percent of the farmers had less than 20 years of farming experience.

Age of the farmer was directly related to their farming experience, therefore when the age increased their farming experience also increased. The people of young age preferred to take new innovative practices in farming, and therefore would like invest more. Thus in the borrowers category we could find that 77.50 percent of the farmers had less than 40 years of farming experience, where as in non-borrowers category it accounted for 40.00 percent.

In a similar study by Feder *et al*., (1991) on "Credit's Effect on Productivity in Chinese Agriculture in China", where they found that it was worth noting that capital, education and farm experience had significant positive effects on the output on the credit-unconstrained households but found insignificant on credit-constrained households.

5.1.5 Land Holding Pattern of the Sample Farms

Farm size was positively related to the cost of operation. The details on land holding pattern of sample respondents in the study area are presented in Table 5.5.

Table 5.5. Land Holding Pattern of the Sample Farms

Sl. No.	Area owned (ha)	No of farmers		Total sample
		Borrowers	Non-Borrowers	
1.	<1	Nil (0)	5 (12.50)	5 (6.25)
2.	1 to 2	13 (32.50)	22 (55.00)	35 (43.75)
3.	2 to 3	22 (55.00)	11 (27.50)	33 (41.25)
4.	>3	5 (12.50)	2 (5.00)	7 (8.75)
	Total	40 (100.00)	40 (100.00)	80 (100.00)
	Average size of land holding	**2.42**	**1.79**	**2.105**

(Figures in parentheses indicate percentage to the total)

For this study, sample respondents were post stratified into marginal, small, medium and large farms taking into consideration the size of the farm. Among the selected respondents, there were 5 marginal farmers (less than one hectare), 35 small farmers (1 to 2 hectares), 33 medium

farmers (2 to 3 hectares) and 7 large farmers (above 3 hectares). Fig 5.5 shows the land holding pattern of the sample farmers.

It was observed from the table that in the borrower's category, nearly 67.50 per cent of the total farmers were in the above 2 ha category whereas in the non-borrower's group it was only 32.50 per cent. The majority of the farmers in the non-borrowers category (67.50 per cent) belonged to the less than 2 ha category whereas in the borrowers it accounted for 32.50 per cent. The average farm size was higher in borrowers (2.42 ha) than that of non-borrowers (1.79 ha).

5.1.6. Asset Position

The farm investment directly enhanced the value of farm assets and is also an important factor for getting various loans from the banks, *i.e.*, it acts as a security and hence, they were discussed in three sections namely land value, livestock position and other assets.

5.1.6.1 Average Land Value of the Sample Farms

It would be apt to discuss land value in terms of garden and dry land owned by the respondents, since the land value showed significant differences across types of lands. Hence, the same was discussed in the Table 5.6.

Table 5.6. Average Land Value of the Sample Farms

Sl. No.	Type of land	Borrowers (lakhs/ha)	Non-Borrowers (lakhs/ha)
1.	Garden land	12.59	12.31
2.	Dry land	12.21	11.56
3.	Average land value	12.40	11.93

It could be observed from the table that the average value of land owned by the borrowers was Rs.12.40 lakhs/ha while it was lesser for non-borrowers at Rs 11.93 lakhs/ha.

5.1.6.2 Livestock Position

Extent of livestock rearing among the sample farms would help in understanding the extent of supplementary income earned by the sample farmers. The details regarding the number of animals maintained by the sample farms are given in the Table 5.7.

Table 5.7. Livestock Position of the Sample Farmers

Sl. No	Livestock	Livestock Units	Borrowers		Non borrowers	
			Present value (Rs)	Per cent to total value	Present value (Rs)	Per cent to total value
1.	Cow	1.6	23475.78	81.09	19062.50	84.96
2.	Calf	0.8	1024.87	3.54	874.98	3.90
3.	Buffalo	1.6	4449.35	15.37	2500.02	11.14
	Total		28950.00	100.00	22437.50	100.00

It could be observed from the table that the total value of livestock was more in borrowers (Rs 28,950 per farm) when compared with that of the non-borrowers (Rs 22,437.50 per farm). The percentage contribution of cow to the total livestock value was lesser in borrowers (81.08 per cent) than that of non-borrowers (84.95 per cent). Similarly the percentage contribution of calf to the total livestock value was lesser in borrowers (3.54 per cent) than that of non-borrowers (3.89 per cent). However, the percentage contribution of buffalos to the total livestock value was higher in the borrower farms (15.37 per cent) than that of the non-borrower farms (11.14 per cent). On the whole, the livestock wealth was higher in the borrower farms than that in non-borrower farms and this was partly because of larger size of holding and other asset position in borrower farms than that of the non-borrower farms.

5.1.6.3. Value of Farm Buildings, Machineries and Equipment's

The position of other assets such as farm house, machineries, pump shed, cattle shed, tractor and other tools of the sample households used in farming was estimated for different categories of farms and has been presented in the Table 5.8.

Table 5.8. Value of Fixed Assets in Borrowers and Non-Borrower Farms

SI. No.	Type of Asset	Borrowers		Non-Borrowers	
		Present value (Rs per farm)	Per cent to Total	Present value (Rs per farm)	Per cent to Total

1.	**Farm Buildings**				
a)	Farm House	7625	4.17	3518.52	3.23
b)	Cattle shed	3525	1.93	1950	1.77
2.	**Irrigation structure**				
a)	Pump set room	7300	4.00	4625	4.23
b)	Electric motor	23350	12.80	16400	15.02
c)	Compressor	11950	6.55	8200	7.51
d)	Borewell	41250	22.60	26000	23.81
e)	Drip/sprinkler irrigation	13400	7.34	9157.50	8.37
3.	**Livestock**	28950	15.85	22437.50	20.55
4.	**Machinaries**				
a)	Tractor	44500	24.36	16480	15.11
b)	Other tools	712.50	0.40	426.25	0.40
	Total	**182562.50**	**100.00**	**109194.80**	**100.00**

It could be observed from the table that the farm building contributed for 6.10 percent of the total asset value in borrowers where as in the case of non-borrowers it accounted for 5.01 percent only. The contribution of irrigation structures was higher for non-borrowers (58.94 per cent) than that of borrowers (53.29 per cent). Similarly the contribution of livestock was higher for non-borrowers (20.55 per cent) than that of borrowers (15.85 per cent).

The contribution of machineries was higher in borrowers (24.76 per cent) than that of non-borrowers (15.51 per cent). Regardless the percentage contribution it was found that value of all the assets was higher in case of the borrower farms (182562.50) than that of the non-borrowers (109194.80). The reason for this could be attributed to the credit that was availed by the borrowers from the various sources of finance for investment on fixed assets whereas non-borrowers depended on their owned capital.

5.1.7. Cropping Pattern of the Sample Farms

The cropping pattern of the sample farms would give an insight on the practice of agriculture and indirectly on the income of the farms. Since as the cropping intensity increased

the yield from the crops also increased considerably, as a result of which the income level of the farmers also increased. The cropping intensity was measured as the percentage of gross cropped area over the net cropped area. Hence, the area under different crops grown and the details on cropping intensity of the borrower and non-borrower farms were analyzed and are presented in the Table 5.9. Fig 5.6 gives the cropping pattern of the sample farms**.**

Table 5.9. Cropping Pattern of the Sample Farms

SI.No.	Crops	Borrowers		Non Borrowers	
		Area (ha)	Percentage	Area (ha)	Percentage
1.	Curry leaves	13.60	19.32	7.60	12.03
2.	Fodder sorghum	-	-	16.60	26.27
3.	Banana	17.60	25.00	16.40	25.94
4.	Turmeric	20.00	28.41	15.20	24.05
5.	Maize	10.80	15.34	-	-
6.	Onion	8.40	11.93	7.40	11.71
7.	**GCA**	**70.40**	100.00	**63.20**	100.00
8.	**NCA**	**54.00**		**53.00**	
	Cropping intensity (%)	**130.34**		**119.24**	

It could be inferred from the table that among the borrower farms, turmeric was largely cultivated and it was followed by banana, curry leaves, maize and onion where as in the case of non-borrower farms fodder sorghum was largely cultivated followed by banana, turmeric, curry leaves and onion. The reason for this could be attributed to the short-term credit availed by the borrower farmers.

The non borrower farmers depended on owned capital to raise the above-mentioned crops, so they showed disinterest in raising commercial crops that required huge working capital. Similarly the borrower farmers showed disinterest in raising low-income crops as they have considerable capital to raise the commercial crops which increased their profit. Appendix III and

appendix IV shows the cost of cultivation of these crops in borrower and non-borrower farms respectively.

The cropping intensity which was measured as the percentage of gross cropped area over the net cropped area and as depicted in the table showed that the borrower farms had higher cropping intensity (130.34 per cent) than that of the non-borrower farms (119.24 per cent). The reason for this could be attributed to the increased gross cropped area which in turn was due to the availability of crop loan availed by the borrower farmers.

5.2 Sources and Pattern of Investment in Farm Firms.

Under the sources and pattern of investment in sample farm firms the following topics are discussed.

5.2.1 Source-wise farm investment in borrowers farm firms

5.2.2 Purpose of investment in borrowers farm firms

5.2.3 Investment on fixed capital

5.2.4 Investment on circulating capital

5.2.5 Total capital investment

5.2.6 Gross income

5.2.1 Source-wise Farm Investment in Borrowers Farm Firms

Farmer's sources of finance for farm investment were broadly classified into three categories, namely, i) own funds, *i.e*. past savings, ii) loans from financial institutions and iii) borrowing. The various sources of farm investment in borrower farm firms are presented in the Table 5.10. Fig 5.7 shows the source and purpose wise investment in borrowers.

Table 5.10. Source-wise Farm Investment in Borrowers Farm Firms

SI. No.	Sources	Total number of farms	Per cent to Total
1.	Commercial Banks	22	55.00
2.	Cooperatives	6	15.00

3.	Regional Rural Bank's	6	15.00
4.	Relatives and friends	5	12.50
5.	Money lenders	1	2.50
	Total	**40**	**100.00**

From the table it could be observed that 55.00 per cent of the borrowers depended on commercial banks to meet their credit requirements. It was followed by regional rural banks (15.00 per cent) and co-operatives (15.00 per cent). The contribution of relatives and friends accounted for 12.50 per cent and the money lenders contributed 2.50 per cent to the borrower farmers.

The non-borrowers made their investment on farms from their own sources of finance like savings, income from crops and livestock *etc*. Income from non-farm activities such as flower shops, machineries, carpenter and off-farm income such as agricultural labourers also contributed to meet their farm credit requirements. The non-institutional sources of finance are also negligible in non-borrowers category. The non-borrowers would make use of their own funds because it avoided all the efforts to negotiate and avail credit. Thereby they could not invest more on high profitable activities which brings them better profit.

5.2.2 Purpose of Investment in Borrowers Farm Firms

The investment pattern played a pivotal role in streamlining the productivity of crop enterprise. Farmers invested on different types of productive assets with the expectations that they would get better returns from them. Different lending agencies have differences among purposes for which the loans are been granted. Therefore, source of finance did not depend solely upon the decision of the borrowers; necessarily there was a relationship between the purpose of loans and the sources of credit. The details on the purpose wise capital investment made by the borrowers are presented in the Table 5.11.

Table 5.11. Purpose-wise Investment in Borrowers Farm Firms

Sl. No.	Asset/ Purpose of Loan	Number of Farms
1.	Crop loan + Drip irrigation loan	14

2.	Crop loan + Bore well loan	6
3.	Crop loan+ Livestock loan	11
4.	Crop loan + Tractor loan	6
5.	Farm building loan	2
6.	Compressor loan	1

In the borrower's category higher number of farmers obtained loan for investment on crops and drip irrigation since most of the farmers used drip irrigation for their commercial crops like curry leaves, turmeric and banana which increases their profit. Similarly investment on crops and livestock was also high since livestock brings better returns from investment. Equal number of farmers also invested on bore well and tractor along with investment on crops. Considerable number of farmers also invested on farm building and compressor.

5.2.3 Investment on Fixed Capital

Investment on fixed capital included the investment made on the fixed assets of the farm. Usually all the fixed assets on the farm had a longer life period. So, their value cannot be taken as such for the analysis. In the present study, the value of the investment made on the fixed assets per farm was annualized based on their life period and the analyzed values are presented in the Table 5.12.

Table 5.12. Pattern of Fixed Capital Investment in Sample Farms

SI.No.	Particulars	Amount (Rs/ha/annum)	
		Borrowers	Non-Borrower
1.	Drip irrigation	1218.18	765.26
2.	Bore well	6281.25	2465.25
3.	Livestock	2453.30	1164.28

4.	Tractor	3871.31	1756.36
5.	Farm building	5381.25	2152.48
6.	Compressor	1063.33	958.21
7.	Others	8506.26	5563.29
	Total	**28774.88**	**14825.13**

From the table it could be inferred that fixed capital investment was higher on the borrower farms (Rs.28774.88) than that of the non-borrower farms (Rs.14825.13). Investment on circulating capital could be met out even from the owned capital, but investment on fixed assets required considerable capital which needed certain borrowing from other sources of finance. Usually it was the fixed assets that bring better results on the farm. Thus, fixed assets played a major role in improving the productivity and profitability on the farms.

5.2.4 Investment on Circulating Capital

Investment on circulating capital included investment on human labour, bullock labour, machine labour, seeds, manures and fertilizers, plant protection chemicals, animal feeds, irrigations costs, interest on working capital *etc*. The variation in the value of inputs under each item in borrowers and non-borrower farms were analyzed and the results are discussed in the Table 5.13.

Table 5.13. Pattern of Circulating Capital Investment in Sample Farms

SI.No.	Particulars	Amount (Rs/ha)	
		Borrowers	**Non-Borrower**
1.	Human Labour	15091.35	12033.58
2.	Animal Labour	3574.17	2271.56
3.	Machine Power	4359.14	2816.33

4.	Seed/Seedlings	25598.55	20367.55
5.	Manure and Fertilizers	7361.58	6195.03
6.	Plant Protections	8362.62	6384.76
7.	Miscellaneous	2146.52	1501.12
8.	Interest on Working Capital	1142.54	862.38
	Total	**67636.47**	**52432.31**

From the table it could be inferred that the working capital investment was higher in case of the borrower farms than that of the non-borrower farms. The total investment on circulating capital worked out to be Rs.67636.47 whereas in the case of the non-borrower farms it was found to be Rs.52432.31. The reason behind low investment in non-borrower farms is due to the lack of sufficient capital.

In a study by Prabha *et al*., (2007), on "Impact of Infrastructure and Technology on Agricultural Productivity in Uttar Pradesh", revealed that for one per cent change in fertilizer and high yielding varieties, the change in agricultural productivity was 0.24 q/ha and 0.91 q/ha respectively. Thus they found that both fertilizer and area under high yielding varieties had positive and significant impact on agricultural productivity at one per cent probability level. Thus investment on these aspects always brought about better results.

5.2.5 Total capital investment

Total capital invested includes the investment made on the fixed assets including investment on land, farm building, machinery, livestock, equipment's *etc*., and the investment on working assets includes the investment made on seeds, manures and fertilizers, plant protection chemicals, human labour, animal labour *etc*. The working capital investment is taken as such for the analysis, whereas the fixed capital investment is annualized depending upon the life period of the fixed asset. Total capital invested in borrower and non-borrower farms are presented in the Table 5.14.

Table.5.14. Total capital invested in sample farms

Sl. No.	Particulars	Investment on fixed assets (Rs/ha/annum)	Investment on working assets (Rs/ha/annum)	Total capital invested (Rs/ha/annum)
1.	Borrowers	28774.88	67636.49	96411.36
2.	Non-Borrowers	14825.13	52432.30	80665.25
	Average	21800.005	60034.395	88538.305

It was observed from the table that the investment made on the fixed assets was higher in the borrower farms (Rs.28774.88), whereas it was lower in case of the non-borrower farms (Rs.14825.13). Similarly the investment made on the working assets was also higher in borrower farms (Rs.67636.49) than that of the non- borrower farms (Rs.52432.30). Overall the investment made on the borrower farms was considerably higher (Rs.96411.36) than that of the non-borrower farms (Rs.80665.25). The reason was that the borrowers availed credit from various sources for their investment purposes.

5.2.6. Gross Income

It was the total income obtained from the sale of all main and by products from the farm enterprise taken up by the farmer in a year, without considering the total expenses involved. Income obtained from different categories were analyzed for the sample farms and are presented in the Table 5.15.

Table.5.15. Gross income obtained in Sample Farms

Sl. No.	Particulars	Crop income (Rs/ha)	Livestock Income ((Rs/ha)	Non-Farm income (Rs/ha)	Gross income (Rs/ha)
1.	Borrowers	141548.02 (45.04)	109682.09 (34.90)	63070.93 (20.06)	314301.07 (100.00)

2.	Non-Borrowers	120332.70 (57.82)	53313.22 (25.62)	34470.43 (16.56)	208116.40 (100.00)
	Average	**130940.40**	**81497.65**	**48770.68**	**261208.70**

It was observed from the table that the major contributor of income for the borrowers was crop income (45.04 per cent), which was followed by livestock income (34.90 per cent) and then by non-farm and off farm income (20.06 per cent). In non-borrowers, it was observed that the crop income, that contributed (57.82 per cent) of the total income, followed by livestock income (25.62 per cent) and then by non-farm and off farm income (16.56 per cent). Thus, it could be inferred that borrowers had higher gross income (Rs.314301.07) than that of the non-borrowers (Rs.208116.40).

5.3. Conventional Farm Business Analysis

Though the physical efficiency in the use of the resources was essential, the economic efficiency ultimately decided the success or failure of the farm business. Therefore the following financial efficiency measures were analyzed for the sample farms.

5.3.1 Crop wise Net income per hectare

5.3.2. Returns from Investment

5.3.3. Net Cash Income

5.3.1 Crop-wise Net income per ha

Crop wise net income per hectare was calculated for the borrower and non-borrower farms and are presented in Table 5.16.

Table 5.16. Crop wise Net income per hectare

SI.No.	Particulars	Turmeric	Banana	Curry leaves	Onion	Maize	Fodder Sorgum
1.	Borrower	86391.87	98467.79	18914.85	93009.28	13629.06	-

2.	Non-Borrower	73881.07	87287.59	14832.64	78360.79	-	8011.36

It can be inferred from the table that the crop wise net income per hectare was higher on the borrower farms than that of the non-borrower farms. The reason behind this higher return in borrower farms can be attributed to the credit that was borrowed for farm investment on the fixed assets like tractors, farm equipment's *etc.*, and also on the working assets like seeds, manures, plant protection chemicals *etc.* This high return from the crops could also be invested in the future periods.

5.3.2. Returns from Investment

Returns from Investment was a performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. Returns on investment were analyzed for the sample farms and the results were expressed as a ratio in the Table 5.17.

Table 5.17. Returns from investment in sample farms

Sl. No.	Particulars	Gain from the investment (Rs/ha)	Cost of the investment (Rs/ha)	Returns from the investment (Rs/ha)
1.	Borrowers	251230.1	96411.36	1.61
2.	Non-Borrowers	173645.9	80665.25	1.15
	Average	212438	88538.31	1.37

From the table it could be inferred that the returns from investment were higher in case of the borrower farms as the returns from investment ratio was 1.61, whereas in case of the non-borrowers it was 1.15. The highest return for rupee invested in the borrowers might be due to the efficient use of the resources by the farmers and also because of the easy availability of credit from the various sources when compared to that of the non-borrowers.

5.3.3 Net Cash Income

The surplus of cash income over cash operating expenses indicated the net cash income. This was the amount available with the farmer for future investment as well as for other family purposes. Net cash incomes in sample farms are presented in the Table 5.18.

Table 5.18. Net cash income in Sample Farms

Sl. No.	Particulars	Gross Gain from the investment (Rs/ha/annum)	Cost of the Investment (Rs/ha/annum)	Net Cash Income (Rs/ha/annum)
1.	Borrowers	251230.11	96411.36	154818.75
2.	Non-Borrowers	173645.92	80665.25	92980.67
	Average	212438.01	88538.30	123899.71

From the table it could be observed that the net cash income obtained was higher in the borrowers (Rs.154818.75) than that of the non- borrowers (Rs.92980.67). The difference indicates how far the farmers in borrowers category were benefitted than that of the non-borrowers. The borrowers then had surplus amount for future investment also.

5.4. Factors influencing Farm Investment in Borrower and Non-borrower Farm Firms

There are several factors influencing farm investment in both the borrower and non-borrower farm firms. They are the size of the farm holding**,** institutional credit in borrowers and owned capital in case of the non-borrower's, cropping intensity, family size, livestock unit, lagged returns to investment, non-farm income and labour usage. Average farm investment per farm was calculated in borrowers and non-borrower farm firms. Per farm refers to 2.42 hectares in borrowers and 1.79 hectares in case of the non-borrowers. The extent of influence of each factor to the average farm investment are presented in the following tables.

Relationship between Average farm investment and Size of the Farm Holdings

The average farm investment depended on the size of the farm holdings and was directly proportional to the farm size. Relationship between average farm investment and size of the farm holdings are presented in the Table 5.19.

Table.5.19. Relationship between Average farm investment and Size of the Farm Holdings

SI. No.	Size of the farm holdings (in hectares)	Average farm investment (in Rs)	
		Borrower	Non Borrower

1.	<1	46293.32	26536.23
2.	1 to 2	78635.18	48895.79
3.	> 2	108387.00	68958.78
	Total	**233315.50**	**144390.80**

It could be observed from the table that as the farm size increased the investment made on it also increased. It was considerably higher in case of the borrower farms when compared to that of the non-borrower farms. In a similar study by Feder *et al*.,(1991) on "Credit's Effect on Productivity in Chinese Agriculture in China", where they found that the quantity of land was an important factor and was found to be an statistically significant determinant of farm investment for credit constrained and credit unconstrained households.

Relationship between Average Farm Investment and Credit/Owned Capital

Farmers needed credit for all their farm activities. Borrowers met their credit demand by way of borrowing from various sources of finance say from credit institutions, money lenders *etc*., whereas the non-borrowers depended on their owned capital. Relationship between average farm investment and credit/owned capital are presented in the Table 5.20.

Table.5.20. Relationship between Average farm investment and credit /owned capital

SI. No.	Credit */owned capital ** (in rupees)	Average farm investment (in Rs)	
		Borrower	Non Borrower
1.	<50000	39568.48	14653.69
2.	50000 to 75000	78510.73	52236.89
3.	> 75000	115236.29	77500.22
	Total	**233315.50**	**144390.80**

* Credit refers to borrowers

** Owned capital refers to non-borrowers

It could be observed from the table that the borrowers invested more on their farm due to the credit they availed whereas the farm investment was considerably lesser on the non-borrower farms.

Relationship between Average Farm Investment and Cropping Intensity

Cropping intensity was the ratio of gross cropped area to net cropped area. Hence, as the cropping intensity increased the circulating capital on the farm also increased as the investment on seeds, fertilizers and manures, plant protection chemicals and other expenses on the farm also increased. Relationship between average farm investment and cropping intensity are presented in the Table 5.21.

Table.5.21. Relationship between Average Farm Investment and Cropping Intensity

SI. No.	Cropping intensity (in percentage)	Average farm investment (in Rs)	
		Borrower	Non Borrower
1.	<100	49893.89	28568.65
2.	100 to 200	67033.19	48963.33
3.	> 200	116388.43	66858.82
	Total	**233315.51**	**144390.80**

From the table it could be observed that average farm investment on the borrower farms increased as the cropping intensity increased. Similarly in a study on "Impact of Agricultural Mechanization on Production, Productivity, Cropping Intensity, Income Generation and Employment of Labour " by S.R.Verma (1980), revealed that farm mechanization led to increase in inputs on account of higher average cropping intensity and larger area, thereby increased agricultural production and profit.

Relationship between Average Farm Investment and Family Size

Family size was inversely related to the farm investment. Since as the family size increased the consumption and other expenditure also increased, thereby the investment to be made on farm got reduced. Relationship between average farm investment and family size are presented in the Table 5.22.

Table.5.22. Relationship between Average Farm Investment and Family Size

SI. No.	Family size (in numbers)	Average farm investment (in Rs)	
		Borrower	Non Borrower
1.	<2	109893.89	25039.32
2.	2 to 4	77178.19	48698.33
3.	> 4	46243.43	70653.15
	Total	**233315.51**	**144390.80**

From the table it could be inferred that as the family size increased, the average investment on the farm by non-borrower farmers also increased. However increase in the family size decreased the investment in the borrower farms. Similar results were obtained in a study by Feder *et al*., (1991) on "Credit's Effect on Productivity in Chinese Agriculture in China", where they found that an increase in the household size while holding the household labour force constant (*i.e*., an increase in the number of dependents) gave a negative impact on investment.

Relationship between Average Farm Investment and Livestock Unit

Higher the livestock, higher would be the investment made on it. And also livestock maintenance required considerable cost; thereby investment on livestock was considerably high. Relationship between average farm investment and livestock unit are presented in the Table 5.23.

Table.5.23. Relationship between Average Farm Investment and Livestock Unit

SI. No.	Livestock unit (in numbers per farm)	Average farm investment (in Rs)	
		Borrower	Non Borrower
1.	<2	41293.32	24522.56
2.	2 to 3	78635.33	48835.88
3.	> 3	113386.86	71032.36
	Total	**233315.51**	**144390.80**

From the table it could be inferred that the average farm investment on livestock would be higher on borrowers, as they availed livestock loan from credit institutions and other sources of finance when compared to that of the borrowers who depended on their own capital.

Relationship between Average Farm Investment and Lagged Returns to Investment

Returns from previous investment would be a major factor influencing farm investment in the current period. Relationship between average farm investment and lagged returns to investment are presented in the Table 5.24.

Table.5.24. Relationship between Average Farm Investment and Lagged Returns to Investment

SI. No.	Lagged returns to investment (in rupees)	Average farm investment (in Rs)	
		Borrower	Non Borrower
1.	<50,000	48336.25	26598.65
2.	50,000 to 100,000	75639.22	56894.36
3.	> 1,00,000	109340.04	60897.79
	Total	**233315.51**	**144390.80**

From the table it could be inferred that as the lagged returns from investment increased the average investment on farm also got increased. This was considerably higher in case of the borrower farms as they availed various sources of finance for their farm investment, where as it was lower in the case of the non-borrowers, since they used this lagged returns for many purposes like consumption expenditures, social ceremonies *etc.*, other than farm investment.

Relationship between Average Farm Investment and Labour Usage

Higher the usage of labour on the farms, higher would be the investment. Relationship between average farm investment and lagged returns to investment are presented in the Table 5.25.

Table.5.25. Relationship between Average Farm Investment and Labour Usage

SI. No.	Labour usage (in man days per annum)	Average farm investment (in Rs)	
		Borrower	Non Borrower
1.	<100	33569.25	18546.26
2.	100 to 200	81563.28	46986.33
3.	> 200	118182.98	78858.21

	Total	**233315.51**	**144390.80**

From the table it could be inferred that the investment was considerably higher in case of the borrowers as their labour usage was high, where as in the case of non-borrowers family labour utilization was high, there by the investment on hired labour got reduced.

Relationship between Average Farm Investment and Non-farm Income

Income from other professions could also be invested on the farms. As the non-farm income increased; investment on the farm also increased considerably. Relationship between average farm investment and lagged returns to investment are presented in the Table 5.26.

Table.5.26. Relationship between Average Farm Investment and Non-farm Income

SI. No.	**Non-farm income (in rupees)**	**Average farm investment (in Rs)**	
		Borrower	**Non Borrower**
1.	<25000	14569.68	11485.99
2.	25000 to 50000	79653.58	58964.45
3.	> 50000	139092.25	73940.36
	Total	**233315.51**	**144390.80**

Thus from the table it could be inferred that farm investment was higher in case of the borrowers when compared to that of the borrowers.

5.5 Factors influencing Returns to Investment in Borrower and Non-borrower Farm Firms

There were several factors influencing returns to investment in borrower and non-borrower farms. They were average farm investment, credit in case of the borrowers and owned capital in case of the non-borrowers, cropping intensity, livestock unit, labour usage and non-farm income. Returns to investment are calculated per farm in borrowers and non-borrowers. Per farm refers to 2.42 hectares in borrowers and 1.79 hectares in non-borrowers. The extents of influence of each factor to the returns to investment in borrowers and non-borrowers are presented in the following tables.

Relationship between Returns to Investment and Average Farm Investment

Average farm investment was the major determinant in determining the returns to investment in both the borrower as well as the non-borrower farms. Average farm investment and returns to investment were directly related. Relationship between returns to investment and average farm investment are presented in the Table 5.27.

Table.5.27. Relationship between Returns to Investment and Average Farm Investment

SI. No.	Average farm investment (in rupees)	Returns to investment (in Rs)	
		Borrower	Non Borrower
1.	<100000	78569.26	38659.26
2.	100000 to 200000	185632.59	69587.26
3.	> 200000	263091.20	119890.90
	Total	**527293.05**	**228137.46**

It could be inferred from the table that as the investment increased the returns from investment also increased. It was considerably higher in the case of borrowers than that of the non-borrowers, since they availed credit from various sources for their farm investment. Similar results were obtained by Feder *et al*., (1991) in a study on "Credit's Effect on Productivity in Chinese Agriculture in China", where they found that one additional yuan of liquidity (credit) yielded 1.235 yuan of additional gross value of output. Thus investment had a greater impact on returns to investment.

Relationship between Returns to Investment and Credit/ Owned Capital

Higher the capital invested higher would be the returns from it. Borrowers used the institutional credit that they borrowed whereas the non-borrowers depended on their owned capital. Relationship between returns to investment and credit/owned capital are presented in the Table 5.28.

Table.5.28. Relationship between Returns to Investment and Credit/ Owned Capital

SI. No.	Credit */ Owned capital** (in rupees)	Returns to investment (in Rs)	
		Borrower	Non Borrower
1.	<50000	69705.25	33413.85
2.	50000 to 75000	172057.37	74206.84
3.	> 75000	285530.43	120516.77

	Total	**527293.05**	**228137.46**

* Credit refers to borrowers

** Owned capital refers to non-borrowers

From the table it could be observed that the returns are considerably higher in the borrower farm firms because of the investment they made, whereas it was lower in case of the non-borrower farm firms due to the lack of sufficient capital. Feder *et al*., (1991) in a study on "Credit's Effect on Productivity in Chinese Agriculture in China", revealed that an increase in the availability of credit would increase the investment, variable input usage, and output of the households, because it allowed increased production.

Relationship between Returns to Investment and Cropping Intensity

The crop coverage in the farms increased the returns from them due to the increase in the crop yield. Relationship between returns to investment and cropping intensity are presented in the Table 5.29.

Table.5.29. Relationship between Returns to Investment and Cropping Intensity

SI. No.	**Cropping intensity (in percentage)**	**Returns to investment (in Rs)**	
		Borrower	**Non Borrower**
1.	<100	79659.51	31256.45
2.	100 to 200	180471.27	71197.86
3.	> 200	267162.27	125683.15
	Total	**527293.05**	**228137.46**

From the table it could be inferred that as the cropping intensity increased the returns also increased, which was considerably higher in the borrower farms than that of the non-borrower farms.

Relationship between Returns to Investment and Livestock Unit

Higher the livestock available, higher would be the income from them. Thus the livestock and the returns to investment were positively related. Relationship between returns to investment and livestock are presented in the Table 5.30.

Table.5.30. Relationship between Returns to Investment and Livestock Unit

SI. No.	Livestock (in numbers)	Returns to investment (in Rs)	
		Borrower	Non Borrower
1.	<2	98698.26	58696.55
2.	2 to 3	148560.25	12653.58
3.	> 3	280034.54	156787.33
	Total	**527293.05**	**228137.46**

It could be inferred from the table that returns from livestock were higher in the borrower farms as the investment made on livestock was higher than that of the non-borrower farms. Similarly in a study by Gryseels (1975) on "The Role of Livestock in the Generation of Smallholder Farm Income in two Vertisol areas of the Central Ethiopian highlands" revealed that the trade in livestock and livestock products contributed a significant proportion of farm cash income which was approximately 50% of the farm gross margin.

Relationship between Returns to Investment and Labour Usage

Higher the usage of labour on farms, higher would be the returns. Relationship between returns to investment and labour usage are presented in the Table 5.31.

Table.5.31. Relationship between Returns to Investment and Labour Usage

SI. No.	Labour usage (in man days per annum)	Returns to investment (in Rs)	
		Borrower	Non Borrower
1.	<100	98654.09	38478.87
2.	100 to 200	176968.20	79612.06
3.	> 200	251670.76	110046.53
	Total	**527293.05**	**228137.46**

From the table it could be inferred that the returns to investment per farm was considerably higher in case of the borrowers than that of the non-borrowers. Similarly in as study on "The Impact of Institutional Credit on Agricultural Production in Pakistan" by Muhammad *et*

al., (2003) revealed that the labour usage had a positive and statistically significant impact on agricultural production.

Relationship between Returns to Investment and Non-farm Income

Non-farm income also significantly played a major role in determining the returns to investment in both the borrower and non-borrower farms. Higher the non-farm income higher would be the farm investment which ultimately increased the returns to investment. Relationship between returns to investment and non-farm income are presented in the Table 5.32.

Table.5.32. Relationship between Returns to Investment and Non-farm Income

SI. No.	Non-farm income (in rupees)	Returns to investment (in Rs)	
		Borrower	Non Borrower
1.	<25000	98659.63	48569.25
2.	25000 to 50000	184636.20	84755.63
3.	> 50000	243997.22	94812.58
	Total	**527293.05**	**228137.46**

Thus from the table it could be observed that the returns were higher with the borrowers than that of the non-borrowers because of their higher non-farm income.

5.6. Three Stage Least Squares Analysis on Borrower Farm Firms

5.6.1. Factors Influencing Farm Investment on Borrower Farm Firms

The magnitude of influence of various factors on average farm investment on borrowers could be analyzed with the help of a three stage least square analysis in which the amount of average farm investment in Rs per farm (Y_{11}) was the dependent variable while the independent variables were the size of farm holdings (X_{11}) in hectares, the institutional credit in rupees per farm (X_{12}), cropping intensity in percentage per farm (X_{13}), family size in number of persons (X_{14}), livestock unit per farm (X_{15}) in numbers lagged returns to investment from the farm (X_{16}) in rupees, labour usage per farm (X_{17}) in man days per annum and non-farm income (X_{18}) in rupees. Three stage least square analysis results of factors influencing farm investment on borrower farm firms are presented in the Table 5.33.

Table 5.33 Estimates of factors Influencing Farm Investment on borrower farm firms

Variables	Coefficients	Standard Error	t Stat
Intercept	605.2672	488.4732	1.2391
Size of farm holdings (X_{11}) in hectares	3952.5279**	1115.3361	3.5438
Institutional credit (X_{12}) in rupees	1.0989**	0.2881	3.8133
Cropping intensity (X_{13}) in percentage	13.9981*	5.2333	2.6748
Family size (X_{14}) in numbers	-6355.6102**	2143.4724	-2.9651
Livestock unit(X_{15}) in numbers	7452.8936	4317.2644	1.7263
Lagged Returns to investment (X_{16}) in rupees	0.5248**	0.1883	2.7869
Labour usage(X_{17}) in man days per annum	145.4833**	51.9910	2.8443
Non-farm Income(X_{18}) in rupees	0.8433	0.5716	1.4751
R Square	0.7864	-	-
F Value	13.9254	-	-
No of samples	40	-	-

** significant at one per cent level.

* significant at five per cent level.

The results obtained could be expressed in equation form as

$$\mathbf{Y_{11}=605.2672+ 3952.5279X_{11} + 1.0989X_{12} + 13.9981X_{13} - 6355.6102X_{14} +7452.8936X_{15} +0.5248X_{16} + 145.4833X_{17}+0.8433X_{18}}$$

R square = 0.7864

F value =13.9254

N= 40

It could be observed from the above result that the estimated function was valid for interpretation as shown by F statistic which was significant at one per cent level. However, the function had explanatory power, *i.e.*, R square value was 0.7864 which could indicate that 78 per cent of variation in farm investment could be explained by the explanatory variables included in the function. The value of R square and statistically significant value of the intercept would indicate that there might be omission of qualitative variables that could not be measured. It might

be the institutional restrictions, past experience of the famers contributing to farm investment or conditions involving advances made by tie-up sales or combinations of such factors. Further, farm investment would include investment made on different types of assets and each asset had its own influencing factors. For example, purchase of tractors and power tiller was influenced by the demand for custom hire service in the area, while investment on pump-set depended upon rainfall and ground water table. Hence, the difficulty in quantifying and measuring these variables was the reason for their omission.

The coefficients of all the included variables had the expected sign. The size of the holdings, institutional credit in rupees, cropping intensity in percentage, lagged net returns, labour usage and nonfarm income have significantly influenced the total farm investment.

An increase in the size of holding of farm by one hectare would increase the total farm investment by 3952.52 rupees keeping all other factors at constant levels. Thus, the increase in farm size would provide ample scope for investment on farms. The average farm investment would increase by 1.10 rupees for every one rupee increase in the institutional credit by keeping all other factors at constant levels. This emphasized the need for institutional credit for investment on the farms.

The study on "Productivity and farm size in Australian agriculture: reinvestigating the returns to scale" by Yu Sheng *et al.,* (2011). They found that the estimated elasticities of farm output to size category were positive and significant at the 1 per cent level. The magnitude of these estimated elasticities showed that medium and large farms have on average a 0.29 per cent and 0.48 per cent higher output than small farms. Thus larger farms are more productive than smaller ones.

The coefficient of variable family size had a priori negative sign. Thus family size and farm investment would be negatively related. As, family size increased, the consumption expenditure would increase and this reduced the savings and in turn, the capital investment was also been reduced. Thus family size was found to be negatively significant.

Given the area available for cultivation and cropping pattern, cropping intensity was calculated. Due to difficulties in measuring the different crop coverage at farm level, usually it was measured in ratio of gross area cultivated to net area cultivated and expressed in percentage. The average farm investment would increase by 13.99 rupees for one per cent increase in the cropping intensity by keeping all other factors at constant levels. Hence, larger the area cultivated,

larger would be the need for investment. Thus, the percentage share of cropping intensity and average farm investment was positively related.

The average farm investment would increase by 7452.89 rupees for one unit increase in the livestock to the total farm investment. Hence, higher the livestock unit available, higher would be the need for farm investment. The lagged net returns also played an important role in the farm investment. As, the lagged net returns increased, the capital investment has also increased. The average farm investment would increase by 0.52 rupee for every one rupee increase in the lagged returns.

Labour usage also has significantly influenced the average farm investment. From the results it could be observed that one unit increase in the labour usage would increase the average farm investment by 145.48 rupees. Increased labour usage also brought about increased returns from the investment. Thus labour usage and farm investment was positively related and seemed complement to each other.

The average farm investment would increase by 0.84 rupee for one rupee increase in the nonfarm income to the average farm investment by keeping all other factors constant levels. Since the income from other professions like shop keeping, selling flowers vegetables and tailoring also yielded income which could be invested on the farms which brought about better returns. This would emphasize the need of the non-farm income for investment on farms.

Thus, the size of farm holdings, the institutional credit, cropping intensity, livestock unit, lagged net returns; labour usage and non-farm income were the major determinants of total farm investment in borrower farm firms.

The extent of farm investment mainly depended on pattern of investment on farm firms. Investment portfolio was much diversified depending upon the availability of farm specific opportunities and ability to invest. The ability to invest largely depended upon farm income surplus and the extent of credit availed.

5.6.2 Factors Influencing Returns to Investment on Farm Firms of Borrowers

The magnitude of influence of various factors on returns to investment on borrowers could be analyzed with the help of three stage least square analysis in which the returns to investment in rupees per farm (Y_{12}) was the dependent variable while the independent variables

were the average farm investment in rupees per farm (Y_{11}), institutional credit (X_{12}) in rupees, cropping intensity in percentage per farm (X_{13}) , livestock unit per farm (X_{15}) in numbers, labour usage per farm (X_{17}) in man days per annum and non-farm Income (X_{18}) in rupees. Three stage least square analysis results of factors influencing returns to investment on borrower farm firms are presented in the Table 5.34.

Table 5.34. Estimates of factors Influencing returns to investment on borrower farm firms

Variables	Coefficients	Standard Error	t Stat
Intercept	871.9538	548.3296	1.5902
Average farm investment(Y_{11}) in rupees	1.4121**	0.4285	3.2952
Institutional credit (X_{12}) in rupees	1.2468**	0.3647	3.4178
Cropping intensity (X_{13}) in percentage	15.0793*	6.1968	2.4334
Livestock unit(X_{15}) in numbers	1399.9684	793.2731	1.7648
Labour use (X_{17}) in man days per annum	233.2738**	82.9182	2.8133
Non-Farm Income(X_{18}) in rupees	0.2352	0.1689	1.3923
R Square	0.7545	-	-
F Value	16.6698	-	-
No of samples	40	-	-

** significant at one per cent level.

* significant at five per cent level.

The results obtained could be expressed in equation form as

$$\mathbf{Y_{12=}\ 871.9538+\ 1.4121Y_{11}+\ 1.2468\ X_{12}+\ 15.0793X_{13}+\ 6399.9684X_{15}\ +233.2738X_{17}\ +0.2352X_{18}}$$

R square = 0.7545

F value =16.6698

N= 40

It could be observed from the above result that the estimated function was valid for interpretation as shown by F statistic which was significant at one per cent level. However, the

function had explanatory power, *i.e.,* R square value was 0.75 which could indicate that 75 per cent of variation in the returns to investment could be explained by the explanatory variables included in the function.

The results revealed that, average farm investment was found to be significant *i.e*. returns to investment would increase by 1.41 rupee for every one rupee increase in average farm investment keeping other variables at constant levels.

It could be observed that for every one rupee increase in institutional credit and one percent cropping intensity, there was a corresponding increase in returns to investment by 1.24 and 15.07 rupees respectively. These two factors played an important role in obtaining higher returns from investment on farm firms.

Similarly in a study by Muhammad *et al.,* (2004)., on "Institutional Credit, A Policy Tool for Enhancement of Agricultural Income of Pakistan", revealed that credit was an important instrument in enabling farmers to acquire commands over the use of working capital, fixed capital and consumption goods. The regression results revealed that agriculture credit contributed positively and significantly in agricultural income. The estimated elasticity was 0.36.

For every one rupee increase in investment on livestock and labour usage, there was a corresponding increase in returns to investment by 1399.96 and 233.27 rupees respectively keeping other variables constant levels. Thus it could be observed that livestock played a major role in determining the returns to investment. The days were gone where marginal physical product of labour was negative. Today scarcity of labour made the labour usage to contribute positively.

Similar trend was also observed in the case of nonfarm income. The returns to investment increased by 0.23 rupee for every one rupee increase in nonfarm income that is been invested on the farms.

Similar results were obtained by Suryanarayana (1958), while working out a whole farm production function to estimate the returns in Telangana farms. A single production function was used which revealed that gross returns were treated as a function of land-fertility, labour and capital per acre and all these factors were found to be highly significant.

Thus, the average farm investment, the institutional credit, cropping intensity, livestock unit, labour usage and nonfarm income were the major determinants in determining the returns to investment in borrower farm firms.

5.7 Three Stage Least Squares Analysis on Non-Borrower Farm Firms

5.7.1 Factors Influencing Farm Investment on Non-Borrower Farm Firms

The magnitude of influence of various factors on average farm investment on non-borrowers could be analyzed with the help of three stage least squares in which the amount of average farm investment in Rupees per farm (Y_{21}) was the dependent variable while the independent variables were the size of farm holdings (X_{11}) in hectares, the owned capital in rupees (X_{12}), Cropping intensity in percentage per farm (X_{13}), family labour utilization in man days per annum (X_{14}), livestock unit per farm (X_{15}) , Lagged returns to investment per farm (X_{16}) in rupees and nonfarm income (X_{17}) in rupees. Three stage least square analysis results of factors influencing farm investment on non-borrower farm firms are presented in the Table 5.35.

Table 5.35. Estimates of Factors Influencing Farm Investment on Non-Borrower Farm firms

Variables	Coefficients	Standard Error	t Stat
Intercept	493.3281	316.6215	1.5581
Size of farm holdings (X_{11}) in hectares	1301.8263**	438.1925	2.9709
Owned capital (X_{12}) in rupees	1.0748**	0.3017	3.5618
Cropping intensity (X_{13}) in percentage	7.9715**	2.8319	2.8148
Family labour utilization (X_{14}) in man days per annum	119.1833**	36.2821	3.2849
Livestock unit (X_{15}) in numbers	2722.9741*	1457.9290	1.8677
Lagged returns to investment (X_{16}) in rupees	0.7457**	0.2405	3.0999
Non-Farm Income(X_{17}) in in rupees	0.9693	0.8287	1.1696

R Square	0.6454	-	-
F Value	8.2785	-	-
No of samples	40	-	-

** significant at one per cent level.

* significant at five per cent level.

The results obtained could be expressed in equation form as

$$\mathbf{Y_{21=}\ 493.3281 + 1301.8263X_{11} + 1.0748X_{12} + 7.9715X_{13} + 19.1833X_{14} + 2722.9741X_{15} + 0.7457X_{16} + 0.9693\ X_{17}}$$

R square = 0.6454

F value = 8.2785

N= 40

It could be observed from the above result that the estimated function was valid for interpretation as shown by F statistic which was significant at one per cent level. However, the function had explanatory power, *i.e.,* R square value was 0.64 which could indicate that 64 per cent of variation in total farm investment could be explained by the explanatory variables included in the analysis. The value of R square and statistically significant value of the intercept would indicate that there might be omission of qualitative variables that could not be measured. It might be the institutional restrictions, past experience of the famers contributing to farm investment or conditions involving advances made by tie-up sales or combinations of such factors, illiteracy *etc*.

The size holdings, owned capital, cropping intensity in percentage, family labour utilization in man days, livestock unit and lagged returns to investment significantly influenced the average farm investment.

An increase in the size of holding of farm by one hectare would increase the farm investment by 1301.82 rupees by keeping all other factors at constant levels. Thus, the increase in farm size provided ample scope for investment on farms.

The farm investment would increase by 1.07 rupees for every one rupee increase in the owned capital to the average farm investment by keeping all other factors at constant levels. This

emphasized the need for owned funds for investment on farms. The coefficient for owned capital had expected positive sign, and it was statistically significant.

Given the area available for cultivation and cropping pattern, cropping intensity was calculated. Due to difficulties in measuring the different crop coverage at farm level, usually it was measured as the ratio of gross area cultivated to net area cultivated and expressed in percentage. The average farm investment would increase by 7.97 rupees for every one per cent increase in the cropping intensity by keeping all other factors at constant levels. Hence, larger the area cultivated, larger would be the need for investment on farms. Thus, the percentage share of cropping intensity and average farm investment could be positively related.

The farm investment would increase by 119.18 rupees for every one unit increase in family labour utilization to the average farm investment. As, family labour utilization increases, the expenditure on hired labour would decrease and this in turn would increase the capital investment. Thus family labour utilization and total farm investment would be positively related. In the non-borrower farms family labour utilization was higher.

The average farm investment would increase by 2722.97 rupees for every one unit increase in the livestock to the total farm investment. Higher investment in livestock was important because most of the farmers would get better returns from livestock as compared to the income from crops. This emphasized the need to increase the livestock unit to obtain better returns which in turn would be reinvested on farms. Hence, larger the livestock unit, larger would be the farm investment.

The net returns also played important role in the farm investment. As, the net returns increased, the capital investment also increased. As, it could be observed from the analysis, farm investment raised by 0.74 rupees for every one rupee increase in the lagged returns.

The average farm investment would increase by 0.96 rupees for every one rupee increase in the non-farm income to the average farm investment by keeping all other factors at constant levels. Since the income from other activities could also be re-invested on farms. This emphasized the need of the non-farm income for investment on farms.

Thus, the size of farm holdings, owned capital, family labour utilization, cropping intensity, livestock unit, lagged net returns and non-farm income were the major determinants of total farm investment in farm firms in non-borrower farm firms.

5.7.2 Factors Influencing Returns to Investment on Farm Firms of Non-Borrowers

The magnitude of influence of various factors on returns to investment on non-borrowers could be analyzed with the help of three stage least squares in which the returns to investment in rupees per farm (Y_{22}) was the dependent variable while the independent variables were average farm investment (Y_{21}), Owned capital (X_{12}) in rupees, Cropping intensity per farm (X_{13}) in percentage, family labour utilization in man days (X_{14}), livestock unit in rupees (X_{15}) and non-farm income (X_{17}) in rupees. Three stage least square analysis results of factors influencing farm investment on non-borrower farm firms are presented in the Table 5.36.

Table 5.36. Estimates of factors influencing returns to investment on non-borrower farm firms

Variables	Coefficients	Standard Error	t Stat
Intercept	376.6344	406.6886	0.9261
Average farm investment (Y_{21}) in rupees	0.9412*	0.3565	2.6395
Owned capital (X_{12}) in rupees	1.0767**	0.3208	3.3554
Cropping intensity (X_{13}) in percentage	24.3394*	8.9158	2.7299
Family labour utilization (X_{14}) in man days per annum	207.0627**	59.57267	3.4758
Livestock unit (X_{15}) in numbers	1727.3567	866.5813	1.9933
Non-Farm Income(X_{17}) in rupees	0.7922	0.5890	1.3448
R Square	0.6958	-	-
F Value	12.3696	-	-

No of samples	40	-	-

** significant at one per cent level.

* significant at five per cent level.

The results obtained could be expressed in equation form as

$$\mathbf{Y_{22=}\ 376.6344+0.9412Y_{22}+\ 1.0767X_{12}\ +\ 24.3394X_{13}\ +\ 207.0627X_{14}\ \ +\ 3727.3567X_{15}\ +0.7922X_{17}}$$

R square = 0.6958

F value = 12.3696

N= 40

It could be observed from the above result that the estimated function was valid for interpretation as shown by F statistic which was significant at one per cent level. However, the function had explanatory power, *i.e.,* R square value was 0.69 which could indicate that 69 per cent of variation in the returns to investment could be explained by the explanatory variables included in the function.

It could be observed from the regression results that, average farm investment was found to be significant *i.e.,* returns to investment would increase by 0.94 rupees for every one rupee increase in investment on seeds, farm yard manure, fertilizers and pesticides keeping other variables constant levels. Thus, the average farm investment and returns to investment were positively related.

It could be observed that for every one rupee increase in share of owned capital and one percent increase in the cropping intensity, there was a corresponding increase in returns to investment by 1.07 and 24.33 rupees respectively by keeping all other factors at constant levels.

Similar trend was also observed in the case of family labour utilization, because as utilization of family labourers increased in the farm activities, it reduced the cost or expenditure on the hired labourers and in turn increased the returns to investment. Thus for every one unit increase in family labour utilization the returns to investment would increase by 207.06 rupees by keeping all other factors at constant levels.

Similarly, for every one unit increase on livestock, there was a corresponding increase in returns to investment by 1727.35 rupees respectively. Thus it could be observed that livestock

played a major role in determining the returns to investment. Similar trend was also observed in the case of nonfarm income. As the non-farm income increased by one rupee, by way of increasing the average farm investment it would increase the returns to investment by 0.79 rupees.

Thus, the investment on seeds, farm yard manure, fertilizers and pesticides, owned capital, cropping intensity, family labour utilization, livestock unit and non-farm income were the major determinants in determining returns to investment in non-borrower farm firms.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In this chapter, a summary of work done and findings of the study are presented, conclusions are drawn with reference to the objectives of the study and their implications for policy and further research are highlighted.

6.1. Introduction

India needs a sustainable agricultural development. Innovation of approved ways of production and investment on productive assets are the two basic requirements for agricultural development. Technological progress and capital investment are, therefore the powerful instruments for agriculture growth. There is a need for both public and private capital investment and the latter is gaining importance in recent years as farmer's attempt to exploit the potentials of new technologies. The farm investment such as well, farm machineries and equipments, livestock, farm buildings and so on are made to increase the farm income and employment and hence desired by the farmers. However, the farm investments are very costly and hence the investor-farmers especially the small and marginal farmers have to depend upon credit for investments. The large farmers also depend on external source of finance for making heavy investments like digging well, construction of farm buildings and purchase of tractor, oil engine *etc*. Thus, credit plays an important role in farm investment. An investor would like to have an idea of the returns he can get from his investment in any particular enterprise. In this context, it gives how the returns are related with different components of investments made on the farm and also on the optimum allocation of resources between various components of fixed and circulating capital to obtain maximum returns.

6.1.1. Problem Focus

The modern agriculture has increased the usage of inputs especially for seed, fertilizers, irrigational water, machineries, implements *etc.*, which has increased the demand for agricultural credit. The adoption of modern technology, which is capital intensive, has commercialized agricultural production in India. Besides, the farmer's income is seasonal while his working expenses are spread over time. In addition, farmer's inadequate savings require the use of more credit to meet the increasing capital requirements. Furthermore, credit is a unique resource, since it provides the opportunity to use additional inputs and capital items now and to pay for them

from future earnings. Agricultural reforms and increased private investment is must, especially for the small farmers and marginal farmers. This will help the farmers to access the high quality technologies and increase the output with international standards to meet the global market requirements. The farm investment is a complex process owing to many factors such as differences in the types of assets and their gestation period apart from varying lending procedures and recovery methods followed by different lending agencies. In this context, the present study was taken up to evaluate the different impacts of credit or owned capital on farm investment and also on the returns to investment.

6.1.2. Objectives

The overall objective of the study was to analyze the impact of farm finance and investment on profitability of farms. The study was specifically, to identify the determinants of farm investment and the factors influencing returns from investment. Thus the specific objectives were:

1. To analyze the factors determining agricultural investment of the farm firms.
2. To analyze the factors influencing the returns to agricultural investment.
3. To analyze the impact of agricultural investment on profitability of the farm firms.

6.2. Methodology

6.2.1 Sampling

This study was conducted in Annur block of Coimbatore district, Tamil Nadu. In the study block, Pasur, Pogalur, Kunnathur and Allapalayam was purposively selected for the study, as agriculture was the predominant sector in these villages. From each village, twenty samples were collected *i.e.,* ten borrowers and ten non-borrowers were randomly selected. Thus, the sample consists of fourty borrowers and fourty non-borrowers resulting in a total sample size of eighty. Required primary data were collected by personal interview of the selected respondents using a pre-tested questionnaire.

The details regarding category wise distribution of land holdings, asset position, farm size, cropping pattern, livestock value, extent of resources used, costs incurred on fixed and circulating capital, income from various sources like income from livestock, income from crops, non-farm income, sources and pattern of farm investment *etc.*, were collected through

a structured interview schedule. The primary data were processed and analyzed using the appropriate tools like averages, percentages, returns from investment, net cash income, three stage least squares *etc.,* with reference to the objectives of the study.

6.3. Research Findings

The findings of the study are summarized below:

Family Size

Average family size of all the sample farms was 4.08. The average size of family was the larger in the non-borrower (4.15) households as compared with that of the borrower (4.02) households. The relatively larger family size of non-borrower households might be a cause for the reduced investment, because as the family size increased the consumption expenditure also gets increased thereby reducing the credit worthiness.

Educational Status

The literacy level was the highest in the borrowers as compared to the non-borrowers. The total literacy level was higher in borrower households (95.00 per cent) than the non-borrower households (85.00 per cent). Thus, educational status of the farmers was high enough to expect rational decisions on farming.

Land Holding Pattern

The average size of land holding was higher in borrowers (2.42 ha) than that of the non-borrowers (1.79 ha). On an average, the land holding size was 2.10 hectares of all the sample farms in the study area. The area under garden land was higher in borrowers than that of the non-borrowers. Thus, the effect of institutional finance on the expansion of garden land was relatively higher than that of the non-institutional borrowing.

Asset Position

The per hectare average value of land was higher in borrowers (Rs.12.40 lakh per ha) than that of the non-borrowers (Rs.11.93 lakh per ha). The total value of livestock was also higher in borrowers (Rs.28950 per farm) when compared with that of non-borrowers

(Rs.22437.50 per farm). The value of the fixed assets including the livestock was higher in the borrower farms (Rs.182562.50) than that of the non-borrower farms (Rs.109194.80).

Cropping Pattern and Cropping Intensity

The cropping pattern of the sample farms showed that in the borrower farms turmeric was largely cultivated and it was followed by banana, curry leaves, maize and onion where as in the case of non-borrower farms fodder sorghum was largely cultivated followed by banana, turmeric, curry leaves and onion. The cropping intensity showed that the borrower farms had higher cropping intensity (130.34 per cent) than that of non-borrower farms (119.24 per cent).

Income Distribution

The gross income was found to be the highest in the borrower farms (Rs.314301.07) than that of the non-borrower farms (Rs.208116.40).

Sources of Farm Investment

The sources of finance which were borrowed by the borrowers in the study area are grouped into commercial banks, cooperatives, RRB's, friends and relatives, and money lenders. Among these different sources, commercial banks (55.00 percent) contributed major share in the farm investment as compared to the other sources of finance. It was followed by regional rural banks (15.00 per cent), co-operatives (15.00 per cent), friends and relatives (12.50 per cent) and money lenders (2.50 percent) to the total farm investment in the borrower's farm firms. Whereas non-borrowers made their investment on farms from various sources of income like income from crops and livestock, owned funds, savings from non-farm income *viz.*, petty shops, machineries, teacher *etc.*, and from off-farm incomes *viz*., agricultural labourers *etc*.

Pattern of Farm Investment

The annualized investment made on the fixed assets was higher in borrower farms (Rs.28774.88), whereas it was lower in case of the non-borrower farms (Rs.14825.13). Similarly the investment made on the working assets per hectare was also higher in borrower farms (Rs.67636.49) than that of the non-borrower farms (Rs.52432.30). Overall the total investment was higher in the borrower farms (Rs.96411.36) where as in the non-borrower farms it was (Rs.80665.25).

Returns to Investment ratio per Hectare

Returns from investment were higher in the borrower farms as the returns from investment ratio was 1.61, whereas in case of the non-borrowers it was 1.15.

Net Cash Income per Hectare

The net cash income obtained was higher in the borrower farms (Rs.154818.76) than that of the non- borrower farms (Rs. 92980.67).

Three Stage Least Squares

Three stage least squares analysis was taken up for the borrower and non-borrower farm firms separately. Two categories namely determinants of average farm investment and determinants of returns to investment were analysed for borrower and non-borrower farm firms seperately.

Borrower Farm Firms

The results of the three stage least squares analysis to assess the determinants of average farm investment in the borrower farm firms revealed that the size of farm holdings, the institutional credit, cropping intensity, livestock unit, lagged returns from the farm, labour usage and non-farm income significantly and positively influenced the average farm investment. The variable family size was found to have a negative impact on average farm investment, because as, the family size increased, the consumption expenditure also increased and thus reduced the savings and in turn, the capital investment was also been reduced. Thus family size and farm investment was negatively related.

The results of the three stage least squares analysis to assess the determinants of returns to investment in borrower farm firms revealed that the average farm investment, institutional credit, cropping intensity, livestock unit, labour usage and non-farm income significantly and positively influenced the returns to investment.

Non-borrower Farm Firms

The results of the three stage least squares analysis to assess the determinants of average farm investment in the non-borrower farm firms revealed that the size of farm holdings, owned capital, cropping intensity, family labour utilization, livestock unit, lagged returns from the farm and non-farm income significantly and positively influenced the average farm investment.

The results of the three stage least squares analysis to assess the determinants of returns to investment in non-borrower farm firms revealed that average farm investment, owned capital, cropping intensity, family labour utilization, livestock unit and non-farm income significantly and positively influenced the returns to investment.

6.4 Conclusions

The research findings of the study lead to the following conclusions:

The value of the assets in borrower farms was higher than that of the non-borrowers. This was due to larger farm investment (in which the major share was from institutional credit) in the borrowers than that of the non-borrowers.

The institutional credit also helped on costly investments like drip irrigation, farm buildings and farm machineries in borrower farms, while the non-borrowers made lesser investments on these assets as compared to the borrowers, due to non-borrowing of credit from any source of finance and due to the usage of owned capital which was lesser.

Also the investment made on circulating capital varied between the borrowers and non-borrowers. This circulating capital brought greater difference on the productivity of the crops, the reason was that timely and adequate availability of inputs always brought better results on the farms. Due to the availability of the crop loan, borrowers were able to gain higher production and better profit.

The three stage least square analysis was taken up for the borrower and non-borrower farms separately with the view to determine the factors influencing farm investment. It was inferred that the coefficients of independent variables such as size of farm holding, institutional credit in borrowers and owned capital in non-borrowers, livestock unit, labour usage, family labour utilization, cropping intensity, lagged net returns, and nonfarm income were found to have positive impact on farm investment and also found to be statistically significant. The coefficient of the family size in the borrower farms was found to have a negative impact on farm investment, because as the family size increased, the consumption expenditure increased and this reduced the savings and in turn, the capital investment would also been reduced.

Similarly the three stage least square analysis was taken up for the borrower farms and non-borrower farms separetely with the view to determine the factors influencing returns to investment. It

was inferred that the coefficients of independent variables such as average farm investment, labour usage, family labour utilization, institutional credit in borrowers and owned capital in non-borrowers, cropping intensity, livestock unit and nonfarm income were found to have positive impact on the returns to investment and also found to be statistically significant.

6.5 Policy Implications

Based on the analytical results and the established conclusions, the following policy prescriptions were drawn.

- Investment augmenting area like drip irrigation and livestock ranks first among different types of investment. This should, therefore, find top priority in institutional credit supply.
- Research efforts to evolve a suitable cropping pattern for this area for the maximum utilization of the resources are necessary.
- The crop loans aided the farmers in the timely application of required quantities of inputs like high yielding variety seeds, farm yard manure, fertilizer, human labour and machine power for cultivating commercial crops like turmeric, banana *etc*. The net returns obtained from these crops were also higher in the borrower farms than that of the non-borrower farms. Hence, bankers may take up lending activity to help in cultivation of these crops on a large scale.
- Rigid lending procedures, non-flexibility of repayment schedule and demanding of high valued securities were expressed as problems faced by the borrowers. The financial institutions could make an attempt to solve these problems so that more number of small and marginal farmers could be covered.
- Rapid implementation of schemes like Kisan Credit Card (KCC) scheme and Mobile Banking will help in the increased coverage of farmers under institutional credit.
- The Scale of Finance may be reviewed and reconstructed
- In few cases of the borrowers a portion of the loan given for production purpose was diverted for consumption purposes. So special interest should be given for the consumption loans.

Above all the farmers must come forward to make the best use of the facilities provided by the Government. This involves conscious efforts on management of credit and investment planning on the part of the farmers. Extension efforts should be geared towards this end to achieve a higher growth in agriculture.

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APPENDIX I

Ratio of Institutional Credit to Private Gross Capital Formation in Agriculture and Allied Sectors

Year	Current Prices (Rs crores)		
	Institutional Credit	Private GCF	Ratio of Credit to Private GCF
2000-01	52827	38558	1.37
2001-02	62045	51283.87	1.21
2002-03	69560	52317.3	1.32
2003-04	86981	49248.12	1.76
2004-05	125309	55773.8	2.24
2005-06	180485	65690.44	2.74
2006-07	229400	74649.85	3.07
2007-08	254658	82004.69	3.11

Source: Central Statistical Organization, Government of India.

APPENDIX II

Gross Capital Formation in Agriculture and Allied Sectors

Year	Current Prices (Rs crores)		
	Public	Private	Total
1990-91	3586	12253	15839
1991-92	3608	8283	11891
1992-93	4116	12522	16637
1993-94	4874	11356	16230
1994-95	5952	11440	17392
1995-96	6678	13160	19838
1996-97	7214	16892	24107
1997-98	6779	21922	28701
1998-99	7476	23544	31021
1999-2000	8668	41483	50151
2000-01	8176	38558	46734
2001-02	10354	51284	61638
2002-03	9565	52317	61882
2003-04	12219	49248	61467
2004-05	16031	55774	71805
2005-06	20634	65690	86324
2006-07	25472	74650	100122
2007-08	33422	82005	115427

Source: Central Statistical Organization, Government of India.