ECONOMICS OF DIFFERENT INTEGRATED FARMING SYSTEMS AND THEIR IMPACTS ON EMPLOYMENT AND LIVELIHOOD IN EASTERN DRY ZONE OF KARNATAKA STATE

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CERTIFICATE

This is to certify that the thesis entitled **"Economics of different integrated farming systems and their impacts on employment and livelihood in Eastern dry zone of Karnataka state"** submitted by **Mrs. Rajeshwari.S. M., ID No. PALB 1104** in partial fulfillment of the requirements for the degree of **Master of Science** in **Agricultural Economics** of the University of Agricultural Sciences, Bangalore, is a record of *bonafide* research work done by her during the period of her study in this University under my guidance and supervision and the thesis is not previously formed the basis of the award of any degree, diploma, associateship, fellowship or similar titles.

Bangalore
26 Feb, 2013

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March, 2013 *(Rajeshwari. S. M.)*

Economics of different integrated farming systems and their impacts on employment and livelihood in eastern dry zone of Karnataka state

Abstract

The focus of the study is to analyze different integrated farming systems and their impacts on employment generation, income level and food security status among different categories of farmers. The study is based on enumeration of 90 households in Venkatenahalli village located in eastern dry zone of Karnataka. The key farming systems identified are: crops alone (FS1), crops with livestock (FS2), crops, livestock and sericulture (FS3), crops, livestock, sericulture and horticulture (FS4). The results revealed that the income level realized by the present employment level is very poor in the study area. Marginal farmers with average family size of 4 members earn INR. 10200. The FS1 farmers accounted for minimum of INR. 10200 for their farm work. FS2 farmers worked for INR.12000, FS3 farmers for INR. 24300 and FS4 farmers for INR. 27600. It was observed that the per capita percentage food expenditure decreased over the farming groups. An individual from FS1 spent Rs.256.07 (23.16 percent) per month, FS2 individual spent Rs. 259.98 (23.52 percent), FS3 individual per month expenditure on food was Rs. 285.52 (25.81 percent) and FS4 farmer spent highest of Rs. 304.15 (27.51 percent) per month on food. Therefore the expenditure on food items was directly proportional to the integration in farming systems and income levels. The results were in conformity with the Engel's law for food in general and cereals in particular. The percentage of expenditure on high value food items like milk, meat, egg and fruits increased as the income increased across farming groups.

Date:21/03/2013 Place: Bangalore	Signature of the student	Dr. T.N. Prakash Kammaradi Major Advisor

ಕರ್ನಾಟಕ ರಾಜ್ಯದ ಪೂರ್ವ ಶುಷ್ಕ ವಲಯಗಳಲ್ಲಿ ವಿವಿಧ ಸಮಗ್ರ ಕೃಷಿ ಪದ್ಧತಿಗಳು ಹಾಗು ಉದ್ಯೋಗ ಮತ್ತು ಜೀವನಶೈಲಿಯಲ್ಲಿ ಅವುಗಳ ಪರಿಣಾಮಗಳ ಆರ್ಥಿಕ ವಿಶ್ಲೇಷಣೆ

ರಾಜೇಶ್ವರಿ.ಎಸ್.ಎಂ.

ಸಾರಾಂಶ

ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಲ್ಲಿ ವಿವಿಧ ಸಮಗ್ರ ಕೃಷಿ ಪದ್ಧತಿಗಳು ಹಾಗು ವಿವಿಧ ಸ್ತರದ ರೈತರಲ್ಲಿ ಉದ್ಯೋಗ ಸೃಷ್ಟಿ, ಆದಾಯ ಮತ್ತು ಆಹಾರ ಭದ್ರತೆಯಲ್ಲಿ ಸಮಗ್ರ ಕೃಷಿ ಪದ್ಧತಿಯ ಪಾತ್ರಗಳು ಮತ್ತು ಪರಿಣಾಮಗಳೆಡೆಗೆ ಬೆಳಕು ಚೆಲ್ಲಲು ಪ್ರಯತ್ನಿಸಲಾಗಿದೆ. ಈ ಅಧ್ಯಯನವು ಕರ್ನಾಟಕದ ಪೂರ್ವ ಶುಷ್ಕ ವಲಯಕ್ಕೆ ಸೇರಿದ ವೆಂಕಟನಹಳ್ಳಿ ಗ್ರಾಮದಲ್ಲಿ ೯೦ ಕುಟುಂಬಗಳ ಮೇಲೆ ನಡೆಸಿದ ಸಮೀಕ್ಷೆಯ ಮೇಲೆ ಆಧಾರಿತವಾಗಿದೆ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಗುರುತಿಸಲಾದ ಪ್ರಮುಖ ಕೃಷಿ ಪದ್ಧತಿಗಳೆಂದರೆ: ಕೇವಲ ಬೆಳೆಗಳು (FS1), ಬೆಳೆಗಳೊಂದಿಗೆ ಜಾನುವಾರು ಸಾಕಣೆ (FS2), ಬೆಳೆಗಳೊಂದಿಗೆ ಜಾನುವಾರು ಸಾಕಣೆ ಮತ್ತು ರೇಷ್ಮೆ ಕೃಷಿ (FS3), ಬೆಳೆಗಳೊಂದಿಗೆ ಜಾನುವಾರು ಸಾಕಣೆ, ರೇಷ್ಮೆ ಕೃಷಿ ಮತ್ತು ತೋಟಗಾರಿಕೆ ಬೆಳೆಗಳು (FS4). ಅಧ್ಯಯನದ ಫಲಿತಾಂಶಗಳಿಂದ ತಿಳಿದುಬಂದದ್ದೇನೆಂದರೆ ಅಧ್ಯಯನ ಪ್ರದೇಶದಲ್ಲಿ ಪ್ರಸ್ತುತ ಉದ್ಯೋಗಾವಕಾಶಗಳು ತುಂಬಾ ಕೆಳಮಟ್ಟದಲ್ಲಿದ್ದು ೪ ಜನರಿರುವ ಸಣ್ಣ ರೈತ ಕುಟುಂಬಗಳು ೧೦೨೦೦ ರೂಪಾಯಿಗಳ ಆದಾಯವನ್ನು ಹೊಂದಿವೆ. FS1, FS2, FS3 ಮತ್ತು FS4 ಕೃಷಿ ಪದ್ಧತಿಯನ್ನು ಅನುಸರಿಸುತ್ತಿರುವ ರೈತರು ತಮ್ಮ ಬೇಸಾಯದಿಂದ ಕ್ರಮವಾಗಿ ೧೦೨೦೦, ೧೨೦೦೦, ೨೪೩೦೦ ಮತ್ತು ೨೭೪೦೦ ರೂಪಯಿಗಳಷ್ಟು ಕನಿಷ್ಟ ಆದಾಯವನ್ನು ಹೊಂದಿದ್ದಾರೆ. ಗಮನಿಸಲಾದ ಅಂಶವೆಂದರೆ ರೈತ ಸಮುದಾಯಗಳಲ್ಲಿ ಶೇಕಡಾ ತಲಾವಾರು ಆಹಾರ ವೆಚ್ಚವು ರೈತ ಸಮುದಾಯದಿಂದ ಸಮುದಾಯಕ್ಕೆ ಕಡಿಮೆಯಾಗುತ್ತಿದೆ. FS4 ಪದ್ಧತಿಯನ್ನು ಅನುಸರಿಸುವ ಕುಟುಂಬದಲ್ಲಿ ಒಬ್ಬ ವ್ಯಕ್ತಿ ಒಂದು ತಿಂಗಳಿಗೆ ಅತಿ ಹೆಚ್ಚು ಅಂದರೆ ೩೦೪.೧೫ ರೂ. (ಶೇ. ೨೭.೫೧) ಗಳನ್ನು ತಮ್ಮ ಆಹಾರದ ಅವಶ್ಯಕತೆಗಾಗಿ ವ್ಯಯಿಸುತ್ತಾನೆ, FS3 ಪದ್ಧತಿಯನ್ನು ಅನುಸರಿಸುವ ಕುಟುಂಬದಲ್ಲಿ ವ್ಯಕ್ತಿಯೊಬ್ಬನ ಆಹಾರದ ಖರ್ಚು ೨೮೫.೫೨ ರೂ (ಶೇ. ೨೫.೮೧) ಗಳಾಗಿದೆ, ಹಾಗೆಯೆ FS2 ಪದ್ಧತಿ ಅನುಸರಿಸುವ ಕುಟುಂಬದಲ್ಲಿ ವ್ಯಕ್ತಿಯೊಬ್ಬ ೨೫೯.೯೮ ರೂ (ಶೇ. ೨೩.೫೨) ಗಳನ್ನು ವ್ಯಯಿಸುತ್ತಾನೆ ಹಾಗು FS1 ಪದ್ಧತಿಯನ್ನು ಅನುಸರಿಸುವ ಕುಟುಂಬದ ವ್ಯಕ್ತಿ ಅತಿ ಕಡಿಮೆ ಅಂದರೆ ೨೫೬.೦೭ ರೂ (ಶೇ. ೨೩.೧೬) ಗಳನ್ನು ಆಹಾರಕ್ಕಾಗಿ ವಿನಿಯೊಗಿಸುತ್ತಾನೆ. ಆದ್ದರಿಂದ ಈ ಸಮೀಕ್ಷೆಯ ಫಲಿತಾಂಶಗಳ ಪ್ರಕಾರ ರೈತ ಕುಟುಂಬದ ಆಹಾರದ ವೆಚ್ಚಗಳು ಸಮಗ್ರ ಕೃಷಿ ಪದ್ಧತಿ ಮತ್ತು ಕುಟುಂಬದ ಆದಾಯದೊಂದಿಗೆ ನೇರ ಅನುಪಾತ ಮತ್ತು ಸಂಬಂಧವನ್ನು ಹೊಂದಿರುತ್ತದೆ ಎಂದು ತಿಳಿದುಬಂದಿದೆ. ಈ ಸಂಶೋಧನೆಯ ಫಲಿತಾಂಶಗಳು ಸಾಮಾನ್ಯವಾಗಿ ಆಹಾರ ಮತ್ತು ನಿರ್ದಿಷ್ಟವಾಗಿ ಹೇಳುವುದಾದರೆ ಧಾನ್ಯಗಳ (Cereals) ಬಗ್ಗೆ 'ಎಂಜೆಲ್' ರವರ ತತ್ವವನ್ನು (Engel's law) ಪುಷ್ಟೀಕರಿಸುತ್ತವೆ. ರೈತ ಕುಟುಂಬಗಳಲ್ಲಿ ಆದಾಯ ಹೆಚ್ಚಿದಂತೆ ಹೆಚ್ಚಿನ ಮೌಲ್ಯಯುತ ಆಹಾರಗಳಾದ ಹಾಲು, ಮೊಟ್ಟೆ, ಮಾಂಸ ಮತ್ತು ಹಣ್ಣು ಹಂಪಲುಗಳನ್ನು ಕೊಳ್ಳಲು ವಿನಿಯೋಗಿಸುವಲ್ಲಿ ಶೇಕಡಾವಾರು ಏರಿಕೆ ಕಂಡುಬರುವುದನ್ನು ಈ ಸಂಶೋಧನಾ ಅಧ್ಯಯನ ಧೃಢೀಕರಿಸಿದೆ.

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Introduction

I. INTRODUCTION

1.1 Problem statement

Agriculture sector continues to be the lifeline of the Indian economy since agriculture supports 60 % of the population, contributing nearly 16% to the GDP (India, 2005). This decline in the share of agriculture in the country's Gross Domestic Product should not normally be a cause of concern for a country that is becoming industrialized. What is alarming is that this small share of income has to support a large percent of the population resulting in inequality in distribution of National Income. This also explains the higher incidence of poverty in the rural areas where the high level of dependence on agriculture has led to unemployment and under employment.

Of the estimated 143 million hectare net cultivated area in India, about 97 million hectare (68%) is dry land producing 44% of the country's food requirements and supporting 40% of human and 60% of livestock population (NBSSLUP, 2011). Even when the full irrigation potential of 139.5 million hectare is realized by 2050 in agriculture, 75 million hectares will continue to be solely dependent upon rainfall. About 15 million hectare of dry land lies in the arid region and receives less than 500 mm rainfall, another 15 million hectare is in 500-700 mm rainfall zone, 42 million hectare is in 750-1150 mm rainfall zone and remaining 25 million hectare receives >1150 mm rainfall per annum (USDA, 2011). Of the 97 million farm holders, 76% are small (<2 hectare) and marginal, cultivating only 29% of the consolidated and scattered arable land.

Hence, farmer's dependence on livestock besides arable farming, as an alternative source of income is imminent. Preliminary estimates revealed that nearly two out of the three heads of cattle population of 219 million thrive in the Indian dry lands (FAO, 2010). Further, resource poor

farmers, poor infrastructure and low investment in technology input characterize the Indian dry lands.

Land being the most limited and scarce resource, particularly on small and marginal farms, the scope to increase farm income, family food security and employment through crop production alone is not too bright. Therefore, one has to look for alternatives in order to get assured increase in the income and employment of the weaker sections. In this regard, integrated farming system is the only answer in which livestock, poultry, piggery and other allied activities are regarded as the important components. Therefore under such circumstances, to ensure a regular employment and income for decent living and to achieve food security, farmers have to undertake some land based enterprises which will complement existing farming activity to get more income leading to social and economic upliftment (Behera *et al*, 2001).

Farming System:

Farming System may be defined as the approach, which involves the allocation of available resources of a farm to the production enterprises in the manner that helps the attainment of the goals of maximization of farm income and employment. The ultimate goal of sustainable agriculture is to develop appropriate farming system that are productive and profitable, conserve the natural resource base, protect the environment and enhance health and safety.

In the farming system approach, different enterprises compete for the scarce resources such as land, labor and capital on the farm and also they exhibit interdependence due to supplementary or complementary relationship. Thus, it is necessary to deal with whole farm approach to minimize risk and increase the production and profit. To put this concept effectively into practice it is necessary to understand

the linkages and the mutual synergies of different enterprises in various farming system.

Thus, farming system is the result of interaction among several interdependent components. The farmer allocates certain quantities and qualities of the four factors of production, to which he has access, to the three processes i.e. crop, livestock and off-farm enterprises in a manner which given the knowledge they possess, helps in attaining the set goals (Norman, 1978).

Integrated Farming System:

At present, the farmers concentrate mainly on crop production which is subjected to a high degree of uncertainty in income and employment to the farmers. In this contest, it is imperative to evolve suitable strategy for augmenting the income of a farm. Integration of various agricultural enterprises *viz.*, cropping, animal husbandry, fishery, forestry etc. have great potentialities in the agricultural economy. These enterprises not only supplement the income of the farmers but also help in increasing the family labor employment.

The integrated farming system approach introduces a change in the farming techniques for maximum production in the cropping pattern and takes care of optimal utilization of resources. The farm wastes are better recycled for productive purposes in the integrated system. A judicious mix of agricultural enterprises like dairy, poultry, piggery, fishery, sericulture etc. suited to the given agro-climatic conditions and socio-economic status of the farmers would bring prosperity in the farming.

Integrated farming systems and food security:

In early years of 19th century, majority of the Indian farmers practiced agriculture as subsistence farming. Subsistence agriculture is

self-sufficiency farming in which the farmers focus on growing enough food to feed themselves and their families. The typical subsistence farm has a range of crops and animals needed by the family to feed and clothe themselves during the year. Planting decisions are made principally with an eye toward what the family will need during the coming year, and secondarily toward market prices.

Today, due to the development in agricultural practices, farmers are adopting diversified/ integrated farming systems which are more of 'market driven' approach compared to the former. Farmers need to depend on market to buy necessary food items to attain family food security. The consumption and expenditure pattern on food items varies across various integrated farming systems. The expenditure on disease and illness consumes a major portion of the farm family income. The farm families adopting integrated farming systems have access to different food groups on farm, which helps them to achieve food and nutrition security.

Disease and sickness have been a part of mankind's progress through the ages, malnutrition and poor sanitation were the dominant hazards (about 17% of total deaths), responsible for almost quarter of the global disease burden (Lopez, 2001). Health expenditure, private (% of GDP) in India was 2.80 as of 2009. Its highest value over the past 14 years was 3.58 in 2002, while its lowest value was 2.80 in 2009. Studies have revealed that the financial burden of households in meeting their health care needs is substantial. Households spend between 4 to 7 times of what the State spends on health care services. This is not a very happy state of affairs considering the fact that more than half the country's population has resources that barely meet their food requirements. When illness strikes, it necessarily eats into food consumption, and worsens

the capacity to earn if the patient happens to be a breadwinner and when he is severely impaired.

There have been many studies on different farming systems done in the past. But till now, no comprehensive study has been made for identification and economic appraisal of various farming systems and their impact on income, employment, food security and sustainable livelihood. With this background this study is a modest attempt in addressing the economic impact of various farming systems on income, food security and employment status. The specific objectives of the study include,

Objectives:

1. To analyze the economics of different integrated farming systems and their impacts on employment and livelihood.
2. To analyze expenditure and consumption pattern of different food groups.
3. To estimate the expenditure on health care and major, minor illness.
4. To study the farmer's perception towards integrated farming systems potentials in ensuring employment and livelihood security.

Hypotheses:

1. a. Majority of the farmers have adopted economically viable integrated farming systems.

   b. The existing/present farming systems ensured adequate returns supporting both employment and sustainable livelihood.

2. a. There is no significant difference in expenditure and consumption pattern of cereals and pulses among different groups.

   b. There is no significant difference in consumption expenditure pattern of fruits, vegetables, milk and meat (protective foods) among different groups.

3. Farmer's practicing highly integrated farming system's expenditure towards health care, major, minor illness is more compared to farmers practicing low or no integration in farming system.

4. The farmers are well aware about the benefits and practicing of integrated farming systems.

Review of Literature

II. REVIEW OF LITERATURE

This chapter provides the synthesis of latest reviews relating to the study objectives, these are classified based on the study objectives and presented in the following themes.

2.1 Integrated farming systems and its impacts

2.2 Income and employment generation in different farming systems

2.3 Income and expenditure elasticities of consumption

2.4 Health expenditure

2.5 Theoretical framework- Sustainable livelihoods approach

2.1 Integrated farming systems and its impacts:

Shanner *et al* (1982) defined farming system as an approach to agriculture research and development and views the whole farm as a system and focuses on (i) the interdependencies between the components under the control of members of household and (ii) how these components interact with the physical, biological and socioeconomic factors, which is not under the control of households.

Maji (1991) referred farming system specifically to a crop combination or enterprise mix in which the products and or the by products of one enterprise serves as input for the production of other enterprise(s). It takes into account the consumption needs of the family, the economic factors like relative profitability of the technically feasible enterprises, availability of farm resources, infrastructure and institutions such as irrigation, marketing facilities including storage and transportation and credit, besides the agro biological considerations,

namely, interdependence if any among the various enterprises and the preferences of the individual farmers.

Deoghare *et al.* (1991) defined farming system as the entire gamut of all farm activities and related decisions with regard to development, management and allocations of all the farm resources, which within the operational units or within the combination of such units results in maximum agricultural production. It involves all-out integrated efforts for improvement of use of farm resources such as land, labour, and capital etc. through their efficient utilization to maximize farm returns.

Yokoyama *et al*, (1998), analyzed the impact of fruit tree incorporation into farming systems on employment and income in the hill region of Nepal, by applying the Gini decomposition analysis as a case study. In the study village, the introduction of orange production reduced employment opportunities in farming by 10% as a whole. The effect was most conspicuous for female labor (both family and hired) which decreased by 20%, while the use of hired male labor increased by 10%. It appears that the farm size was the major factor for the introduction of orange cultivation. Neither human resources (both quantity and quality) nor direct access to cash affected the dissemination of orange cultivation. Income from orange farming accounted for 44% of the total household income and for 56% of the total income inequality. Replacement of traditional upland crops by commercial orange may have worsened the income distribution, though absolute income increase might be significant. No villagers participated in marketing activities of orange, which has a large potential of employment and income generation. To further promote rural development focusing on the poor, use of labor for post-harvest activities such as marketing and processing is recommended.

According to Brent *et al* (2006), **A**groforestry is an ancient land use practice and modern science involving the deliberate management of trees on farms and in surrounding landscapes and an integral part of a farming system. With appropriate technical and institutional support, the practice of agroforestry can contribute to rural food and health systems and help buffer households against health and nutrition shocks. As a science, agroforestry integrates perspectives from agriculture, ecology, and rural development. For the practice of agroforestry to yield its full potential, it needs to bring health and nutrition to the fore. Their study focuses on conceptual framework of agroforestry, health, and nutrition linkages that focuses on five pathways between agroforestry and health, dubbed the MINER pathways: M—medicinal plant conservation, domestication, and propagation; I—income earned and inputs saved through improvements in the farm resource base and products for sale; N—nutritious agroforestry foods, including fruits and leaves; E—changes in ecosystem structure and function that affect disease risk and transmission; and R—responses of agroforestry priorities and program design to changes in farmers' circumstances resulting from health and nutrition problems.

According to Timothy *et al* (2006), Farming systems rich in agro biodiversity are characterized by a range of crops, many of which may be represented by numerous traditional varieties even in the same field. Agro biodiversity used and conserved in a livelihood context can directly contribute to nutrition, health, and income generation. Health and prosperity linked to robust sociocultural institutions, in turn, help individuals and populations make healthy behavioral choices, and help institutions develop public policies that maintain the diversity and health of ecosystems. Utilizing and encouraging agro biodiversity requires viable markets, which depend on demand from consumers, which in turn

translates into opportunities for income generation and improved livelihoods for rural farmers.

International Livestock Research Institute (2006) conducted a study on Impact of livestock production on human health and nutrition, understanding of the links between livestock keeping and the health and nutrition of poor people, particularly those engaging in smallholder livestock production and marketing. Livestock production along with farming was found beneficial in terms of improved health, nutrition and additional income to the farmers with fewer inputs.

2.2 Income and employment generation in different farming systems:

Rajbanshi and Shreshtha (1980), based on their study on the economics of integrated farming systems in Nepal for a period of two years, opined that in the first year the farmer concentrated on cereal crops while in the second year he added piggery, combined duck raising with fish culture and used improved varieties of cereals. The first year income was Rs.9,058 while that of second year turned out to be Rs.10,592 from crops and a total of Rs. 15,660 from duck-fish culture.

Rangaswamy *et al*. (1992) in a study to evolve a economically viable and sustainable farming system for small and marginal farmers in rice based wetlands of Coimbatore opined that the net profit worked out under integrated farming system was 100 per cent higher than the conventional cropping systems followed in these wetlands. The additional employment generated through integrated farming system over conventional cropping system was 48 per cent higher. They finally concluded that farming system, comprising crops, poultry, fisheries and mushroom production enhanced the net income of the low land rice farmers.

Jayaram *et al*. (1993) conducted a study on the feasibility and economics of integrated fish culture. Results revealed that the integrated fish culture system was found to be profitable small-scale system. The total returns and returns less total cost were Rs.20,848 and Rs.5,290, respectively. The system also generated 92 mandays of employment.

Koppad and Khan (1996) made a comparative economic analysis of two farming systems *viz*., maize-wheat and maize-sunflower on large farmers in Malaprabha command area, Karnataka. Comparison of resource use pattern showed that human and bullock labour were higher in the maize-sunflower system, while use of fertilizers was higher in maize-wheat system.

Korikanthimath *et al*. (1996) conducted a study for three years on mixed cropping of *Arabica* coffee with cardamom verses sole crop of arabica coffee. The study revealed that the cost of cultivation was higher in mixed cropping than mono-cropping. The highest net returns of Rs.2,02,690 per hectare was realized in mixed cropping due to a bumper crop of cardamom when averaged over three years; the returns of mixed cropping were 4.04 times greater than those of mono-cropping.

Korikanthimath *et al*. (1997) in their study carried out on mixed cropping of *Areca catechu* and cardamom in comparison with mono-culture of *Areca catechu* concluded that the cost of cultivation was higher in mixed cropping than under mono-culture and correspondingly, the net return realised in mixed cropping was also 1.56 times higher than in mono-culture. The incremental net gain in mixed cropping was Rs.58, 211 per hectare. Benefit cost ratio was higher by 1.01 times under mixed cropping compared with monoculture.

Ganesh (2000) made an evaluation of alternative farming systems in Gazani lands of coastal Karnataka *viz*., paddy cultivation, paddy cum

prawn farming and mixed farming. The study revealed that highest net income was realized from mixed farming in small and large farms Rs.2,52,495 and Rs.2,27,082 respectively.

Alagumani and Anjugam (2000) in their study on impact of dairy enterprises on income and employment in Madhurai district of Tamil Nadu found that about 57 per cent of the farm households were engaged in dairy enterprises and 43 per cent of them were having both crop and livestock enterprise. Additional income and employment generated per household were Rs.4900 and 365 mandays, respectively.

Rajeshwari (2004) in her study carried out on coconut based farming system in Tumkur district of Karnataka, opined that the net farm income was higher in Farming System- V (coconut, arecanut, ragi and dairy), but the generation of employment, both human and bullock, were high in Farming System-II (coconut, greengram, *rabi* ragi, dairy) as farmers were taking up labour intensive enterprises under this farming system.

2.3 Income and expenditure elasticities of consumption:

National Council of Applied Economic Research (1962), estimated income elasticities of demand using the data of the household consumption survey. The estimated income elasticities of demand for rice, wheat and jowar were 0.24, 0.75, and -0.39 respectively in the rural areas. The corresponding figures for urban areas were 0.13, 0.18 and -0.86. The elasticity co-efficient were higher in rural areas as compared to urban areas. Jowar was found to be an inferior cereal in both rural and urban areas.

Anthonia (1967) estimated income elasticity for various food items. He reported that an income elasticity of 0.603 for some of the food items such as for animal protein, 0.673 for fruits and nuts, 0.426 for vegetable

and 0.429 for staples. The results of the study indicated that about 60 percent of monthly income is spent on food items.

Radhakrishna and Murthy (1973) analyzed the consumption patterns for broad groups either by the Linear Expenditure System (LES) or by the Frisch's method based on computation of all direct and cross price elasticities under conditions of want independence. It was found that price elasticities, both direct and cross, are close to those given by the LES for comparable groups in the case of urban areas and they differ slightly in case of rural areas.

Molla *et al.* (1974) estimated the demand elasticities for different products like poultry, brinjal and potato using regression models. Results showed that income elasticity was more than unity for poultry and lesser than 1 for both brinjal and potato indicating that they are necessary food items.

Kumar (1979) analyzed the consumption expenditure data drawn from NSS reports for the period 1960-61 to 1973-74 for rural areas in India. He had observed that the per capita expenditure at the constant prices declined over the period though in intervening period it fluctuated. Comparison of data by fractile groups as also otherwise indicated rise in per capita expenditure in 1973-74 (28th round) as compared to that in 1964-65 (19th round). The decline in per capita expenditure was attributed to decline in the purchasing power of the consumers because of sharp rise in the prices.

Mruthyunjaya and Srinivas (1982) estimated consumption demand for potato in Karnataka using log-linear regression model. Results showed that the income elasticity for potato was 0.5442 and demand for potato would grow at the rate of 0.2 percent per year in coming years.

Rao et al. (1982) based on a study of 230 sample house holds of Vijayawada town, Andrapradesh, estimated expenditure and income elasticities of demand for food and non-food items. It was found that expenditure elasticities co-efficients for food and non-food items were 0.7608 and 1.3066 respectively indicating that the food items were in the category of essential goods.

Bhalla and Chadha (1990) in their study "Green Revolution And The Small Peasant: A Study Of Income Distribution In Punjab Agriculture" have reported that the level of total per capita expenditure on milk and milk products, clothing, footwear, beverages, meat, egg and fish, miscellaneous goods and services, etc, is more intimately tagged with the per capita total expenditure of the household. On the other hand, the per capita expenditure on essential food items (e.g., cereals and cereal products, pulses, salt and spices) is much less influenced by per capita total expenditure. With respect to commodity priorities as revealed by the value of expenditure elasticity, meat, fish and egg have the highest value of expenditure elasticity exceeding 3.0, clothing has the next highest value of nearly 1.8, footwear, beverages and durable goods share among themselves the next three positions with expenditure elasticity figures exceeding 1.5 in most cases. The lowest expenditure elasticity, around 0.22, is shown by cereals and cereal products. On the one hand, the cultivating households of Punjab do not suffer from cereal deficiency; hence the expenditure elasticity for cereal is the lowest. On the other hand, there is a tendency to spend additionally on meat, egg and fish, which is much more than the percentage addition to income. Also, clothing and footwear command fairly high priorities in spending incremental incomes.

Samad and Hossain (1993) in their study "Estimation of Income and Expenditure Elasticity for Major Consumption Items in Bangladesh"

reported that the principal consumption items, i.e., rice, wheat, potato, fish, pulse, soybean oil, mustard oil, vegetables and tobacco, etc., appear as income inelastic items. This implies that the expenditure on these items increased at a lesser rate than the income. Meat and sugar turn out to be elastic food items, indicating that a more than proportionate change in expenditure is related to the change in income. According to expenditure elasticity, fish, meat, soybean oil, sugar and tobacco appear as luxury goods while rice, wheat, potato, pulse, mustard oil and vegetable remain as necessary items. Both income and expenditure elasticity for food in the urban area appear smaller than those for the rural area. This implies that the urban people (who are relatively better off than the rural people) spend money in less proportion on food and in more proportion on other items. This is in accordance with the Engel's law.

Murthy (2000) concluded that the expenditure elasticity of demand for cereals declines though not secularly, with rise in income. But the own-price elasticity of demand for cereals (in absolute values) seems to exhibit the opposite pattern.

Paroda and Kumar (2000) reported that the level of consumption of high value foods is much lower than the recommended levels. Cereals contribute two-thirds of the total calorie intake and hold the key to nutritional security in south Asia. Decline in per capita consumption of cereals and rapid increase in consumption of fruits, vegetables, milk, meat, eggs and fish is observed.

In a study by Kumar and Dey (2004), on Modelling of Household Demand for Fish in India" reported that the expenditure on food of animal origin accounted for 13 percent in the total food expenditure. The share of fish was about 12 percent. Only 35 percent population in India has been estimated to be fish eaters; this being 46 percent in the coastal

and 27 percent in the non-coastal states. Wide regional variations in fish consumption have been observed. The fish consumption showed an increasing trend from 6.9 kg/year/capita in the year 1983 to 9.1 kg/year/capita in the rural areas and from 8 kg/year/capita 1983 to 11 kg/year/capita in 1999 in the urban areas. The responsiveness of demand for fish to changes in price and income (expenditure) varies for fish across income classes, regions, and urbanization. The food expenditure elasticity with respect to income was estimated to be 0.77. The response of the non-vegetarian food expenditure to changes in food expenditure was non-linear. At the mean level, the non-vegetarian food expenditure elasticity with respect to food expenditure was estimated to be 0.56. The prices of cereals, pulses and non-vegetarian food had negative and significant effect on per capita consumption of non-vegetarian food. The coefficient of vegetable prices was positively and significant indicative of substitutive relationship between vegetables and non-vegetarian food. The larger family size in the household reduced the per capita consumption of non-vegetarian food. Own price elasticity of demand for fish is high and has not shown any sign of decline during the last 15 years. Low expenditure (income) groups were more sensitive to demand price of fish than higher expenditure (income) groups. These elasticities are substantially higher in the eastern, northeastern and southern states.

Qadeer and Priyadarshi (2005) reported that the proportion of total calories derived from cereals and cereal substitutes have come down to 80 and 74 percent for the two poor classes, 65 percent for the middle and 51 percent for the well-off. For the two classes of the poor, 82 percent and 73 percent of the proteins also comes from cereals and it still provides nearly 70 percent of iron and 30 percent of fat. Thus, while foods with high protective value are important, as cereals are the cheapest sources for energy and proteins. Milk and vegetables show a

sharp increase among the middle and the well-off classes where the current intake levels have reached 200 gms and above. For the poor, the proportion of calories from oils and vegetables, milk and milk products, and fruits shows only a marginal increase over time, while that from pulses declines, and stagnates from sugars. None of these foods contribute more than 4 percent of the total calories. The total expenditure on selected food and non-food items across classes shows a uniform trend of a tripling of expenditures over time. The well-off have over time spent 5 times more compared to the very poor. The increase in expenditure on non-food items over time varied from two and a half times in the well-off to not even double in the poorest class. For food items, the rich show an increase of 3.5 times and the poor of 2.4 times. For non-cereals, both the extreme groups show a rise of expenditure by 4 times, but for cereals the poorest have an expenditure jump of 3.5 times as compared to the rich who raise their expenditure only 2.4 times.

2.4 Health expenditure:

The third round of the NSS in 1951 recorded a private health expenditure of Rs.5.77 per capita per year (NSS, 1952). Together with State health expenditure in the same year it worked out of 2.53% of GDP with private health expenditure having share of 87%.

In the fifties and early sixties Prof. S.C. Seal and his colleagues conducted pioneering general health surveys in districts from nine States of North India. In these surveys private health expenditures were also recorded. The average was Rs.3.34 per capita and these varied in different districts from between Rs.0.40 to Rs.7.20 per capita (Seal *et al*; 1961, 1962, 1963) but what was remarkable was that this health expenditure worked out to be in between 3% to 4% of the respective SDP and the private health expenditure share was between 83% and 88%.

Carmen (2003) analyzed the evolution of Private Consumption on Health, having into account that there are substitution effects between public and private expenditure in OECD countries. From the analysis of the evolution of these variables main conclusion is that the increase of expenditure on Health, with economic development, is generally positive for welfare and obeys to a rational behavior of consumers. The estimated econometric models for private expenditure results confirm the existence of a high degree of substitution. Thus, diminutions in public expenditure do not imply diminution in total expenditure on health but an increase in private one. The findings support a distribution between private and public expenditure, in order to guarantee general assistance of population, to get high standards of consumers' welfare and to avoid abuses in demand.

Nandraj *et al* (1996) conducted research on disaggregated financial data analysis of major communicable diseases control programme such as Malaria, Tuberculosis, Leprosy, AIDS, Blindness, Measles, Goitre, Filaria etc. State wise health expenditure and five year plan outlay on major disease programmes in India. The valuable data will be of great use to health economists as well as policy makers also.

Madhiwalla *et al* (2000), study covers most of the health problems of women in rural as well as urban areas in Nashik district of western Maharashtra. The study throws light on health care services, health expenditure, across gender, age and other socially important factors. Explain in details with figures

The first comprehensive document on ethical principles and guidelines for conducting research in medical sciences as well as social science research in health related issues was taken up by Jesani *et al* (2000). It has thrown light on rights and responsibilities of researchers, reviewers, editors, organizations, funding agencies and publishers that

are important role players in dissemination of information obtained through research.

Nandraj *et al* (2001) made an attempt to understand and document analytically the perceived morbidity patterns, the problems faced by women in accessing health care facilities in connection with their utilization and expenditure incurred by households on women's health care with special reference to socio-economic differentials.

2.5 Theoretical framework- Sustainable Livelihood Approach:

In present study this approach is used as a relevant framework to understand the situation of the farmer in the study area through this approach. The vulnerability components and lack of livelihood assets are discussed in the problem statement. Livelihoods concept was initially developed by Robert Chambers in the mid-1980s (further developed by Chambers, Conway and others in the early 1990s). It is a tool to improve our understanding of livelihoods, particularly the livelihoods of the poor. It was developed over a period of several months by the Sustainable Rural Livelihoods Advisory Committee, building on earlier work by the Institute of Development Studies (DFID, 1999). It is a way to improve understanding of the livelihoods of poor people. It draws on the main factors that affect poor people's livelihoods and the typical relationships between these factors. It can be used in planning new development activities and in assessing the contribution that existing activities have made to sustaining livelihoods (IFAD, 1995) which is presented in figure 1.

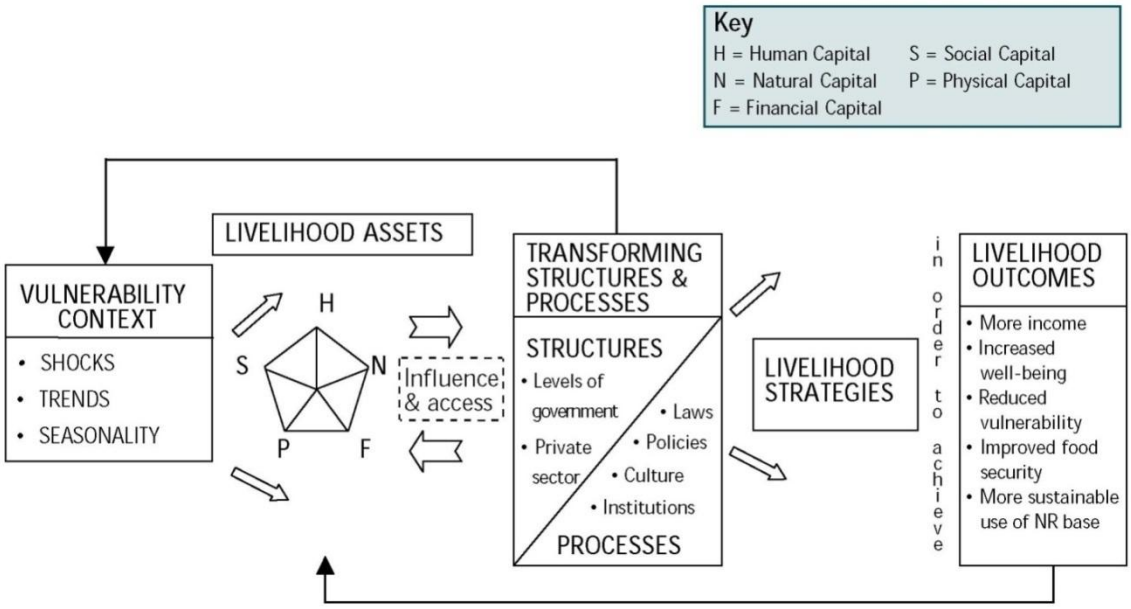


Figure 1: Sustainable livelihoods framework

Source: DFID, 1999.

The smallholder farming (<5 acres* per farm) accounts for 78% of the total operational holdings and occupies 32% of the total agricultural area. The average size of 84 million small farm holdings in India is below 2.5 acres*, with many producing incomes below the poverty threshold. Smallholder dry land farming systems accounts for 70% of the total cultivable area. These systems are characterized by low productivity and widespread, persistent poverty. Improving the profitability of these highly vulnerable smallholder systems is a priority for reducing the rural poverty in India (Yadav and Singh, 2000 quoted by Ramasamy *et al,* 2004, NBSSLUP 2011). This major section of the farming may be better described by a 'Deprivation Trap' which is characterized by isolation, powerlessness, vulnerability, physical weakness and poverty (Chambers, 1983). The problems and the condition of these resource poor farmers can be effectively explained with Sustainable Livelihood Approach (SLA)

which was developed by basic concepts of Robert Chambers in the mid-1980s. Later it was developed by the British Department for International Development (DFID). Starting from 1997, DFID integrated the approach in its program for development cooperation (Kollmair and Gamper 2002, Ian Scoones 1998). In this approach, the rural poor are placed at the center, characterized by vulnerability factors like *Trends, shocks and seasonality.*

The *trends* in governance, agricultural policies keep on changing which makes the conditions of the farmers vulnerable in India. With the emergence of free market economy in the wake of liberalization, globalization, privatization and the fast expansion of agri-business, smallholders may find it difficult to cope up with the resultant volatility in the economy. This can be witnessed from reduced farmers' incomes, and the threat to the viability of cultivation because of raising input costs and falling output prices. This also reflects the combination of reduced subsidy and protection to the farmers in India, and trade liberalization which exposes these farmers to competition from highly subsidized production in the developed world (Swaminathan *et al* 2006).

The farming community in India is highly prone to *shocks* from nature, human and economy of the country. Diseases and pests, floods, earthquakes, unpredictable weather and rainfall and other natural hazards have often completely devastated crops and livestock of the farmer making his living thorny. Adding to the situation, there is no coverage of insurance for the crops and livestock against these risks which leaves farmers alone to bear the risk and uncertainty involved in farming. *Seasonality* is another key factor which makes farmers lives further susceptible. Seasonality in cropping has led to unemployment and under employment in seasons and off-seasons of cropping which has invariably resulted in the higher incidence of poverty in the rural areas

and the undesired effect of this is migration of rural mass to urban areas in search of work and living. Seasonality in crop production also affects market price. The glut and shortage of farm produce in the market may result in high fluctuation in product price which make farmers uncertain about his expected income (Shrivastava, 2006).

3.1 Lack of livelihood assets:

The lack of livelihood assets like human, social, natural, physical and financial capital is the foremost struggle of an Indian farmer. Majority of the farmers in India are primary level literates or illiterates. For example, according to a 2001 census, the literacy rate for male subsistence farmers in India was 73.4% and 47.8% literacy rate for females in India (Dillard, 2008). They lack the technical skills and the production techniques needed to take up any agro-business in commercial scale as they do not have higher education and technical aspects and farm related trainings. Although 58% of population is engaged in agriculture, vocational training for farmers is one of the weakest links in the Indian educational system (India vision- 2020, 2002). They also do not have access to updated information about market demand needed to make production decisions.

When it comes to food and nutrition aspect which is an important component of the *human capital*, the diet of the rural mass is often protein-poor, consisting mainly of energy-rich cereal grains, with the protein consumed being quantitatively and qualitatively less than the optimal requirement (Prabhakaran, 2003; Swaminathan *et al,* 2006). It is unattainable to achieve any significant improvement in these areas unless an increase in crop rotation, livestock, poultry and fish farming takes place (Ramrao *et al,* 2006). According to World food summit, the number of undernourished people to be between 830-840 million in the world and South Asia alone accounted for one-third of these people. In

India, FAO estimated the number to be 207 million (WFP, 2001). In 1999-2000, almost 77% of the rural population consumed less than the poverty line calorie requirement of 2400 calories. Low productivity and income appear to be the most important cause of endemic under- and malnutrition among farmer-consumers (Swaminathan *et al,* 2006) which is otherwise linked to lack of financial capital.

The farmers also lack *social capital* as there is very less co-operation, networks and connectedness and membership in more formalized groups among themselves. The lack of social capital render the farmers inoperative from bargaining power, collective actions in favour of farming community and also to fight against any exploitations of farmers by agri-business companies or unfavorable policies by government (Pretty, 2003).

In a land constraint country like India, lack of *natural capital* is a major setback for farmers. Of the estimated 143 million hectare net cultivated area in India, about 97 million hectare (68%) is dry land producing 44% of the country's food requirements and supporting 40% of human and 60% of livestock population (NBSSLUP, 2011). There is no more scope for horizontal expansion of agriculture in India as the fragmentation of land holdings due to increase in family size is working in contradiction to land consolidation. Lack of adequate irrigation facilities for cropping is another major vulnerable factor in Indian agriculture (Brugere and Lingard, 2001). In this regard, inclusion of livestock farming like poultry, piggery and dairy along with cropping system seems to be most appropriate to ensure a regular income for decent living and to achieve food and nutrition security (Behera *et al,* 2001). The rural community of India is deprived of good infrastructure facilities and *physical capital* like local market access, transportation facilities, communication means, good roads, regional rural banks,

health centres etc (Sebastian, 2004) which keeps farmers away from moving towards development.

Access to *financial capital* as got the strongest influence on all other assets. But lack of financial resources is the major problem of Indian farmers. The majority of the smallholder producers experience difficulties in obtaining credit for production inputs as they lack sufficient assets to pledge against the loan. This makes the situation difficult to invest lump sum amount at a time in new enterprises. Also lack of credit and liquidity makes it hard to purchase specialized inputs or to make investments needed to produce these commodities and for basic infrastructure of the farm (Robert and Douglas, 2006).

Also Indian farming lacks well established forward and backward linkages (reliable and co-effective) such as extension advice, mechanization services, supply of seeds, fertilizers and credit, as also guaranteed and profitable markets for their produce (Eaton and Shepherd, 2001 quoted by Erappa, 2006). The government intervention in assuring market and stable price for farm produce is reported to be minimal.

Methodology

III. METHODOLOGY

In order to evaluate the research objectives, a sound research methodology with appropriate tools of analysis is essential. This chapter deals with the sampling technique adopted, database and the analytical tools and techniques adopted to fulfill the objectives of the research study. Besides, other details such as the location of the area under study, population, soil, topography, rainfall, land utilization pattern, cropping pattern, irrigation facilities, infrastructure and details of livestock enterprises are also presented.

3.1 Description of the study region

3.2 Data-base

3.3 Analytical tools and techniques used in the present study and

3.4 Concepts and definitions

3.1 Description of the study region:

The study was undertaken in one of the taluks of Eastern Dry Zone (EDZ) of Karnataka (figure 2). The EDZ covers 24 taluks, spanning a total geographical area of 17.97 lakh ha. The EDZ is predominantly agrarian in nature with 50.36 percent of total geographical area of the zone being put under agricultural and horticultural crops and 83.45 percent of its population depend on agriculture for their livelihood. The soils are red sandy loam characterized by shallow depth. (NBSSLUP, 2011) The sample respondents were post-stratified into marginal, small, medium and large farmers based on the size of operational holdings.

The annual rainfall in the zone ranges from a minimum of 679 mm to a maximum of 889 mm with an average of 784 mm. The monsoon is active in the months of July to October. June is generally a lean period

with fairly dry weather and the monsoon starts picking from middle of July. The mean maximum temperature ranged between 29° C in December and 37° C in April. Out of the total geographical area of 17.97 lakh ha in the zone, the net cropped area is about 48 percent. About 27.60 percent of the cultivated area is under irrigation, primarily groundwater.. The major sources of irrigation include tanks and wells. The principal crops grown under irrigation are Mulberry, Vegetables, finger millet (ragi) and Maize.

Devanahalli taluk, Bangalore Rural district was selected for the study. Devanahalli taluk is located in the northern part of Bangalore rural district. The geographical area of the taluk is 431 sq. kms. i.e. about 7.41 percent of the total geographical area of the district.

The taluk consists of 4 hoblies and 220 villages as detailed in table 3.1

Table: 3.1 General features of the study area (2003-04)

Particulars	Devanahalli taluk	Bangalore Rural District
Geographical area (sq. Kms.)	431	5814
Hoblies (number)	4	35
Villages (number)	220	1883
Population (number)	184872	1881514
Density of population (sq. km)	428	324
Sex Ratio	944	955
Literacy Rate (%)	68.24	64.97
Number of Self Help Groups (SHG)	497	6011
Number of Banks	14	115
Regulated markets	2	13
Cooperative societies	201	1135
Normal rainfall (mm)	767	817
Actual Rainfall (mm)	386	1006
Number of rainy days (average)	50	50

Source: District at a Glance 2003-2004, Bangalore rural district

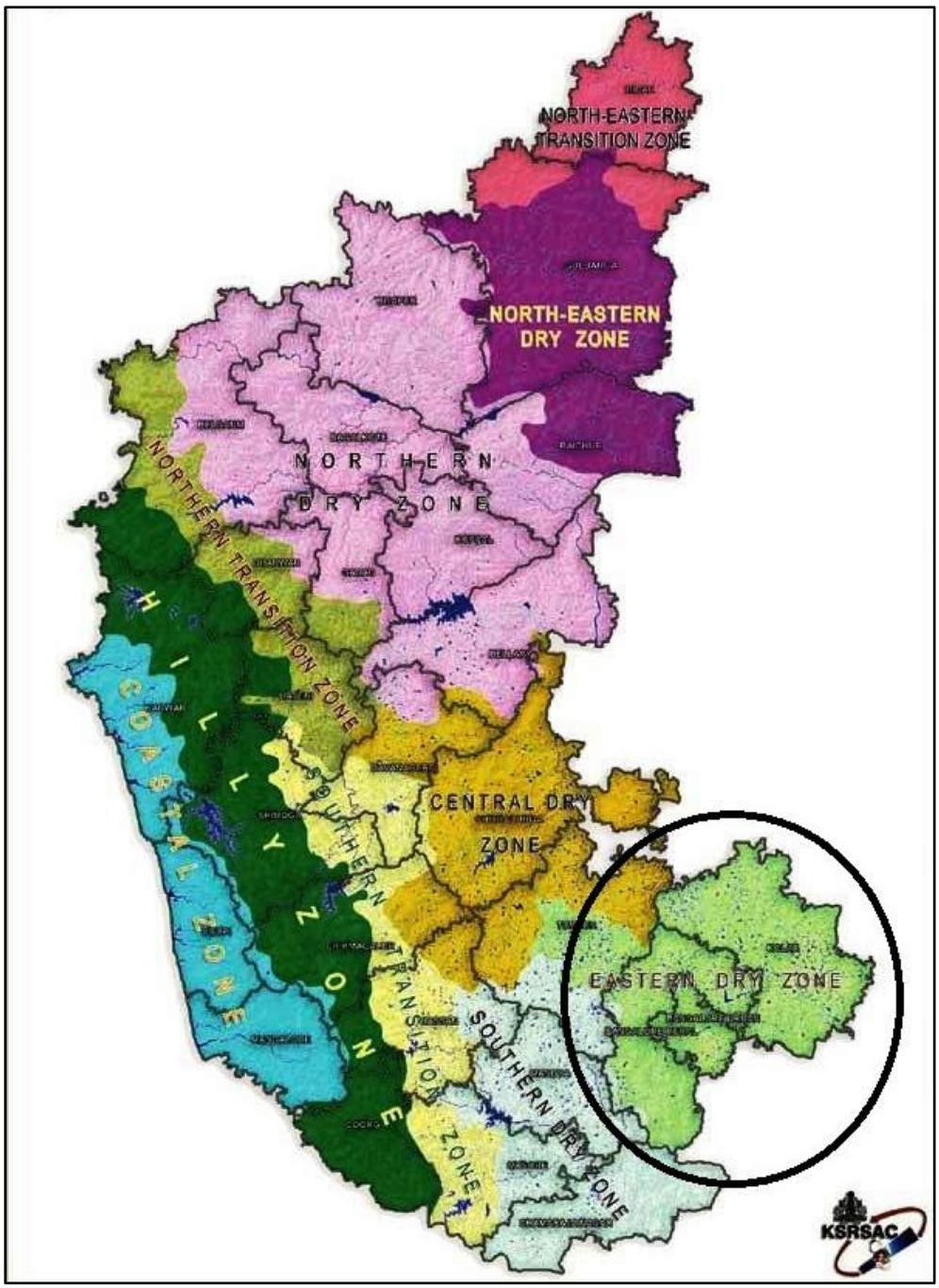


Figure 2: Map of the study area

3.1.1 Demographic features:

The population of the taluk as per 2004 census was 1.84 lakh accounting to 9.84 percent of the districts population. The rural population constituted 72 percent and the urban population constituted about 28 percent of the total.

3.1.2 Land utilization pattern:

The table 3.2 provides the land utilization pattern in the study area during the year 2003-04. The total geographical area of Bangalore rural district is 5.85lakh hectares, out of which 46 per cent is net cultivated area (2.74 lakh hectares). The total irrigated area was 5506 hectares accounting 20 percent of the net cultivated area. Of the total irrigated area, well irrigation accounts for a major share (51 per cent from bore wells and 23 per cent from open wells) followed by tank irrigation (26 percent). The area not available for cultivation constituted 16 per cent, fallow land 15 per cent and forest area 14 per cent of the total geographical area during 2003-04.

Table: 3.2 Land use pattern (area in hectares)

Particulars		Devanahalli taluk	Bangalore Rural District
Geographical area		44935 (8)	585431
Forest area		2275 (3)	81268
Land not available for cultivation		9482 (10)	93840
Fallow land		764 (1)	85176
Total cultivated area		27545 (10)	274241
Irrigated area			
	i) Tanks	1995 (14)	14490
	ii) Wells	3539 (28)	12622
	iii) Bore wells	3413 (12)	27955

Source: District at a Glance 2003-2004, Bangalore Rural

The total geographical area of Devanahalli taluk is 44935 hectares, out of which 61.29 percent is net cultivated area. The area not available for cultivation was 21.1 per cent, other uncultivated area was 15.89 percent, fallow land forms 1.7 per cent and area under forest cover was 5.06 per cent. The total irrigated area forms 32.48 per cent of net cultivated area. Out of the total irrigated area, tank irrigation accounts for 22.30 per cent while bore well share is 38.15 percent and 39.56 percent is well irrigated.

Table 3.3: Size of holdings in the study area (area in hectares)

Size of holdings	Devanahalli taluk				Bangalore rural district			
	Number	in %	Area (Ha)	In %	Number	In %	Area (Ha)	In %
Marginal (<1ha)	15283	62	6982	24	191609	63	87330	25
Small (1-2 ha)	5402	22	7514	25	65000	22	91440	26
Semi medium (2-4 ha)	2652	11	7202	24	33241	11	89324	26
Medium (4-10 ha)	1023	4	5779	19	10992	4	61415	18
Large (>10 ha)	150	1	2244	8	1181	0.5	17273	5
Total	24510	100	29721	100	302023	100	346782	100

Source: District at a Glance 2003-2004, Bangalore Rural

3.1.3 Cropping pattern

In Bangalore rural district during 2003-04, the total net area sown was 2.74 lakh hectares. During 2003-04, the total net area sown in the Devanahalli taluk was 38390 hectares, of which about 17.63 per cent was

under cereals, and 10.27 per cent under pulses and the share of oilseeds constituted to the tune of 3.02 per cent. Gross cropped area under different crops in the Bangalore rural district and Devanahalli taluk is presented in the table 3.4.

Table: 3.4: Gross cropped area under different crops (area in hectares)

Crops	**Devanahalli taluk**	**In %**	**Bangalore Rural District**
Paddy	786	6.69	6185
Ragi	10422	88.72	106002
Maize	539	4.59	4780
Total area under cereals	11747	40.81	116967
Total area under pulses	1182	4.11	27266
Total area under Oil Seeds	240	0.83	15021
Total Fruits	2512	8.73	26477
Total Vegetables	2142	7.44	6442
Sugarcane	12	0.04	1959
Total area under Other Non- food crops	10952	38.04	80109
Total sown area	27545	100.00	274241

Source: District at a Glance 2003-2004, Bangalore Rural

The sericulture and dairy are the major subsidiary activities in the region, (table 3.5 and table 3.6). The area under mulberry cultivation during the year 2003-04 was 881.73 hectares. The production in terms of cocoon yield for the same period was 588 tonnes. About 3.73 percent of the farmers are engaged in this activity.

Table 3.5: Details about Sericulture activities in the study area (2003-04)

Particulars	Devanahalli taluk	Bangalore Rural District
Area under mulberry (in ha)	2984 (19)	16062.27 (100)
Cocoon production (in tonnes)	2224 (20)	11142 (100)
Chawki rearing centers		
Government	2 (6)	32 (100)
Private	36 (16)	220 (100)
Seed storage		
Government	4 (16)	25 (100)
Private	30 (13)	227 (100)

Note: Figures in parentheses refers to percentages to total.

Source: District at a Glance 2003-2004, Bangalore Rural.

Table 3.6: Details of Livestock in the study region (2003-04)

Particulars	Devanahalli taluk	Bangalore Rural District
Cattle		
Indigenous	11988 (2)	552890 (100)
Exotic	78 (1)	8029 (100)
Cross breed	35449 (18)	193235 (100)
Total	47515 (6)	754154 (100)
Buffaloes	20438 (11)	195324 (100)
Sheep	50250 (8)	623211 (100)
Goats	22887 (7)	344700 (100)
Pigs	553 (6)	9721 (100)
Poultry	446866 (11)	3899889 (100)

Note: Figures in parentheses refers to percentages to total.

Source: District at a Glance 2003-2004, Bangalore Rural.

Table 3.7 gives the proportion of population engaged in agriculture and allied activities in the study area. Out of the total working population, 57.42 percent are male and 42.58 percent are female.

Table 3.7: Details about working population in the study area (2003-04)

Particulars	Devanahalli taluk	Bangalore Rural District
Male	11868 (57)	77417 (58)
Female	8799 (43)	55345 (42)
Total	20667 (100)	132762 (100)

Note: Figures in parentheses refers to percentages to total.

Source: District at a Glance 2003-2004, Bangalore Rural.

3.2 Data-base:

In consonance with the main objectives of the study, Venkatenahalli village of Devanahalli taluk was purposively selected to assess the impact of farming system on income, employment and livelihood since many interventions have been undertaken by the University of Agricultural Sciences in this village.

The detailed information was elicited from 90 respondents practicing different integrated farming systems considering marginal, small, medium and large farmer categories. Data collection was carried out with the aid of structured and pre-tested schedules, covering the following aspects. General information about the family such as size of the family, type of the family, age and education level of the members of the households, size of operational holdings, sources of income etc. Information regarding cropping pattern, existing farming system, sources of irrigation, crop wise particulars, cost of cultivation, inputs used, yields of crop, price of output, expenses and income from different enterprises

were collected. In addition, information on their consumption pattern, household expenditure, and health status were also drawn.

Secondary data on land utilization pattern, area under principal crops, agro-climatic conditions, rainfall, population, workforce, size of holdings, irrigation sources and livestock population for the study area were collected from the records of the State Departments.

3.3 Analytical tools and techniques used in the present study:

The data collected was tabulated and analyzed according to the objectives of the study. Averages and percentage were worked out to examine the socio-economic factors, size and composition of farm holdings, cropping pattern followed.

3.3.1 Economics of integrated farming systems:

a). Gross income per hectare:

This is the indicator reflecting the effect of different farming systems on production capacity.

$$\text{Gross income per hectare (Rs.)} = \frac{\text{Money value of total output (Rs.)}}{\text{Area under cultivation (Ha)}}$$

b). Return to cost ratio:

Return to cost ratio indicates the returns generated per unit of expenditure.

$$\text{Return to cost ratio} = \frac{\text{Total value of output (Rs.)}}{\text{Total cost of cultivation (Rs.)}}$$

3.3.2 Estimation of income and expenditure elasticities:

Engel curve is one of the well-known devices to ascertain the consumption expenditure of different classes of consumers in a society. According to the Engel's first law, expenditure on food increases with income, but at a lesser rate (Cramer, 1971). There are of course alternative methods of employing Engel functions to estimate the income or expenditure elasticities for various food and non-food items. These include both parametric and non-parametric functional forms.

Empirical investigation reveals that a particular type of Engel function does not confirm to the expenditure pattern of the consumers for different food and non-food items. Different functions may be suitable for different commodities. The choice of a particular function should generally be governed by the properties like goodness of fit, computational simplicity, additivity and theoretical feasibility (Iyengar, 1967). Estimating coefficients from functions lacking these desirable properties may lead to inconsistent results.

With respect to dependent variable, the question is whether to consider the quantity consumed or the corresponding expenditure on the item. For perfectly homogeneous goods it is immaterial whether quantity or expenditure is used as the dependent variable because price is invariant in this case. However, particularly for food items there are usually a number of qualities with obvious variation in price, and in such circumstances the use of quantity as the dependent variable may under state the effects of income on consumption patterns (Currie, 1972). Thus, expenditure is considered as the dependent variable for all the forms of the Engel function.

To begin with, the per capita income is considered as the relevant regressor in the equations. From these expenditure-income relations, the

income elasticities have been computed. According to permanent income hypothesis of Friedman (1957), the expenditure pattern is mainly determined by permanent income rather than transitory income (Currie, 1972). For this reason, total expenditure is considered as the indicator of purchasing power, again, for all the items. In reality some other explanatory variables, *e.g.*, size of the household, age, sex, geographical location, etc., may play a role in the determination of expenditure pattern of the consumers. The household size has been taken into consideration by transforming both the dependent and independent variables to per capita basis.

Engel curve expresses the relationship between household expenditure and income, as given in equation (1). Hicks and Johnson (1968),

$$e(Y) = pq(Y) \quad \text{..... (1)}$$

Equation (1) expresses that expenditure (e), which is a product of price (p) and quantity (q), depends upon income (Y). If prices are held constant, then elasticity of expenditure (e) with respect to Y becomes equal to that of quantity (q) with respect to income (Y); that is:

$$\delta e/\delta y\ (Y/e) = \delta q/\delta y\ (Y/q) \quad \text{..... (2)}$$

At low income level when income (y) rises, the effect of income on consumption (q) is positive ($\delta q/\delta y > 0$), with the second derivative negative ($\delta 2\backslash q/\delta 2y < 0$), suggesting that at sufficiently low income level almost all goods are normal. While with the further increase in income, $\delta q/\delta y$ drops and at some level reaches zero; so in practice, Engel curve is not linear but nonlinear. Thus to capture nonlinear relationship of consumption (q) and income (Y), the log-log-inverse (LLI) form of Engel equation can be used.

For expenditure (e) and income (Y) relationship, equation to be considered is:

Log log inverse= $\ln e_{ij} = \alpha + \beta (1/Y_j) + \gamma \ln Y_j + \mu$ .....(3)

Where e refers to per capita expenditure on the i^{th} item in the j^{th} income class and Y_j pertains to per capita income of the j^{th} class.

Estimation of equation 3 would give values of parameters α, β, γ and if β is equal to zero, the LLI model would simplify to double log model, suggesting constant elasticities. Similarly, if γ is equal to zero, LLI model would simplify to log inverse model. However, if both β and γ are not equal to zero, then elasticities would be worked out, as follows:

Elasticity= MP/AP

MP is first differentiation of expenditure with respect to income, whereas AP is e/Y. solving this equation gives,

$\varepsilon = \beta (1/Y) + \gamma$ .....(4)

The goodness of fit of the function have primarily been assessed by

a) the t-ratios

b) adjusted coefficients of determination ($\bar{R}^2$) and

c) standard errors of estimates (SEE).

Since the functional forms are different, ($\bar{R}^2$) and t-ratios alone cannot ideally be used as criteria of good fits. From the estimated functions in which all parameters were statistically significant, those functions were selected which showed a minimum value of SEE and as high a value of ($\bar{R}^2$) as possible (Rahman, 1980).

3.3.3 Employment generation:

Employment generated was arrived at by calculating the deferential employment generated in man days per year by taking into consideration of employment status under different selected farming systems. The procedure adopted by Kantharaju (1986) and Dixit (1993) with slight modification was used. One man day is equivalent to eight working hours, women working days were converted into mandays by using the formula; three women days is equal to two man days.

3.3.4 Dietary Pattern:

Diet survey was conducted using 7-days recall method. Sets of pre-standard vessels were used to obtain estimates of amount of raw and cooked foods consumed by the respondents. Similarly, different size of spoons, ladles, balls and cardboard discs were used to determine the size of ragi balls, ragi roti/chapathi. Information on the type of preparation, actual ingredient used and the quantity consumed by men, women, and children were recorded. Consumption of food by children in anganwadi centre and in the school provided under the ICDS programme and mid-day meal scheme were also taken into consideration.

3.4 Concepts and Definitions:

3.4.1 Household: A group of people living together and taking food from common kitchen constitutes a household. The word “normally” means that temporary visitors are excluded but temporary stay-aways are included. Thus a son or daughter resident in a hostel for studies is excluded from the household of his/her parents, but a resident employee or resident domestic servant or paying guest (but not just a tenant in the house) is included in the employer/host’s household. “Living together” is usually given more importance than “sharing food from a common kitchen” in drawing the boundaries of a household in case the two

criteria are in conflict. However, in the special case of a person taking food with his family but sleeping elsewhere (say in a shop or a different house) due to space shortage, the household formed by such a person's family members is taken to include the person also. Each inmate of a mess, hostel, boarding and lodging house, etc. is considered as a single-member household except that the family living in a hotel (say) is considered as one household only. The same applies to residential staff of such establishments.

3.4.2 Household consumer expenditure: The expenditure incurred by a household on domestic consumption during the reference period is the household's consumer expenditure. The household consumer expenditure is the total of monetary values of consumption of various groups of items namely (i) food, fuel and light, (ii) clothing and (iii) miscellaneous goods and services and durable articles.

3.4.3 Value of consumption: consumption out of purchase is evaluated at the purchase price. Consumption out of home produce is evaluated at ex-farm or ex-factory rate. Value of consumption out of gifts, loans, free collection and goods received in exchange of goods and services is imputed at the rate of average local retail prices prevailing during the reference period.

3.4.4 Household size: The size of a household is the total number of persons in the household.

3.4.5 Adult: A person who has attained an age of 15years.

3.4.6 Monthly per capita consumer expenditure (MPCE): For a household, this is its last 30 days' total consumer expenditure divided by its size. A person's MPCE is understood as that of the household to which he or she belongs.

3.4.7 Cost of cultivation: To estimate the costs and returns from any crop production activity, it is very necessary to know about the concepts used in the present study. The various concepts used are presented below for better understanding.

3.4.7.1 Costs

The total costs were divided into two broad categories:

(1) Variable cost.

(2) Fixed cost.

The method adopted for computing the different cost items are described below:

(1) Variable costs

a) **Seed**: farm produced seed has been accounted at the village prices prevalent at the time of sowing, while the purchased seeds at actual rates paid by the sample farmers.

b) **Farmyard manure**: Farm produced manure has been accounted at the village prices prevalent at the time of sowing, or at actual rates paid by the farmers.

c) **Fertilizers and plant protection chemicals**: Costs of fertilizers and plant protection chemicals were the amount actually paid by the farmers.

d) **Labour**: labour was charged at the prevailing wage rates paid per day (eight hours) in that locality for men, women and bullock pair.

(2) Fixed costs

(a) **Depreciation charges**: depreciation charges on implements/machines were calculated by straight-line method, i.e., by dividing the actual cost of the item (less salvage value) by the expected life of the item as estimated by the sample farmers.

(b) **Land revenue**: Land revenue was charged at the rates levied by the government. Allocation of the cost was done in proportion to the area under the crop.

3.4.7.2 Returns

(a) **Gross returns**: Per hectare gross returns were calculated based on what the sample farmers realized actually at the prevailing market prices in rupees.

(b) **Net returns over variable cost**: It is calculated by taking into account of gross returns minus variable costs.

(c) **Net returns over total cost**: It is calculated by taking into account of gross returns minus total costs.

(d) **Cost of production per quintal/tonne/Kg**: This is calculated as total cost per hectare divided by the yield per hectare (quintal/tonne/Kg).

Results

IV. RESULTS

The data collected from the respondents were tabulated and analyzed according to the objectives of the study. The results are presented under the following heads:

4.1 General characteristics of the sample farmers and household-Livelihood Assets Context

4.2 Farming systems and cropping pattern followed by the sample respondents

4.3 Different integrated farming systems across different categories of farmers and impact on employment.

4.4 Consumption pattern of food groups by sample households across different farming systems in comparison with recommended dietary allowances.

4.5 Per capita and family consumption of food items by different groups of the rural population.

4.6 Per capita and family expenditure on food items among different groups of the rural population.

4.7 Expenditure pattern on human health among different farming systems.

4.8 Expenditure pattern on human health among different categories of farmers

4.9 Awareness and perception of farmers towards integrated farming systems.

4.1 General characteristics of the sample farmers and household-Livelihood Assets Context

This section serves to exemplarily illustrate the composition of rural livelihood in the case study area. A selection of livelihood capital assets including natural, human, physical, social and financial capital is linked with the case study conditions and subsequently presented. Selection and study of livelihood assets is limited and focused to the assets concerning integrated farming systems in the study area.

Natural capital

The landholdings of the sample respondents are categorized into 5 groups based on the standard classification of farmers according to landholdings given by GOI and are presented in table 5.1. Analysis of agricultural holdings by different categories of farmers reveals that around 37.0 percent of the sample farmers are marginal owning around 1.04 acres and they operated only 8.4 percent of the total operated area, while, 30.0 percent are small farmers owning 3.64 acres and they operated around 28 percent of the total operated area. On the contrary, 25 percent of the total operated area is by large farmers who accounted only 6.7 percent. Similarly, 38 percent of the total operated area is by medium farmers who accounted for 27 percent.

Table 4.1: Size of land holding among sample respondents in study area

Category of farmers	Number of farmers	Dry land (in acres)	Irrigated (in acres)	Fallow (in acres)	Total area (in acres)	Average land holding (in acres)
Marginal Farmer (< 2.5 acres)	33 (37)	24 (68)	9 (26)	1 (2)	35 (100)	1
Small Farmer (2.5- 5.0 acres),	27 (30)	54 (45)	43 (36)	1 (1)	98 (100)	4
Medium Farmer (5.0-10.0acres)	24 (27)	72 (45)	57 (36)	1 (1)	130 (100)	5
Large Farmer (>10.0 acres)	6 (7)	41 (38)	28 (26)	1 (1)	71 (100)	12
Total	90(100)	192	137	5	335	4

Note: Figures in parenthesis indicate percentage to the total.

1 acre of irrigated land = 2.5 acres of dry land is considered for sake of classification.

It was observed that overall in the study area more than 50 percent of the cultivated area is under rain fed, while around 40 percent of the area is under irrigated and the fallow land constituted a meager proportion. Further, across different size groups, it is evident from the table that 75 percent of marginal holdings and 60 percent of small holders do not have irrigation. Around 56 percent of the medium holdings were irrigated.

Physical capital

It is a positive growth in the study village to notice that all of the sample respondents lived in pukka house. Nearly 50 percent of the respondents owned cattle shed and bore well. Heavy machineries like tractor/ power tiller was noticed with large farmers, medium and small while none of the marginal farmers owned them. All categories of farmers owned bollock cart and drip equipment's for irrigation.

Table 4.2 Details of physical capital owned by sample respondents

Particulars	Marginal (33)	Small (27)	Medium (24)	Large (6)	Total
Housing					
Puckka house	33(37)	27(30)	24(27)	6(7)	90
Cattle shed	21(46)	11(24)	9(20)	5(11)	46
Bore well	8(17)	15(31)	19(40)	6(13)	48
Tractor/power tiller	0	1(11)	3(33)	5(56)	9
Bullock cart	6(18)	8(24)	16(48)	3(9)	33
Drip equipment	7(20)	13(37)	11(31)	4(11)	35

Note: Figures in parenthesis indicates percentage to the total.

Table 4.3: Total livestock population owned by the sample respondents

Particulars	Marginal		Small		Medium		Large	
	Total	Average (3 farm families)	Total	Average (3 farm families)	Total	Average (3 farm families)	Total	Average (3 farm families)
Dairy animals								
a) Cows	46	4	34	4	22	3	33	16
b) Buffaloes	12	1	10	1	7	1	4	2
Total	58	5	44	5	29	4	37	18
Bullock Pair	6	1	8	1	16	2	3	2
Sheep	229	21	61	7	62	8	37	19
Goat	19	2	10	1	8	1	6	3
Poultry birds	250	22	130	15	134	16	61.5	31

The profile of livestock owned by different categories of farmers reveals that on an average every household possessed one milch cow barring large household. The large farmers possessed on average 5 cows per household. The startling revelation from the table is that buffaloes are not popular irrespective of the size of the holdings. Even the bullocks, which are crucial to perform various agricultural operations, are not popular with the households. On the contrary, every household possesses sheep and poultry birds. There was one goat for every two households of marginal, three households of small, medium and for every one household of large. Thus, next to dairy enterprise, sheep and goat rearing is prominent in the study village. Poultry also constituted a major part of livestock in the village.

Human capital

A grouping of respondents according to the age has been undertaken based on studies by Kwon etal 1999, Horng etal 2001, Bailey 2002. The average age of the respondent was 45 years in the case of marginal farmers, while in the case of small and medium farmers it was 46 and 54 respectively and large farmers average age was 57 years on an average.

Table 4.4 Age and family composition of the sample respondents

Particulars	Marginal (33)	Small (27)	Medium (24)	Large (6)	Average
Average age of the Head of the family (Yrs.)	45	46	54	57	51
Family members (in numbers)					
Adult male	2	2	2	3	2
Adult female	1	2	2	2	2
Children	1	1	2	2	2
Total	4	5	6	7	6

Table 4.5: Percentage of the work force to family size and dependents

Particulars	Marginal (33)	Small (27)	Medium (24)	Large (6)	Average
Male	50	40	33	42	41
Female	25	40	33	28	32
Dependents	25	20	33	28	27

The family sizes of the sample respondents were around 4, 5, 6 and 7 persons in marginal, small, medium and large farmers respectively. Thus the family size varied with the size of holding. The proportion of male available for work varied from 33 percent to 50 percent across different holdings. Marginal holdings have highest proportion of male workforce (50 %) followed by large (43 %) and small (40 %). The medium holdings had the least proportion of workforce (33 %). In the case of female, as an overall figure, 73 percent (41 percent male and 32 percent female) constituted workforce, and 27 percent were dependents.

Table 4.6 Literacy levels of the sample respondents (in number)

Particulars	Marginal	Small	Medium	Large	Total
Primary school	15(45)	11(41)	13(54)	3(50)	42(47)
High school	5(15)	6(22)	4(17)	1(17)	16(18)
College	2(6)	3(11)	2(8)	1(17)	8(9)
Illiterates	11(33)	7(26)	5(21)	1(17)	24(27)
Total	33(100)	27(100)	24(100)	6(100)	90(100)

Note: Figures in parenthesis indicates percentage to total.

With respect to educational status, more than 70 percent of the farmers irrespective of size of holdings are literates. There has been significant difference with respect to level of literacy among different categories of farmers. Among sample farmers, 58 percent of them had primary education, 28 percent farmers had higher secondary and 14 percent of them had college education respectively.

Major source of information regarding agriculture practices and price for farmers (in percentage)

Television and radio are the major sources of information for most of the respondents followed by short message service provided in mobile device. Other major source of information stated were extension service provided by Agriculture department of Karnataka state, fellow farmers in the village, traders and input dealers and lastly, newspapers. Nearly quarter of the respondents felt there is no need to get any information.

Financial capital

The farmers' access to the financial resources is limited in the study area. Only 38 percent of the growers had access to the formal sources of credit provided by banks, cooperative institutes, etc. The remaining 62 percent of the respondents relied on the informal source of finance to satisfy their financial needs. They found finance from friends, relatives or local lenders. The interest rate for the amount borrowed from formal institutions is considerably low compared to informal credit. The formal institutions charged interest rate between 9 to 14 percent per annum while informal source of credits charged interest rate from 24 to 36 percent per annum.

Social capital

The respondents were asked about their involvement in any of the social organizations in their village vicinity. A few farmers (20 percent)

were members in community organizations like youth clubs, sthree shakthi (self-help group at village level for women), farmer cooperative societies. The farmers expressed deep sense of trust and friendship within the fellow farmers in the village.

4.2 Farming systems and cropping pattern followed by the sample respondents

4.2.1 Existing cropping pattern

Table 4.7 gives the existing cropping pattern followed by the farmers. Crops like finger millet, maize, red gram and intercrops like field beans, horse gram were prominent among the sample farmers under rainfed condition in kharif season.

Table 4. 7 Cropping pattern among sample respondents: (in acres)

Kharif season	Marginal	Small	Medium	Large	Overall
a) Dry Land					
Finger millet	2.28(10)	6.24(12)	7.05(10)	4.12(9)	19.69(10)
Finger millet + field bean	5.65(24)	10.69(22)	15.12(24)	10.26(23)	41.72(23)
Finger millet + horse gram	6.52(27)	14.05(27)	15.68(27)	13.35(28)	49.6(27)
Maize	6.85(29)	14.12(27)	18.14(29)	12.42(28)	51.53(28)
Red gram	2.65(11)	9.20(12)	7.18(10)	5.85(12)	24.88(11)
Total	24.35(100)	54.3(100)	72.00(100)	41(100)	191.65(100)
b) Bore Well irrigated area					

Mulberry	4.38(47)	9.85(49)	12.86(46)	7.65(40)	30.36(45)
Tomato	5.04(54)	4.75(24)	7.65(27)	3.85(20)	16.25(24)
Ridge gourd	0	0.65(4)	0.75(3)	0.7(4)	2.1(3)
Maize (hybrid)	0	1.85(11)	1.75(6)	1.8(10)	5.4(8)
Cauliflower	0	0.65(3)	0.68(2)	0.5(3)	1.83(3)
Carrot	0	2.15(11)	2.9(10)	2.25(12)	7.3(11)
Beans	0	0	1.65(6)	1.25(7)	2.9(4)
Ginger	0	0	0	0.75(4)	0.75(1)
Paddy	0	0	0	0.25(1)	0.25(0.5)
Total	9.42(100)	20(100)	28.24(100)	19(100)	67.14(100)
Rabi					
Bore well irrigated area					
Mulberry	3.5(59)	9.85(53)	12.86(60)	7.65(48)	30.36(54)
Tomato	0	1.15(6)	1.68(8)	1.36(9)	4.19(7)
Potato	0	3.58(19)	3.96(18)	2.54(16)	10.08(18)
Beans	0	0.68(4)	0.52(2)	0.82(5)	2.02(4)
Beetroot	0	1.48(8)	0.56(3)	0.78(5)	2.82(5)
Ginger	0	0	0	0.85(5)	0.85(2)
Carrot	0	1.32(7)	1.65(8)	1.23(8)	4.2(8)
Ridge Guard	2.45(41)	0.5(3)	0.35(2)	0.74(5)	1.59(3)
Total	5.95(100)	18.56(100)	21.58(100)	15.97(100	56.11(100)

Summer					
Bore well irrigated area					
Tomato	3.6	2.45(18)	2.74(16)	2.05(18)	7.24(17)
Mulberry	0	9.85(71)	12.86(77)	7.65(66)	30.36(72)
Potato	0	1.50(11)	1.15(7)	1.86(16)	4.51(11)
Total	3.6	13.80(100)	16.75(100)	11.56(100)	42.11(100)
c) Perennial crops					
Jasminum	0	0	0.26(100)	0	0.26(6)
Crossandra	0	0.25(100)	0	0	0.25(6)
Coconut	0	0	0	3.5(100)	3.5(87)
Total	0	0.25(100)	0.26(100)	3.5(100)	4.01(100)
Grand Total	**43.32**	**106.91**	**138.83**	**91.03**	**361.02**

Note: Figures in parenthesis indicates percentage to total.

Finger millet based intercropping, occupied a lion's share in the rainfed agriculture (60.33 %) followed by maize and red gram across all the holdings during kharif season. The popular intercrops include legumes like field beans and horse gram. Under bore well irrigation, commercial crops like mulberry; a host plant for silkworms and vegetables dominated the cropping pattern among all categories of farmers. Among vegetables, hybrid tomato has the largest area share during kharif and summer while during rabi season, potato has a considerable area share. Groundwater irrigation has enabled to grow a variety of commercial vegetables as evident from the table. Tomato

occupied 23.75 percent and 27.09 percent of area in case of small and medium farmers, 20.26 percent of area in large farmers. Perennials like coconut (3.5 acres), crossandra (0.25 acres) and jasminum (0.26 acres) were also cultivated.

4.2.2 Types of farming systems

Table 4.8 Types of farming systems practiced by different categories of farmer

Farming Systems	Marginal	Small	Medium	Large	Grand Total
FS-1	6(18)	5(19)	4(17)	0(0.0)	15(17)
FS-2	21(64)	10(37)	8(33)	0(0.0)	39(43)
FS-3	4(12)	4(15)	6(25)	2(33)	16(18)
FS-4	2(6)	3(11)	6(25)	4(67)	15(17)
Total	33(100)	27(100)	24(100)	6(100)	90(100)

Note: Figures in parenthesis indicates percentage to total.

FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Horticulture

The sample respondents in Venkatehalli, Bangalore rural district followed four key farming systems viz., crops, (FS-1) crops with livestock (FS-2), crops plus livestock plus sericulture (FS-3), crops, livestock, sericulture with vegetables. (FS-4). Majority of the farmers followed the

farming system (FS-2) comprising crops plus livestock, followed by the other three farming systems. FS-1 was being practiced by 17 percent of the farmers, FS-2 and FS-3 being practiced by 43 and 18 percent of farmers. FS-4 followed by 17 percent farmers among sample respondents (table 4.8).

4.3 Different integrated farming systems across different categories of farmers and impact on employment.

The economic analysis of different farming systems is presented in table 4.9 and 4.10. The marginal farmers practicing farming systems, Crops (FS-1) and Crops plus Livestock (FS-2). FS-1 fetched them annually net returns of Rs.4635.1 and FS-2 fetched them net returns of Rs. 37250.2, with returns to cost ratio being 1.83 and 2.06 in case of FS-1 and FS-2 respectively. From FS3 they realized Rs. 32790 and Rs. 37400 from FS4 farming systems.

Small farmers practiced all four types of Farming systems, Crops (FS-1) with net returns Rs.7054.7, Crops+ Livestock (FS-2) with net returns of Rs. 36286.9, Crops + livestock + sericulture (FS-3) with net returns of Rs. 68025.2, Crops + livestock + sericulture + Vegetables (FS-4) with net returns of Rs. 98760.8, with returns to cost ratio being 1.87, 2.32, 2.22 and 2.18 in case of FS-1, FS-2, FS-3 and FS-4 respectively. Medium farmers realized maximum net returns from FS-4, Rs. 141118.0 followed by FS-3 (Rs. 95014.6), FS-2 (Rs.30014.6) and FS-1 (Rs. 7068.9). Returns to cost ratio being 2.14, 2.16, 2.27 and 1.83 in case of FS-4, FS-3, FS-2 and FS-1 respectively. Likewise, large farmers realized maximum net returns from FS-4, Rs. 404819.2 followed by FS-3 (Rs. 284950.3), FS-2 (Rs. 140223.6) and FS-1 (Rs. 27455.9). Returns to cost ratio being 2.17, 2.21, 2.32 and 1.85 in case of FS-4, FS-3, FS-2 and FS-1 respectively.

Plate 1: Livestock rearing helps marginal/ small farmer to reduce machinery costs required for farming.

Plate 2: An important component of IFS- Floriculture. Farm women harvesting Crossandra to pack and market in nearby town.

Plate 3: Milching animals raised to satisfy dual purpose of farm families- additional farm income and assuring family food security.

Plate 4: Horticulture component of IFS- Munireddy posing in his Brinjal field.

Table 4.9 Economics of different enterprises and farming systems across different categories of farmers (INR/year)

Farming Systems	Marginal Farmer(/ farm of 1 acre)				Small Farmer(/ farm of 2.6 acres)			
	TC	GR	NR	Returns to cost ratio	TC	GR	NR	Returns to cost ratio
Crops	5558	10194	4635	1.83	8140	15194	7054	1.87
Livestock	25547	54024	32615	2.11	19296	48528	29232	2.51
Sericulture	0	0	0	0.00	28320	60059	31738	2.12
Horticulture	0	0	0	0.00	28208	58943	30735	2.09
FS-1 (rainfed)	5558	10194	4635	1.83	8140	15194	7054	1.87
FS-2 (rainfed)	21106	44218	23250	2.09	27436	63723	36286	2.32
FS-3 (irrigated)	38678	71467	32789	1.84	55757	123782	68025	2.22
FS-4 (irrigated)	41456	78854	37398	1.90	83965	182726	98760	2.18

Note: TC= Total cost, GR= Gross returns, NR= Net returns

FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Horticulture

Table 4.9 Economics of different enterprises and farming systems across different categories of farmers. (INR/year) (Contd....)

Farming Systems	Medium Farmer (/ farm of 3.54 acres)				Large farmer (/ farm of 10.5 acres)			
	TC	GR	NR	Returns to cost ratio	TC	GR	NR	Returns to cost ratio
Crops	8479	15548	7068	1.83	32151	59607	27455	1.85
Livestock	15140	38085	22945	2.52	73722	186489	112767	2.53
Sericulture	58000	123001	65000	2.12	129142	273869	144726	2.12
Horticulture	42312	88415	46103	2.09	110011	229880	119868	2.09
FS-1 (rainfed)	8479	15548	7068	1.83	32151	59607	27455	1.85
FS-2 (rainfed)	23619	53634	30014	2.27	105874	246097	140223	2.32
FS-3 (irrigated)	81620	176635	95014	2.16	235016	519966	284950	2.21
FS-4 (irrigated)	123932	265050	141118	2.14	345028	749847	404819	2.17

Note: TC= Total cost, GR= Gross returns, NR= Net returns

FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Horticulture

Table 4.10 Net returns from different farming systems (INR/year)

Farming Systems	Marginal Farmer	Small Farmer	Medium Farmer	Large Farmer
FS-1	4635	7054	7068	27455
FS-2	23250	36286	30014	140223
FS-3	32789	68025	95014	284950
FS-4	37398	98760	141118	404819

Note: FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Horticulture

4.3.2 Different integrated farming systems and impact on employment generation:

The average employment generation for the farmers following various farming systems is presented in table 5.11. farmers doing only crop cultivation had 34 man days of work per year while farmers with crops and livestock had 40 days, farmers with crops, livestock and sericulture had 81 days and maximum 92 days of employment was generated in crops, livestock, sericulture and horticulture farming system.

Table 4.11 Employment generation for farmers under different farming systems

Particulars	FS1 (15)	FS2 (39)	FS3 (16)	FS4 (15)
Employment generation (man-days/year)	34	40	81	92

Note: FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Horticulture

Table 4.12 Income generation at the identified employment level (in INR)

Particulars	FS1 (15)	FS2 (39)	FS3 (16)	FS4 (15)
Income per farm family per year	10200	12000	24300	27600

FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Horticulture

In study area, the labor wage for men per day (8 working hours) was INR.300 and for women it was INR 150. The FS1 farmers accounted for minimum of INR. 10200 for their farm work. FS2 farmers worked for INR.12000, FS3 farmers for INR. 24300 and FS4 farmers for INR. 27600.

4.4 Consumption pattern of food groups by sample households across different farming systems in comparison with recommended dietary allowances.

4.4.1. Foodstuffs consumed and adequacy of diets:

The consumption of various foodstuffs by the sample households was computed on a per consumer unit per day basis. Table 5.13.5.14 and 5.15 shows the consumption of food groups by children, women and men respectively in the sample village. Coming to the adequacy of diets, on average only cereals exceeded the recommended dietary level in all the groups {children (128.01 percent), women (109.39 percent)}, but in case of men it remained below the RDA (89.48 percent). No much difference was observed in consumption of cereals across the groups. On an average, 60 to 70 percent of the protein requirement was met in all the four farming systems. FS-1 (children-70.09 percent, women-69.84 percent, men-69.72 percent).

Table 4.13 Consumption of food groups by rural children across different farming systems in comparison with Recommended Dietary Allowances (gms/day)

Food Groups	RDA	FS-1		FS-2		FS-3		FS-4	
		Mean	Adequacy	Mean	Adequacy	Mean	Adequacy	Mean	Adequacy
			(%)		(%)		(%)		(%)
Cereals	200	261 (41)	130	256 (36)	128	262 (22)	131	267 (24)	138
Pulses	53	37 (4)	70	35 (4)	66	33 (3)	63	31 (3)	58
GLV	75	39 (6)	52	36 (3)	49	34 (3)	45	33 (8)	44
Roots & Tubers	51	33 (6)	65	35 (6)	68	38 (5)	74	39 (4)	77
Fruits	100	19 (14)	19	21 (15)	21	27 (16)	27	28 (16)	28
Milk	400	304 (69)	76	314 (77)	78	326 (48)	81	344 (58)	86
Fats & Oils	26	10 (2)	39	12 (2)	47	13 (3)	52	15 (5)	60
Meat & egg	35	32 (3)	92	34 (3)	97	36 (2)	104	37 (2)	105
Sugar & Jaggery	32	14 (10)	45	15 (10)	47	15 (11)	47	15 (10)	49

Note: Figures in parentheses indicate SD.

RDA-Recommended Dietary Allowances

Table 4.14 Consumption of food groups by rural women across different farming systems in comparison with Recommended Dietary Allowances (gms/day)

Food Groups	RDA	FS-1		FS-2		FS-3		FS-4	
		Mean	Adequacy (%)	Mean	Adequacy (%)	Mean	Adequacy (%)	Mean	Adequacy (%)
Cereals	300	331 (38)	110	329 (32)	109	332 (40)	110	334 (29)	111
Pulses	50	35 (2)	69	34 (2)	68	33 (3)	66	33 (2)	66
GLV	100	82 (2)	82	80 (2)	80	78 (2)	78	77 (3)	77
Vegetables	75	31 (9)	41	32 (10)	43	34 (15)	45	41 (16)	56
Roots & Tubers	75	34 (2)	45	35 (1)	46	36 (4)	48	36 (1)	48
Fruits	60	15 (8)	25	17 (12)	29	18 (10)	30	21 (11)	33
Milk	250	82 (55)	34	89 (72)	35	91 (60)	34	93 (76)	37
Fats & Oils	40	17 (1)	43	18 (1)	45	20 (1)	50	23 (1)	54
Sugar & Jaggery	30	18 (3)	60	18 (2)	61	19 (3)	63	19 (3)	64
Meat	60	38 (3)	63	44 (1)	73	47 (1)	78	51 (1)	86
Egg	30	8 (1)	28	9 (2)	30	10 (4)	33	11 (1)	35

Note: Figures in parentheses indicate SD.

RDA-Recommended Dietary Allowance

Table 4.15 Consumption of food groups by rural men across different farming systems in comparison with Recommended Dietary Allowances (gms/day)

Food Groups	RDA	FS-1		FS-2		FS-3		FS-4	
		Mean	Adequacy (%)	Mean	Adequacy (%)	Mean	Adequacy (%)	Mean	Adequacy (%)
Cereals	475	422 (18)	88	425 (32)	89	427 (27)	89	429 (17)	90
Pulses	65	45 (3)	70	45 (3)	68	43 (2)	66	43 (2)	66
GLV	125	105 (2)	84	103 (5)	82	97 (2)	78	95 (6)	76
Vegetables	75	39 (5)	52	43 (7)	57	46 (4)	62	52 (4)	69
Roots & Tubers	75	50 (3)	66	50 (4)	67	52 (4)	69	53 (3)	70
Fruits	60	18 (12)	30	19 (11)	32	20 (11)	34	21 (12)	36
Milk	250	114 (59)	46	119 (37)	47	121 (52)	48	123 (44)	49
Fats & Oils	40	19 (4)	53	22 (2)	54	24 (1)	60	29 (2)	73
Sugar & Jaggery	40	21 (2)	52	22 (2)	54	20 (2)	52	21 (1)	54
Meat & Fish	60	42 (4)	70	46 (4)	78	51 (4)	85	55 (3)	92
Egg	30	11 (8)	35	11 (8)	36	12 (8)	41	13 (7)	43

Note: Figures in parentheses indicate SD.
RDA-Recommended Dietary Allowances

Farming system1 (children-70.09 percent, women-69.84 percent, men-69.72 percent) and Farming system2 (children-66.47 percent, women-68.32 percent, men-68.75 percent) consumed more amount of pulses compared to Farming system3 (children-63.09 percent, women-66.24 percent, men-66.97 percent) and Farming system4 (children-58.55 percent, women-66.14 percent, men-66.42 percent).

Only 50 to 70 percent of the vegetable requirement was met in all the cases. Coming to different items under vegetables, green leafy vegetables were consumed more by Farming system1 (children-52.87 percent, women-31.22 percent, men-34.12 percent) and Farming system2 (children-49.00 percent, women-30.01 percent, men-33.78 percent) when compared with farming system3 (children-45.35 percent, women-29.13 percent, men-33.58 percent) and Farming system4 (children-44.00 percent, women-28.12 percent, men-30.62 percent). In contrast to GLV, roots and tubers and other vegetables were consumed more by Farming system4 (children-77.35 percent, women-56.37 percent, men-69.50 percent) and Farming system 3 (children-74.94 percent, women-45.41 percent, men-62.76 percent) when compared to farming system2 (children-68.65 percent, women-43.39 percent, men-57.67 percent) and Farming system1 (children-65.12 percent, women-41.61 percent, men-52.16 percent).

4.5 Per capita consumption of food items by different groups of the rural population.

Quantities of different food items consumed by the sample households are shown in tables 4.16 and 4.17. Dietary pattern of households in all groups was mainly cereal based. Rice and finger millet were the main grains consumed by the sample households.

Table 4.16 Consumption of food items (per capita) by different groups of the rural population. (Quantity/Month)

Food Groups	FS 1	FS 2	FS 3	FS 4
Cereals (Kg)	8.72	8.61	8.06	8.23
Millets (Kg)	5.11	5.36	4.06	4.42
Pulses (Kg)	1.18	1.08	1.04	1.03
Greens (Kg)	0.97	0.93	0.93	0.92
Vegetables (Kg)	2.10	2.42	2.57	2.82
Fruits (Kg)	0.67	0.81	0.85	0.93
Milk (ltrs.)	6.77	7.23	7.51	8.94
Meat (Kg)	0.66	0.74	0.83	0.91
Egg (number)	4.37	5.47	6.33	6.67
Edible oil (ltrs.)	0.52	0.51	0.66	0.61
Sugar/Jaggery (Kg)	1.06	1.03	1.17	1.21

Per capita consumption of cereals in Farming system1 was 8.72 kg/month, in Farming system2 8.61 kg/month, in Farming system3 it was 8.06 kg /month and in Farming system4 it was 8.23 kg/month. Consumption of millets varied between 5.11 kg/person/month in farming system1 to 4.42 kg/person/month farming system4 (table 4.16)

Consumption of pulses, which are generally considered to be the low-cost protein sources for vegetarians, amounted to 1.18 kg/month in

FS-1, 1.08 kg/month in FS-2, 1.04 kg/month in FS-3 and 1.03 in FS-4. Greens were also consumed more by FS-1 farmers (0.97 kg/month), followed by FS-2 (0.93 kg/month), FS-3 (0.93 kg/month) and FS-4 (0.92kg/ month).

In food groups like fruits, milk, meat and egg, consumption is more in FS-4 and FS-3. In group of milk and milk products, FS-4 individual consuming 8.94 liters of milk per month, FS-3 individual consuming 7.51 liters of milk per month, followed by FS-2 individual consuming 7.23 liters of milk per month, and least amount being consumed by FS-1 individual consuming 6.77 liters of milk per month. In group of fruits, FS-4 individual consuming highest of 0.93kgs per month, FS-3 individual consuming 0.85kgs per month, FS-2 individual consuming 0.81kgs per month, FS-1 individual consuming 0.67kgs per month.

In group of meat and egg, FS-4 individual consuming 0.91kgs per month, FS-3 individual consuming 0.83kgs per month, FS-1 individual consuming 0.74kgs per month, FS-4 individual consuming 0.66kgs per month.

4.6 Per capita expenditure on food items among different groups of the rural population.

Average expenditure shares of food items for different groups are presented in table 5.17. The expenditure on cereals, millets and pulses was more in all the groups when compared with other food items and there was no much difference across groups in expenditure on these food items. In a FS-1 household, an individual spent INR. 122.75 on these staple food items per month, FS-2 individual spent INR.117.97/ month, FS-3 individual spent INR.118.42/month and FS-4 individual spending INR.118.21/month. Farming system1 expenditure on food groups like milk (INR. 32.56), meat (32.58), fruits (INR.6.40) and vegetables (INR. 18.23) were less when compared with farming system2 expenditure on

food groups like milk (INR.41.27), meat (33.00), fruits (INR.7.26) and vegetables (INR. 19.08).

Farming system4 expenditure on food groups like milk (INR. 49.56), meat (54.56), fruits (INR.11.85) and vegetables (INR. 24.56) was highest among all four farming groups followed by Farming system3 whose expenditure on food groups like milk was INR. 48.26, meat INR.42.56, fruits INR.8.16 and vegetables INR. 21.45. The total expenditure per month per individual was accounted highest of INR.303.15 in case of farming system4 households, followed by farming system3 households with INR.286.28, then farming system2 with INR. 259.98 and least by farming system1 with INR. 256.07

4.6.1 Marginal Propensity to Consume:

The marginal propensity to consume was estimated by obtaining the regression coefficients of expenditure on income (expenditure being the dependent variable and income the independent variable) for each of the commodity/commodity group, separately for all the groups. Regression coefficients (β) that were statistically significant only are used for interpretation. The α (Constant) was positive (Table 5.18) for majority of the food items suggesting that these commodities are essential to the household. However, the low levels of α for some of the food items like fruits, milk and meat in some groups, which is attributed to the household's socio-cultural environment, tastes and preferences and rigidities in the supply of these commodities. The marginal propensity to consume (β) for different food items were generally low but was higher for high value food items like milk and fruits was found to be higher. There was substantial difference in the magnitude of β_2 across different groups. In general, the MPC was higher for commodities that are rich in nutrients.

Table 4.17 Per capita expenditure on food items among different groups of the rural population. (INR/Month)

Particulars	FS 1		FS 2		FS 3		FS 4	
	Value	% to total	Value	% to total	Value	% to total	Value	% to total
Cereals	124	24	119	23	119	21	120	20
Millets	49	10	50	10	53	9	56	10
Pulses	73	14	68	13	65	11	61	10
Greens	12	2	11	2	11	2	9	2
Vegetables	36	7	38	7	43	8	49	8
Fruits	13	3	15	3	16	3	24	4
Milk	65	13	83	16	97	16	99	17
Meat	65	13	66	13	85	15	109	18
Sugar	32	6	32	6	30	5	33	5
Egg	5	1	8	1	7	1	8	1
Edible oils	37	7	33	6	44	8	41	7
Total Expenditure/ Individual	512	100	520	100	571	100	608	100

Table 4.18 Result of regression analysis (Expenditure-Income relationships) for different groups of integrated farming systems.

Particulars	FS1				FS2			
Food Groups	α	β_1	β_2	Adj R^2	α	β_1	β_2	Adj R^2
Cereals	5.13	0.32	0.53* (0.19)	28.0	5.24	0.26	0.05** (0.01)	59.30
Pulses	0.65	0.18	-0.01** (0.001)	97.9	0.72	0.31	0.25 (0.25)	-
Vegetables	1.14	0.46	0.02*** (0.009)	26.0	1.25	0.33	0.54* (0.07)	30.00
Fruits	0.21	0.53	0.24 (0.23)	-	0.34	0.62	0.89* (0.29)	25.20
Milk	3.45	0.92	-0.03* (0.01)	97.5	4.19	0.87	1.03* (0.29)	30.50
Meat	0.15	1.24	0.03*** (0.01)	56.0	0.13	0.97	0.03** (0.01)	24.00
Sugar	0.53	0.56	0.89 (0.29)	25.00	0.45	0.42	0.01*** (0.0)	18.10
Edible Oil	0.12	0.48	0.01** (0.0)	89.6	0.32	0.19	0.29 (0.22)	-

Note: Figures in parentheses indicate standard error of the estimates.

* Denotes significance at 1 percent level.

** Denotes significance at 5 percent level.

*** Denotes significance at 10 percent level.

Table 4.18 (Contd.) Result of regression analysis (Expenditure-Income relationships) for different groups of integrated farming systems.

Particulars	FS3				FS4			
Food Groups	α	β_1	β_2	Adj R^2	α	β_1	β_2	Adj R^2
Cereals	4.8	0.14	0.26 (0.19)	-	5.12	0.43	0.43* (0.02)	69.60
Pulses	0.63	0.23	3.17** (1.54)	13.00	0.54	0.45	0.54* (0.07)	30.00
Vegetables	1.59	0.48	0.53* (0.19)	28.0	1.98	0.39	0.02** (0.008)	32.0
Fruits	0.23	0.46	1.30* (0.41)	31.50	0.56	0.76	0.50 (0.39)	-
Milk	4.98	0.71	0.85** (0.05)	20.50	7.12	0.86	0.03** (0.01)	24.00
Meat	0.65	0.89	1.30 (0.41)	35.00	0.65	0.84	-0.98** (0.07)	27.00
Sugar	0.67	0.36	0.52** (0.24)	18.20	0.83	0.61	0.23 (0.33)	-
Edible Oil	0.25	0.37	0.79* (0.30)	23.30	0.32	0.52	1.78*** (0.51)	16.00

Note: Figures in parentheses indicate standard error of the estimates.

* Denotes significance at 1 percent level.

** Denotes significance at 5 percent level.

*** Denotes significance at 10 percent level.

Table 4.19 Estimated income elasticities for different farming systems in the study village.

Food Groups	FS 1 33)	FS 2 (27)	FS 3(24)	FS 4 (6)
Cereals	0.32	0.26	0.14	0.43
Pulses	0.18	0.31	0.23	0.45
Vegetables	0.46	0.33	0.48	0.39
Fruits	0.53	0.62	0.46	0.76
Milk	0.92	0.87	0.71	0.86
Meat	1.24	0.97	0.89	0.84
Sugar	0.56	0.42	0.36	0.61
Edible oils	0.48	0.19	0.37	0.52

FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Vegetables

Note: Elasticity is calculated using formula, $\varepsilon = \beta_{1} = \beta_{2} / Y$

Geometric mean of per capita income (Y) realized by different farming systems are as follows,

FS1=850, FS2=1000, FS3=2025, FS4=2300

The estimated income elasticities for different food groups across different classes of farmers are given in table 4.19. The income elasticities were generally higher for high value commodities such as

edible oil, sugar, milk, fruits and vegetables compared to cereals and pulses. This implies that for every rupee increase in the total expenditure, the outlay for high value commodities such as edible oil, sugar, milk, fruits and vegetables would increase compared to food grains. The income elasticity did not vary much across farming systems. The income elasticities for a majority of food items were found to be less than unity. The income elasticities of staple food groups were very less in all farming groups. In FS-1, cereals had income elasticity of 0.32 and pulses 0.18. FS-2 with elasticity of 0.31 in pulses, FS-3 with elasticity of 0.14 in cereals and 0.23 in pulses, FS-4 with elasticity of 0.43 in cereals. In vegetables also less elasticity was recorded in all groups. FS-1 with 0.46, FS-2 with 0.33, FS-3 with 0.48 and FS-4 with 0.39.

In food groups like milk, meat and fruits elasticity was nearer to unity indicating that 1 rupee increase in income led to more expenditure on high valued food items. In-group of FS1 farmers, elasticity of fruits was 0.53, milk was 0.92 and on meat highest of 1.24. FS2 farmers recorded elasticity of 0.87 in case of milk and 0.97 in case of meat. . In-group of FS3 farmers, elasticity of milk was 0.71. In-group of FS4 farmers, elasticity of fruits was 0.76, milk was 0.86 and meat was 0.84.

4.7 Expenditure pattern on human health among different farming systems.

Expenditure pattern on human health across four categories of farmers was calculated and presented in table 4.20. Expenditure on major illness was calculated for last five years and expenditure on minor illness was calculated for current year. Among Marginal farmers, three persons suffered from major illness and on average spent INR. 2850.75 in last five years and INR.845.63 on minor illness. Large farmers (two sufferers) incurred highest health expenditure, INR. 6500 on major illness and INR. 1265 on minor illness. Followed by medium farmers (two

sufferer) with INR. 4225.5 on major illness and INR. 1112.67 on minor illness. Small farmers spent INR. 3500.5 on major illness and INR. 926.83 on minor illness.

Table 4.20 Expenditure pattern on human health among different farming systems (in INR)

Farming groups	Major illness (2007-11)	Minor illness (2010-11)
FS-1	0	745
FS-2	3460	816
FS-3	4850	978
FS-4	6240	1164

Note: n= number of sufferers in that particular period.

FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Horticulture

4.8 Expenditure pattern on human health among different categories of farmers

Expenditure pattern on human health across four farming systems was calculated and presented in table 4.21. Expenditure on major illness was calculated for last five years and expenditure on minor illness was calculated for current year. Farming system1 had no expenditure on major illness in last five years but spent INR.745.23 on minor illness.

Highest health expenditure was incurred by farming system4, INR. 6240 on major illness and INR. 1164.25 on minor illness. Followed by farming system3 with INR. 4850 on major illness and INR. 978.56 on minor illness. Farming system2 spent INR. 3460 on major illness and INR. 816.58 on minor illness.

Table 4.21 Expenditure pattern on human health among different categories of farmers (in INR)

Farming groups	Major illness (2007-11)	Minor illness (2010-11)
Marginal farmers	2850	845
Small farmers	3500	926
Medium farmers	4225	1112
Large farmers	6500	1265

n= number of sufferers in that particular period.

4.9 Awareness and perception of farmers towards integrated farming systems.

Farmers irrespective of the integrated farming systems they were following, all of the farmers responded positively towards their level of awareness and perception towards integrated farming systems.

Table 4.22 Awareness and perception of farmers towards integrated farming systems (in percentage)

Particulars	FS1	FS2	FS3	FS4
I am very much aware about the IFS and its practices	72	81	83	91
IFS is beneficial to farmers	67	83	72	87
IFS creates more employment to the farm family	57	63	87	67
IFS utilizes the resources efficiently which are available on farm	81	64	83	86
By practicing IFS it has been possible for our family to have a secured livelihood (in terms of income, farm produce, food and nutrition security, employment)	72	67	87	92
I would like to continue with IFS in the future	78	64	58	88

FS-1= Crops

FS-2= Crop+ Livestock

FS-3= Crop+ Livestock+ Sericulture

FS-4= Crop+ Livestock+ Sericulture+ Horticulture

Discussion

V. DISCUSSION

The results of the study, presented in chapter 5 are discussed here under the following sub heads:

5.1 General characteristics of the sample farmers and household-Livelihood Assets Context

5.2 Farming systems and cropping pattern followed by the sample respondents

5.3 Different integrated farming systems across different categories of farmers and impact on employment.

5.4 Consumption pattern of food groups by sample households across different farming systems in comparison with recommended dietary allowances.

5.5 Per capita and family consumption of food items by different groups of the rural population.

5.6 Per capita and family expenditure on food items among different groups of the rural population.

5.7 Expenditure pattern on human health among different farming systems.

5.8 Expenditure pattern on human health among different categories of farmers

5.9 Awareness and perception of farmers towards integrated farming systems.

5.1 General characteristics of the sample farmers and household-Livelihood Assets Context

To give an overall idea about the livelihood situation of the sample respondents the data was analyzed as per the five livelihood asset

features. To begin with the *natural capital*, land holding of the sample respondents is calculated. The four different categories of farmers viz., marginal, small, medium and large farmers were presented in table 4.1 based on the size of operational holdings. It was found that maximum respondents belonged to marginal farmers, followed by small and then by medium farmers. Large farmers formed a lesser portion of the sample. The distribution of operational holdings was highly skewed in the study area. The marginal farmers operate on an average of 1.04 acres as against 11.73 acres by large farmers (table 4.1). The farmland consists of small fragments with different mix of enterprises like dairy, sericulture, poultry, sheep, poultry and horticultural crops.

Many of the farmers had irrigated land, while marginal farmers had meager access to irrigation due to non- availability of financial sources coupled with less land area and smallholdings while medium and large had more of irrigated land almost two to three times the existing dry land farmers. Majority of the area in the sample village (57.20 percent) was under rainfed condition as indicated in table 4.1, followed by irrigated land (41.06 percent) and meager proportion of fallow land. Majority of the area being cultivated by marginal and small farmers as they are more in number followed by medium and large farmers. The sample respondents were found to be satisfactory with *physical resources* like house, cattle shed, machineries and equipments. It is noticeable that most of the farmers owned considerable livestock to support their livelihood, a crucial component of integrated farming systems. The fact that the study area is one of the major milk producing area is reiterated by the results which indicated that majority of the farmers maintained dairy cows for converting low valued bulky by- products of crops into high valued milk. Majority of the sample farmers own crossbred cows, local cows and buffaloes for dairy purpose. The number of livestock maintained by different farming systems was partly dependent on the quantity of fodder

availability and labour force on these farms. The number of bullock pairs maintained by sample farmers was one each in marginal, small and medium farmers whereas two pairs of bullocks were maintained by large farmers (table 4.3). This is mainly because of land use intensification, and provision of purchased inputs change the role of animals in most of the farming systems (Ruthenberg, 1979).

Marginal farmers in the study village maintained highest number of sheep, goat and poultry, (53.12 percent) as they were the major source of their income. This was mainly due to the reason that these animals do not need much purchased inputs and can thrive on green pastures available in the village. Followed by small (19.48 percent), medium (17.35 percent) and large farmers (10.05 percent).

Then, coming to *human capital* of the respondents, the study considers the age, workforce of the family, education status and source of information. The educational level of the respondents will influence the level of adoption of innovations. It was found that the majority of the respondents were educated up to primary level (58 percent), while high school educated formed 28percent followed by Pre University educated and graduates by 14 percent (table 4.4). High literacy rate (72 percent) among the sample farmers might be due to the availability of transport facilities and nearness of the sample village to town and city. Hence high literacy rate provided wider scope for adopting innovations in the study area.

The family size is an important decisive factor that indicates the availability of family labour and the capacity to save and investing on food items and farming. In the present study, the average family size was positively related with the operational holdings of the household i.e., the family size increased with size of operational holdings (table 4.5). This abundant availability of male and female force throughout the year

reduces the requirement of hired labor on the one hand and on the other hand, the quantity of food items required will be more in case of families with more number of members.

Television and radio are the major sources of information for most of the respondents followed by short message service provided in mobile device. Other major source of information stated were fellow farmers in the village, traders and input dealers. Nearly quarter of the respondents felt there is no need to get any information and none of the respondents are informed from any extension personnel employed by government and animal husbandry department (table 4.7).

The sample respondents were found to have very limited access to *financial resources*/assets in the study area. Only quarter of the growers had access to the formal sources of credit provided by banks, cooperative institutes, etc. The remaining more than half of the respondents relied on the informal source of finance to satisfy their financial needs. They found finance from friends, relatives or local lenders. The interest rate for the amount borrowed from formal institutions is considerably low compared to informal credit. The formal institutions charged interest rate between 9 to 14 percent per annum while informal source of credits charged interest rate from 24 to 36 percent per annum.

The respondents reported rich *social assets* within themselves. They expressed deep sense of trust and solidarity within the community they find their livelihood.

5.2 Farming systems and cropping pattern followed by the sample respondents

5.2.1 Existing cropping pattern

Most of the farmers tried to meet food grain needs for the family consumption and fodder requirement for livestock from their own farm production. Their priority in cropping decisions was to provide for these needs plus a safety factor to cover yield uncertainty. This was clearly reflected in the existing cropping patterns followed by the sample farmers. When we look from supply side alone it may be more profitable to grow some other commercial crops and purchase the entire family consumption requirements assuming that there is no production and marketing risks. The study area comes under the eastern dry zone of Karnataka, the average annual rainfall is 744 mm, study area receives good rainfall only once in four to five years. Most farmers choose one or two enterprises as their principal or main enterprise that has high and sustained marginal returns. Farmers adopt other enterprises along with crops, which would employ unused resources equally advantageously at the margin over space and time.

The existing cropping pattern of the different categories of farmers is presented in the table 4.7. It was found that in general during kharif, finger millet + horse gram was the major food crop on dry land. This was mainly because finger millet formed the staple and also energy rich food and ideally suited to the agro climatic conditions. Finger millet + horse gram combination was preferred by the farmers as it was found drought resistant and the by-products is highly nutritious and palatable fodder for livestock. Other important crops grown in kharif are maize, finger millet + field bean and red gram.

In tube well irrigated land in general during kharif, mulberry occupied the maximum area in all the categories of farmers. As the study area is a major cocoon producing area in the state most of the farmers were cultivating mulberry crop. Next to mulberry, vegetable crops like tomato, potato, carrot and beetroot covered majority of the area.

In rabi season under tube well-irrigated condition potato occupied major area and was cultivated by all categories of farmers (except marginal farmers). Mulberry occupied the same area as it was in kharif. It was observed that tomato, carrot, cabbage and beetroot were also being practiced but under small acreage. In summer season, under tube well-irrigated land mulberry occupied major area followed by tomato and potato. In the study area, as perennial crop, only coconut was taken up by a large farmer. Many of the floriculture crops were grown by the sample farmers in the village like crossandra, jasminum and marigold but in very less area.

5.2.2 Types of farming systems

Farming system approach employs combination of crops and livestock enterprises aimed at the efficient use of resources to maximize the income. It also minimizes the production risk by spreading the risk to the various enterprises instead of one activity/enterprise. The existing farming systems indicated that sample farmers were following different types of farming systems in order to augment the income from various enterprises. All categories of farmers followed all the identified farming systems namely, crop and crops + livestock. It was not possible to take up other two farming systems (sericulture and horticulture) by marginal farmers in large scale because of non-availability of water resources and lack of investment capital. Small and medium farmers followed all four types of farming systems whereas all the large farmers in the study area followed most diversified farming system(C+L+S+V).

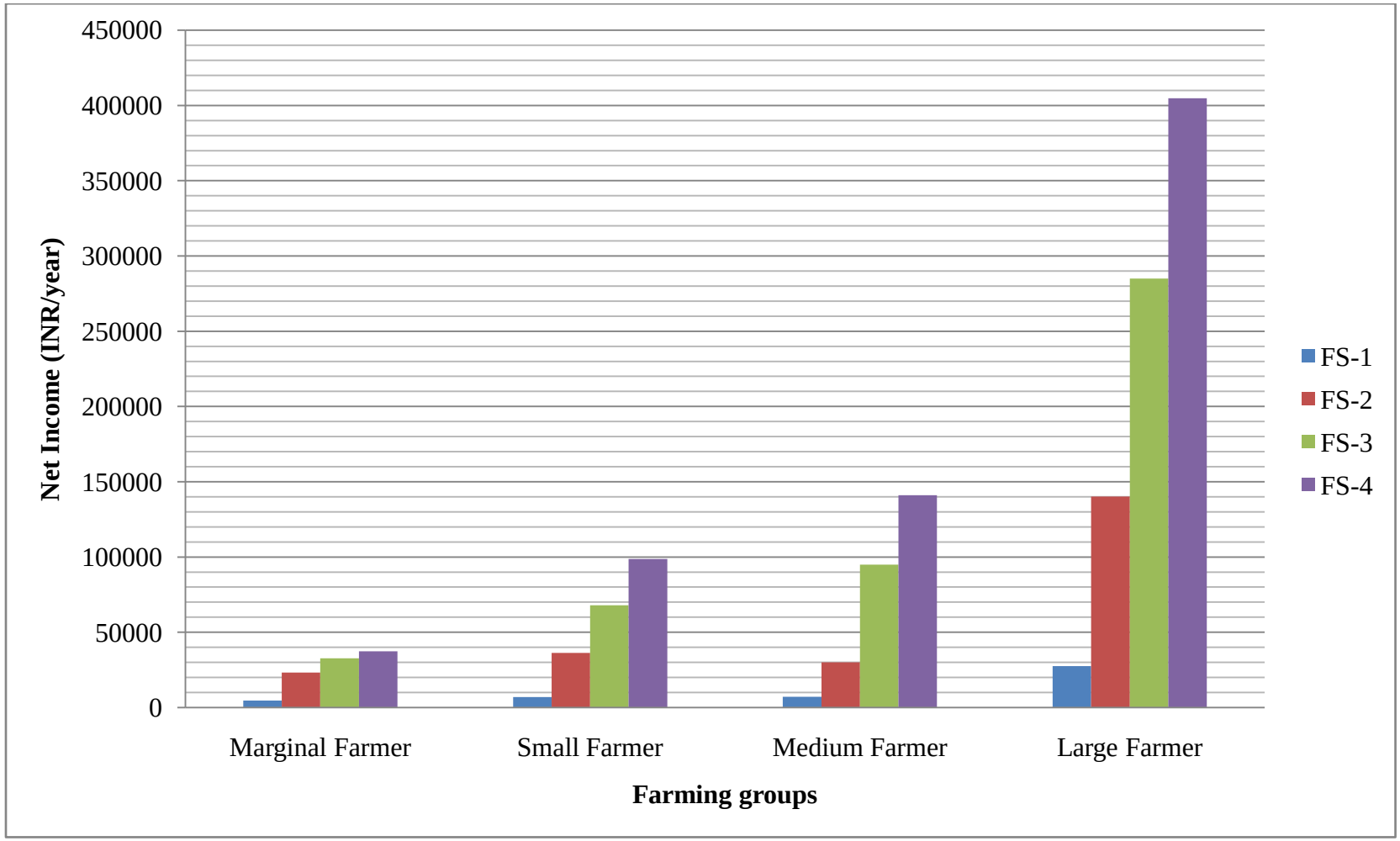
The area under study is one of the dairy dominated regions in the district and it formed a major component in the combination of different farming systems. Accordingly, in the present study, a majority of the sample farmers practiced C+L (51.7 percent) system followed by C+L+S+H (20 percent) farming system and then by C+L+S (18.3 percent) and only cropping system (10 percent).

5.3 Different integrated farming systems across different categories of farmers and impact on employment.

The sample farmers in the study area were following highly diversified, mixed farming system. It was found that marginal farmers derived maximum net farm income from C+L+S+H system followed by C+L+S and C+L. The small farmers derived maximum farm income from C+L+S+H farming system followed by C+L+S and C+L farming system. Similarly, medium and large farmers had highest returns from C+L+S+H farming system followed by C+L+S and C+L farming system (table 4.9 and 4.10).

Thus, farming system involving the combination of crops, livestock, sericulture and horticulture fetched maximum returns irrespective of the size of the holding due to complimentary and supplementary nature if relationship existing between these biological processes. The farming system comprising of C+L+S+H provides adequate opportunities for a complementary relationship in the sense that crop and mulberry residues (sericulture) provides good fodder to the livestock and thereby contributing to higher milk yield. The dairy in turn provides manure required for mulberry cultivation thereby contributing to higher returns in sericulture. Vegetables being high value crops fetch higher returns per unit area thereby contributing to higher returns to the farmers. Thus, it is interesting to note that the farming system C+S+L+H not only fetched highest returns to farmers but is also scale neutral and hence recommended for all categories of farmers to increase their income levels.

Figure 3: Net returns from different farming systems (INR/ year)



5.3.2 Different integrated farming systems and impact on employment generation:

The findings of the present study are in line with the findings of the Nanjareddy (1965) and Malathesh *et al* (2008) about employment generation under different integrated farming system. From the results, it can be concluded that more employment was generated in case of farmers with Crop + Dairy+ Sericulture+ Horticulture farming system followed by crop + Livestock+Sericulture farming system and very less in case of crop farming system. Hence combinations of enterprises should be followed in farming system rather than following single enterprise.

5.4 Consumption pattern of food groups by sample households across different farming systems in comparison with recommended dietary allowances.

The main categories of food stuffs consumed were cereals, millets, pulses, vegetables, fruits, milk, fats and oils, meat and egg, sugar and jaggery. Dietary pattern was assessed according to farming system groups. It shows that cereals were consumed in the largest quantities across all the groups. These were followed by milk while the least consumed items were fats and oils, meat and egg, sugar and jaggery. Consumption increased with increase in the per capita expenditure. As expected the lowest consumption was observed for very poor households i.e. Farming system1 farmers.

Even though most of the households in the village had dairy animals, the consumption of milk was very low irrespective of the groups. High valued foodstuffs like milk, fruits, fats and oils, meat and egg were consumed more by high income people like Farming system3 and Farming system4 who followed diversified farming systems compared to Farming system1 and Farming system2.

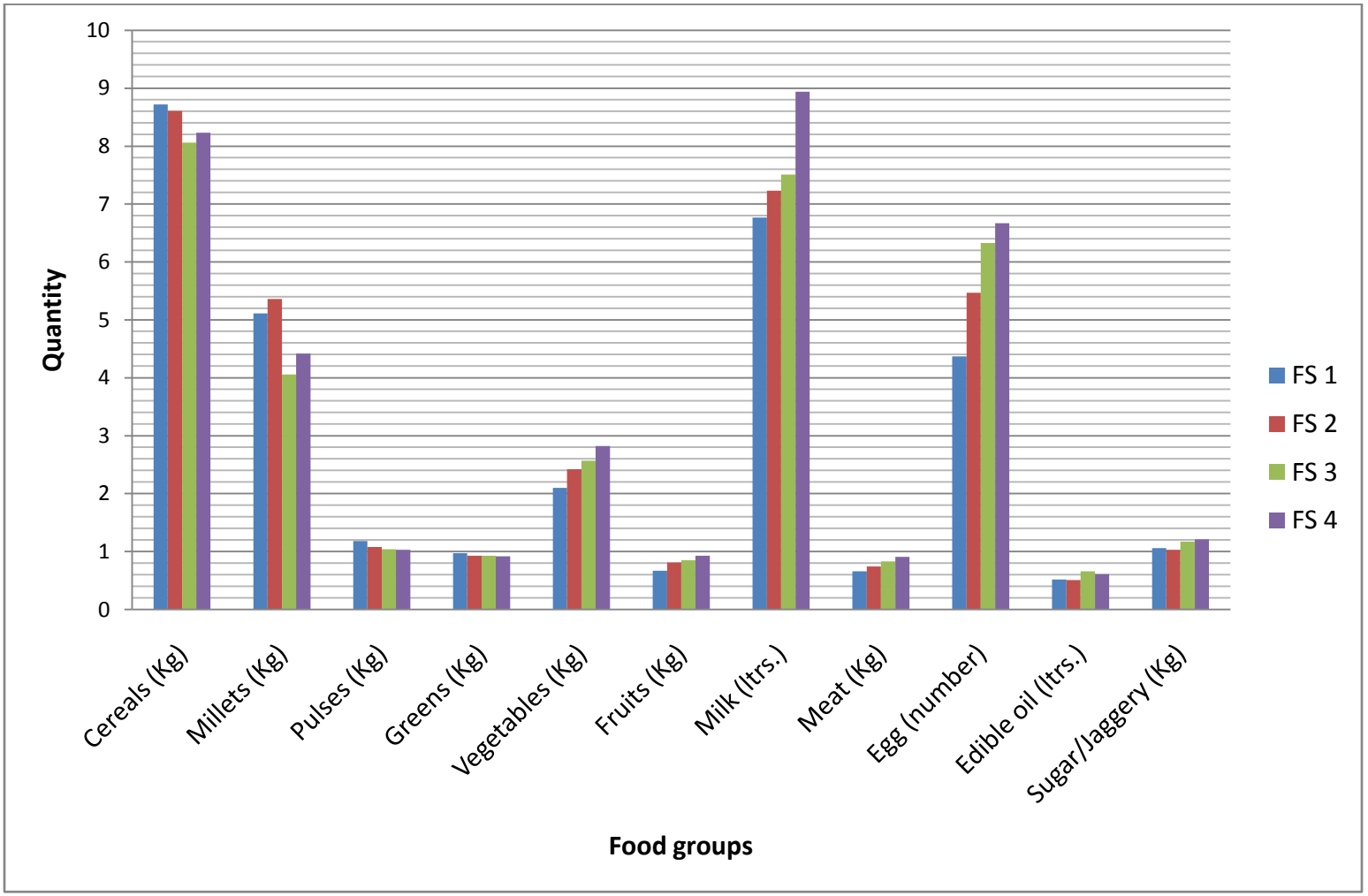
5.5 Per capita consumption and expenditure of food items by different groups of the rural population.

Quantities of different food items consumed by the sample households are shown in tables 4.16 and 4.17, figure 3 and 4. Dietary pattern of households in all groups was mainly cereal based. Rice and finger millet were the main grains consumed by the sample households.

No much difference was observed in consumption of cereals and millets across four farming systems, as these are the staple food of the community. In case of pulses and green leafy vegetables, farming system 1 consumed more amount as these are being grown in their fields and forms a major part of their diet. The low consumption of meat and eggs was basically due to composite effect of various social, economic, psychological and cultural factors. Moreover, the non-vegetarians did not consume meat regularly. The most compelling reason, of course, was low level of income. Meat being a high priced food item is generally out of reach of a majority of the population. In majority of the cases, food items other than cereals and millets were consumed in larger quantities by the households following farming system 3 and farming system 4.

There was no much difference being noticed in consumption of low valued food items like cereals, millets, pulses and greens. Considerable difference was noticed in consumption of high value food items like milk, meat, fruits and oils. The most diversified farming systems with high income that is farming system 4 and farming system 3 consumed more high valued crops. They were able to purchase the food items from market and food diversification was also good in these groups. But farming system 1 and farming system 2 with low income, tried to manage their diet with their own farm produce like cereals, millets, pulses and greens. Therefore food diversification was very less in these groups.

Figure 4. Consumption of food items (per capita) by different groups of the rural population (quantity per month)



5.6 Per capita expenditure on food items among different groups of the rural population.

Average expenditure shares of food items for different groups are presented in table 4.18 and figure 4. The share of food expenditure in total consumption expenditure declined with an increase in household income (i.e., as we move from farming system1 to households following farming system 4). This is in conformity with the Engel's law that states that the proportional allocation of budget to food would decline with increase in household income.

On an average, cereals, millets and pulses all put together shared 43 percent of the total per capita expenditure on food, whereas vegetables formed 7.12 percent of the total per capita expenditure. Fruits, on an average, had a very small share of 2.62 percent out of the total per capita expenditure. The share of food grains in per capita total expenditure declined continuously as we move across the different farming systems (i.e., from farming system1 to households following farming system 4). The share of livestock products (milk, meat and egg) and vegetables all put together (roots and tubers and other vegetables except greens) also showed a similar trend, whereas in absolute terms it showed an opposite pattern. It may be noted that, other than farming system1 and farming system2, the proportional allocation of total consumption expenditure to livestock products was almost equal to that of food grains.

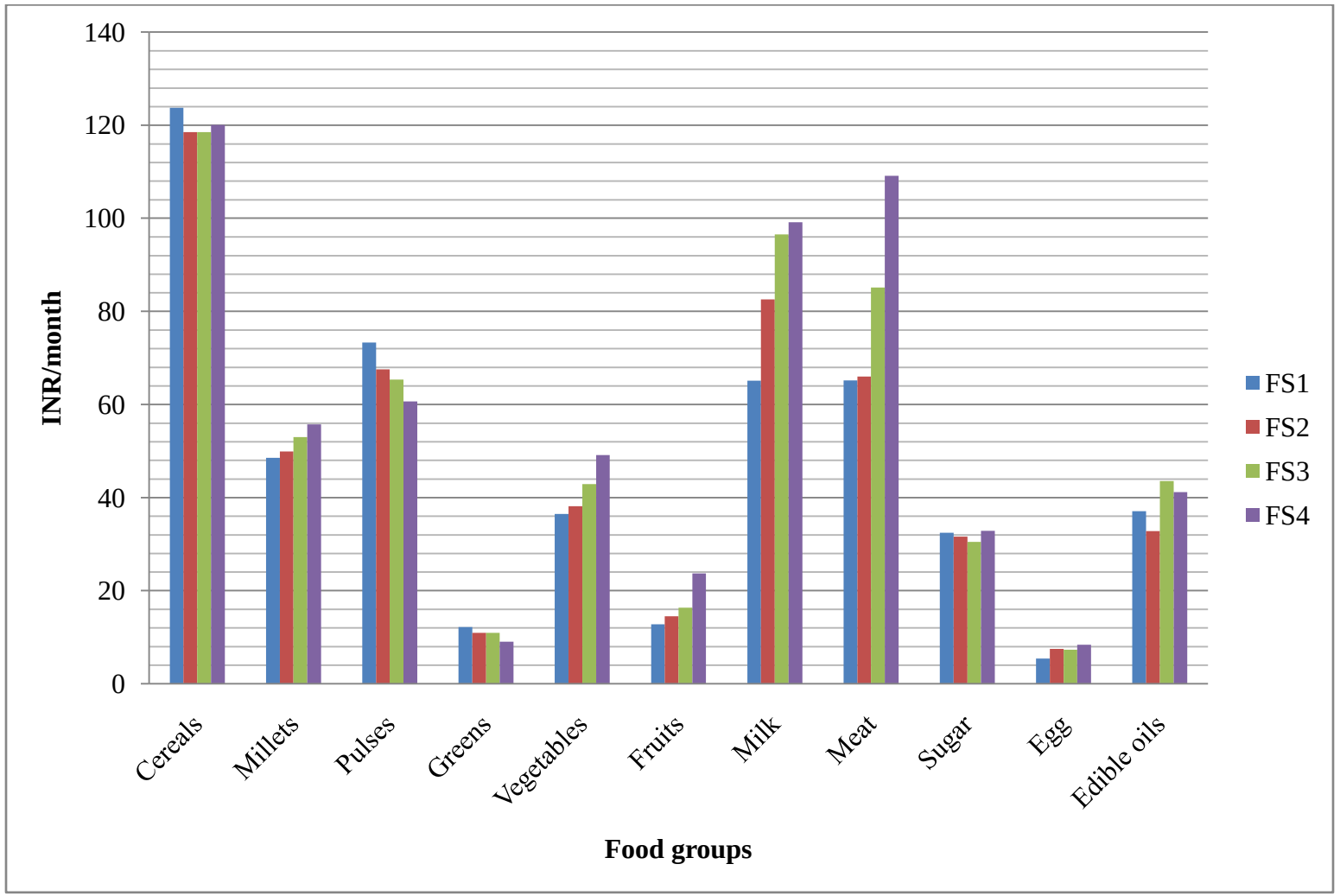
At the commodity level, it appears that the items for which the expenditure shares declined are those, which are considered to be basic essential items such as cereals, millets, pulses, edible oils and vegetables. Among the livestock products, meat and egg accounted for the highest expenditure share, except in case of households following farming system1 and farming system 2, followed by milk. The

expenditure spent on millets was almost same in all four farming systems. On an average, cereals accounted for 21.56 percent of total expenditure. The expenditure pattern on cereals (24.16 percent), pulses (9.47 percent), green leafy vegetables (2.38 percent) was more in case of farming system1, followed by farming system2, farming system3 and farming system4.

In high valued food groups like fruits (3.91 percent), milk (15.92 percent), meat (18 percent) and egg (1.39 percent), edible oils (6.79 percent), vegetables (8.10 percent) farming system4 expenditure was more, followed by farming system3, farming system2 and farming system1. Farming system1 and farming system2 expenditure on high valued food items was less, their diet comprised mainly of the food items which they grow in their own fields like cereals, pulses and green leafy vegetables. Their economic condition will not support them to buy high valued, nutritive crops from market. Farming system1 households consumption of milk and milk products is very less as they do not take up dairy enterprise and have to purchase milk from outside.

Therefore, total expenditure of an individual per month was accounted highest of Rs.608.3 in case of farming system4 households, followed by farming system3 households with Rs.570.56, then farming system2 with Rs. 520 and last, farming system1 with Rs. 512.

Figure 5. Per capita expenditure on food items among different groups of the rural population.



5.6.1 Marginal propensity to consume and expenditure elasticities:

Several functional forms of Engel curves were tried in order to select a suitable form for estimation of elasticity co-efficients. The log-log inverse function gave the best fit for majority of the commodities. The log-log inverse function was found to be the best fit in the case of Indian expenditure data. (Sinha, 1966; Bhattacharya and Maitra, 1969; Maitra 1969; Desai, 1972; Mitra, 1986; Sharma 1990). However, low values of R^2 were found in the case of cereal and millets, which are considered to be inferior goods. Hence, these were overlooked in the estimation. The signs of regression co-efficients were also as expected. The goods are considered essential if between zero and one, inferior goods if the elasticity is less than zero and luxury if the elasticity is greater than one.

The estimated expenditure elasticities of different food items are presented in table 5.19. The income elasticities for a majority of food items were found to be less than unity. The response of items such as cereals, pulses, edible oils, vegetables, sugar to income changes was very low as compared to meat, milk and fruits. The response of food items to income changes varied across different groups. It may be noted that the list of items with higher income elasticities was more or less common to all the groups though it differed in commodity ordering depending on tastes and preferences of the households. For instance, with 1 percent increase in income, the households in farming system 1 group would spend proportionally more on milk, vegetables and meat while the households in farming system 4 groups would prefer to consume meat, vegetables and milk.

The principal consumption items that are cereals, pulses, edible oils, sugar appear as relatively income inelastic items when compared with vegetables, fruits, milk and meat. This implies that the expenditure on these items increased at a higher rate along with increase in income.

5.7 Expenditure pattern on human health among different farming systems.

Farming system1 farmers had no expenditure on major illness and least expenditure on minor illness. This is because the net income of farming system1 farmers is very low and their expenditure towards health is also low. In case of illness, they prefer to consult government hospitals and doctors at low cost rather than consulting a private doctor, which can increase their expenditure. As the net income of the farming groups increased, expenditure on health also increased. In Farming system3 and Farming system4 groups, which are considered as high-income groups, take care towards their health. They prefer to consult private doctors for each and every illness and spend more on health. (for details regarding components considered under minor and major illness, please refer to appendix 1- questionnaire, pp102 and 103)

5.8 Expenditure pattern on human health among different categories of farmers

Expenditure pattern on human health across four categories of farmers was calculated and presented in table 5.21. Marginal farmers had least expenditure on minor and major illness. This is because the net income of marginal farmers was very low and their expenditure towards health is also low. In case of illness, they prefer to consult government hospitals and doctors at low cost rather than consulting a private doctor, which can increase their expenditure. As the cultivated area increased, expenditure on health also increased. In categories of large and medium farming groups, which are considered as high-income groups, take more care towards their health compared to marginal and small farmers. They prefer to consult private doctors for each and every illness and spend more on health.

5.9 Awareness and perception of farmers towards integrated farming systems.

It is an optimistic finding to note that all the respondents were well aware about integrated farming systems and its benefits. Farmers irrespective of the integrated farming systems they were following, all of the farmers responded positively towards their level of awareness and perception towards integrated farming systems.

Summary and Conclusion

VI. SUMMARY AND CONCLUSION

Indian agriculture is dominated by large number of small holders with scattered fragmented holdings. Lack of adequate capital for investment has been the major constraint contributing to the decline in growth of agriculture. The consumption basket in India is changing towards high value agriculture due to rise in income, urbanization, changing tastes and preferences of consumers. Thus, the move is towards integrated farming systems of agriculture with high value commodities such as milk, meat, fish, fruits and vegetables. In view of risk and uncertainty in agriculture especially of high value commodities, adoption of farming system approach integrating rising of crops, livestock and agro-forestry has become important and been an effective strategy for Indian farmers. This would internalize the complementarities of all the natural resources to realize high productivity, increased employment rate, sustainability, profitability, better nutrition and low cost of production.

With this backdrop, efforts were made to analyze the farmer's strategy to mitigate the predicament. Results have indicated that integrated farming system was found to be one of the best alternative solution in upliftment of rural economy in terms on increased employment, income levels and food security. Therefore, the main focus of the study was to analyze the economics of different farming systems and its importance in employment generation, income, food security and health with an emphasis on analyzing income and expenditure elasticity's of major food items in particular and also to study farmers perception towards integrated farming systems.

A brief summary of the research conducted along with the salient findings is presented in this chapter. The important conclusions drawn from this study and policy options developed for planners and

administrators are also indicated here under. The specific objectives of the study were as follows:

6.1 Specific objectives of the study:

1. To analyze the economics of different integrated farming systems and their impacts on employment and livelihood.
2. To analyze expenditure and consumption pattern of different food groups.
3. To estimate the expenditure on health care and major, minor illness.
4. To study the farmer's perception towards integrated farming systems potentials in ensuring employment and livelihood security.

6.2 Methodology

The present study was done in Bangalore rural district located in Eastern dry zone of Karnataka during the months of September and October, 2012. This area is dominated by small and marginal farmers suffering from scarcity of groundwater and also it has more proportion of dry land to the total cultivated area. The study village, Venkatanahalli was selected purposively and samples of 90 farmers were selected based on simple random sampling method among the identified farming systems within the selected village.

6.2.1 Nature and source of data

The results of the study are based on the primary data. Data was collected from primary and secondary sources. As primary source of information, 90 farmers were personal interviewed using pre- tested comprehensive schedule. The primary data was collected on socio-

economic conditions, employment status of the family, cropping pattern, size of operational holdings, existing farming systems, cost of cultivation, consumption and expenditure on food items, expenditure on health and the perception of farmers towards integrated farming systems. Secondary data on land utilization pattern, rainfall, population, work force; marketing and banking facilities were collected from District at a Glance 2003-2004, Bangalore Rural.

6.2.2 Analytical technique

The data collected were tabulated and analyzed to draw inferences inline with the objectives. The data was analyzed using measures of central tendency and regression analysis. Economics of different farming systems and its impact on employment, income, food security and health was analyzed using tabular framework. To study the expenditure and consumption pattern on food items, logistical regression was used. Percentages and averages were used to calculate cost and returns of crops grown in the study area and also to know the economics of existing farming systems. The expenditure on healthcare, major and minor illness was estimated using tabular framework. To study the farmer's perception towards nutritious and processed foods tabular framework averages and percentages were used.

6.3 Major findings of the study

1. The average land holding size of the marginal farmers was 1.04 acres (8.4 percent), small farmers had 3.64 acres (30 percent), medium farmers had 5.42 acres (38 percent) and large farmers had 11.73 (25 percent) acres. Since most of the dry land farmers had small land holdings with low net returns, the integration of subsidiary enterprises along with appropriate technologies

facilitate to realize high employment status, sustained stable net returns and family food security from the entire farm.

2. Four types of farming systems were found to be practiced by farmers in sample village namely Crops (17 percent), Crops+ Livestock (43 percent), Crops+ Livestock+ Sericulture (18 percent) and Crops+ Livestock+ Sericulture+ Horticulture (17 percent). Marginal farmers practiced majorly crops and C+L enterprises, as they had limited access to source of water to take up sericulture and horticulture. Small and medium farmers practiced all four types of farming systems. All large farmers in the village practiced the most integrated farming system that is C+L+S+V system as they had access to all sources of inputs.

3. In dry lands, finger millet, finger millet along with intercrops like field bean and horse gram is being grown in larger area in 57.01 acres (60 percent) followed by maize (28.11 percent) and red gram (11.48 percent). Whereas in irrigated condition, mulberry forms the major area (45.22 percent), followed by vegetable crops like tomato (24.20 percent), carrot (10.87 percent), beans (4.32 percent) and ridge gourd (3.13 percent). Hybrid maize is grown in 8.04 percent of irrigated area.

4. In case of perennials, not much tree species grown in study village, only coconut is grown in about 3.5 acres of land in entire village. Floriculture is gaining more area now a days as the farmers are getting interest to take up floriculture as it assures subsistence income and very less chance of crop failure along with minimal maintenance cost.

5. Net return was higher for following more than two enterprises as compared with other farmers. Under existing farming systems,

C+L+S+V system generated a maximum net income of Rs. 98760.8, Rs. 141118.0, Rs. 404819.2 among small, medium and large categories of farmers respectively, followed by C+L+S system which generated maximum income of Rs.68025.2, Rs95014.6., Rs. 284950.3 in that order. Marginal farmers drew minimum net income from crops (Rs. 4635.1) and from C+L enterprise (Rs. 23250.2), from C+L+S (32789.8) and from C+L+S+H (37398.5)

6. The present study focused more on studying the employment generation in individual farming systems. It is noteworthy that the average working days for the farmers following only crop cultivation had 34 man days of work per year while farmers with crops and livestock had 40 days, farmers with crops, livestock and sericulture had 81 days and maximum 92 days of employment was generated in crops, livestock, sericulture and horticulture farming system.

7. The income level realized by the present employment level is very poor in the study area. Marginal farmers with average family size of 4 members earn INR. 10200. The FS1 farmers accounted for minimum of INR. 10200 for their farm work. FS2 farmers worked for INR.12000, FS3 farmers for INR. 24300 and FS4 farmers for INR. 27600. In contrast, survey data on income generated from employment by farmer households during 2002-2003 shows that on an average, a farmer household on all India basis, earns some Rs. 2115 per month (NSS report, 2003 quoted by Swaminathan, 2006).

8. Considering RDA among Children, FS4 (83.54 percent) is near to RDA levels when compared with FS1 (77.39 percent), FS2 (78.23 percent) and FS3 (80.94 percent). Among rural women, all the farming systems have the problem of inadequacy but

comparatively better is FS3 (67.26 percent) and FS4 (69.62 percent) whereas FS1 women were adequate only by 64.79 percent and FS2 with 66.16 percent. In-group of men, the same trend continued, FS4 (73 percent) and FS3 (71 percent) men were in better position when compared with FS1 (68.43 percent) and FS2 (69.9 percent).

9. Final to say, FS4 has better food security as compared with other farming systems. This is mainly due to high-income levels achieved by following integrated farming systems. In case of FS3 and FS4 along with high income levels, diversification is noticed in their diet, as they have to purchase most of their diet from market, they won't purchase uniform food items but try to purchase different food items though they may purchase in less quantity. This provides all required nutrients especially micronutrients to the farmers. FS1 and FS2 farmers diet was mainly cereal and millet based. They use green leafy vegetables and pulses in more quantity if grown in their own fields. But consumption of food items rich in minerals, vitamins, micro nutrients is very less as they have to purchase these from market and family income is the important constraint here.

10. Cereals form the major consumption basket of rural households (52.72 percent) followed by other foods in inconsequential quantities. Among cereals finger millet (28.54 percent) meets the major dietary requirement of rural households. This is because of less water requirement and can be grown in rainfed conditions with minimal costs and can withstand hunger for longer time and an energetic food, which is available at very low price. This indicates importance of cereals in enhancing the nutritional status or rural households.

11. It was observed that the per capita percentage food expenditure decreased over the farming groups. An individual from FS1 spent Rs.256.07 (23.16 percent) per month, FS2 individual spent Rs. 259.98 (23.52 percent), FS3 individual per month expenditure on food was Rs. 285.52 (25.81 percent) and FS4 farmer spent highest of Rs. 304.15 (27.51 percent) per month on food. Therefore the expenditure on food items was directly proportional to the integration in farming systems and income levels.

12. The results were in conformity with the Engel's law for food in general and cereals in particular. The percentage of expenditure on high value food items like milk, meat, egg and fruits increased as the income increased across farming groups.

13. Expenditure elasticity for low value food items like cereals and millets (0.43), pulses (0.31) and vegetables (0.48) was low when compared with high valued crops like fruits (0.76), milk (0.92), meat (1.24) and sugars (0.56). This implies that for every rupee increase in the total expenditure, the outlay for high value commodities such as fruits, milk, meat, edible oil, sugar, would increase compared to food grains (cereals, millets and pulses). The expenditure elasticity was higher for most of the food groups in FS1, followed by FS2, FS3 and FS4. This is because if there is increase in net income of a FS1 farmer, he would prefer to spend that amount on purchasing food items for consumption, but a FS4 farmer spends an additional rupee in purchasing some things to his house or purchasing inputs to his farm.

14. The percentage expenditure on health was highest in FS4 farmers (38.06 percent), followed by FS3 farmers (24.74 percent), FS2 farmers (20.50 percent) and FS1 farmers (16.69 percent). The same trend was noticed in case of different categories of farmers. Highest

expenditure on health was noticed by large farmers and lowest by marginal farmers. This result indicates that income level of a family is directly proportional to health expenditure. As income increases expenditure on health also increases, this is mainly because high-income farmers (FS3, FS4 and large farmers) always prefer to consult a private doctor for any health ailments as they take care of their health in greater sense. Whereas low income farmers, (FS1, FS2 and marginal farmers) prefer to cure their disease in home without consulting any doctor or visiting hospitals. If in case of serious ailments they get cured from government hospitals at low cost.

15. Nearly three fourth of the farmers were well aware and had positive perception towards integrated farming systems. All of them admitted to know the benefits of the integrated farming systems and expressed ample interest to adopt it.

6.4 Testing of the framed hypothesis:

- Majority of the farmers have adopted economically viable integrated farming systems.

  The framed hypothesis was accepted from the results of the study. Nearly 82% of the farmers in the study area followed one or the other farming system along with crop cultivation.
- The existing/present farming systems ensured adequate returns supporting both employment and sustainable livelihood.

  The framed hypothesis was rejected from the results of the study. Except farmers following most integrated farming systems with crops, livestock, sericulture and horticulture other farmers realized very low levels of employment and income levels.
- There is no significant difference in expenditure and consumption pattern of cereals and pulses among different groups.

The framed hypothesis was accepted from the results of the study. As cereals and pulses are the staple food of all groups of farmers, irrespective of the integrated farming systems, and categories, all of them consumed almost similar quantities of cereals and pulses.

- There is no significant difference in expenditure and consumption pattern of fruits, vegetables, milk and meat (protective foods) among different groups.

  The framed hypothesis was rejected from the results of the study. There lies considerable difference in the consumption and expenditure pattern of food items across various integrated farming systems.
- Farmer's practicing highly integrated farming system's expenditure towards health care, major, minor illness is more compared to farmers practicing low or no integration in farming system.

  The framed hypothesis was accepted from the results of the study.
- The farmers are well aware about the benefits and practicing of integrated farming systems.

  The framed hypothesis was accepted from the results of the study.

6.5 Policy implications

1. The transition of existing farming systems from subsistence to commercialization needs emphasis to increase and stabilize employment generation, income from dry land horticulture (sapota, mango, jack fruit etc) and other livestock enterprises (like dairy, sheep, poultry and piggery) as they help in reducing risk of getting lower income on the one hand and generate additional income and employment to farmers on the other. Along with these benefits, integrated farming enterprises encourages the farm family to consume these products (fruits, milk, meat and egg) in plenty as

they not purchase them from market, in turn improving their food security status.

2. Need to create awareness among farmers about importance and benefits of integration of farming systems. Introducing agro forestry in the study village and encouragement to grow perennial trees like sapota, mango, eucalyptus, teak trees and other trees in fields. Supply of these seedlings in subsidized price by Government is very crucial.

3. Integration across crops and enterprises will realize higher employment rates, net returns and better food security.

4. Farmers should be encouraged for integration across crops and enterprises via,

    a. Supplying the inputs at subsidized prices

    b. Supporting the farmers who opt/venture for diversification in terms of incentives for better nutrition levels of farm households.

5. Due attention has to be given by the extension workers and farmers while preparing the farm plan. There is a need to have suitable government policies and programmes to encourage farmers in rural areas to go for different crop and animal based enterprises. Also, extension workers have to adopt the farming system approach while educating the farmers.

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Appendices

Appendix: Questionnaire

DEPARTMENT OF AGRICULTURAL ECONOMICS

UNIVERSITY OF AGRICULTURAL SCIENCES, GKVK, BANGALORE

Research title: Economics of different integrated farming systems and their impacts on employment and livelihood in Eastern dry zone of Karnataka state.

Rajeshwari S M

Master Thesis Research

Questionnaire

For interviewers:

Along with data please also note the remarks and other information respondent provides during interview. Make use of the last pages of the questionnaire to write your comments.

I. General/ Personal information:

1. Name of the respondent:

2. Sex of the respondent:
Male……Female……

3. Age of the respondent:……

4. Level of education: Illiterate……
Primary…….Secondary……University…….

5. Number of years in farming:……

6. Family size:……

7. Land cultivated (in acres):……

a. owned:…..
b. Lease:……
c. Other:……

II. Economics of different farming systems:

1. Existing farm enterprises:

a. _____
b. _____
c. _____
d. _____
e. _____

2. Details of land holding

Type of land	**Area (in acres)**
Rainfed land	
Irrigated	
Fallow land	
Total	

3. Details of farm assets

Type of assets	**Number**	**Year of purchase**	**Life span**	**Present value (Rs)**
Housing a. Puckka house b. Kachaa house				
Cattle shed				
Well				
Pump set				

Tractor/power tiller				
Bullock cart				
Drip equipments				
Other farm implements				

4. Source of funds for investment

Source	**Amount**	**Rate of interest**
Own capital		
Borrowed capital a. Banks b. Money lenders c. Relatives and friends		

5. Please give the source of water for irrigating the crops:

Season	**Well no:** **Area irrigated (Acres)**		**Well no:** **Area irrigated (Acres)**	
	Drip	**Flow**	**Drip**	**Flow**
Kharif crop				
Rabi crop				
Summer crop				
Perennial crops				
Annual crops				

6. Please provide below particulars regarding crop production:

Particulars	Season		Season		Season	
	Crop		Crop		Crop	
	Area		Area		Area	
	Duration of crop:		Duration of crop:		Duration of crop:	
	Quantity	Value	Quantity	Value	Quantity	Value
Material inputs:						
Seed/planting material						
Manure (cart load)						
Fertilizer (kgs)						
Plant protection chemicals						
Labour charges:						
1. Human labour (man days+ Women days)						
Land preparation						
Intercultivation						
Harvesting						

& processing						
Transportation						
2. Machine hours						
3. Bullock labour (bp days)						
Post-harvest charges:						
Bagging, transport, packing, marketing costs						
Main product						
Byproduct (kgs/qtls/tones/basket)						

**Please add additional sheets in case of more crops*

7. Capital requirement per crop of Mulberry per acre

Inputs	**Quantity**	**Value (in Rs)**
Setts (number)		
Fertilizer (kgs)		
FYM (tonnes)		
Irrigation (Number)		
Human labor for all the operations		
a) Man days		
b) Woman days		
Bullock labor (Pair days)		
Total establishment cost		
Maintenance cost/ crop		
FYM		
Fertilizer		
Plant protection chemicals		
Labour charges		
Amortized cost of establishment costs		
Total costs		
Mulberry yield		

8. Capital requirement for silk cocoon rearing

Inputs	**Quantity**	**Value (in Rs)**
Laying's		
Mulberry leaves		
Disinfectants/ chemicals		
Labour requirements (total)		
Total investment on the equipments		
Rental rate for mountages		
Marketing costs		
Cocoon yield (kgs)		
By product		

9. Livestock particulars (cows and buffaloes) cost per month

Particulars	**Cows**		**Buffaloes**	
	Qty	**Amount (Rs)**	**Qty**	**Amount (Rs)**
Feed (Kg)				
Fodder (Kg)				
Dry fodder (Kg)				
Water requirement				
Labor used				

Veterinary care				
Insurance policy				
Lactation period				
Investment on cow/buffaloes				
Milk yield (liters)				

Source of water:

10. Livestock particulars (other than cows and buffaloes)

Description	**No.**	**Capital investment**	**Maintenance cost**	**No. of animals sold per year**	**Average selling price of animal**
Sheep					
Goat					
Poultry a. Boilers b.Layers					

11. Employment details of the farm family:

Farming enterprise	**Family labor (in mandays)**	**Hired labor (in mandays)**
1. Crops (rainfed) per crop		
2. Horticulture (per crop)		
3. Sericulture (per batch)		
4. Livestock		
Cows and buffaloes		
Sheep		
Goat		
Poultry		
Others		

12. On-farm and off-farm income of the farm family:

Activity	**No. of members**	**Average wage rate**	**Income per month**
Agriculture			
Tailoring			
Petty Business			
Others			

III. Expenditure and consumption pattern of different food groups.

1. Average consumption and expenditure on various foods / Week

Particulars	**Quantity / Week**	**From own produce**	**Purchased from other source**	**Amount spent (in Rs)**
a) Cereals				
Rice & Rice Products				
Wheat & its products				
Finger millet & its products				
Others (Specify)				
b) Oils and Fat				
Sunflower oil				
Ground nut oil				
Others specify				
c) Vegetables				
Green leafy vegetables (Specify)				
Tomato				
Brinjal				
Cucumber				
Potato				
Onion				
Radish				
Carrot				

Others specify				
d) Pulses and grams				
Cowpea				
Red gram				
Green gram				
Others (specify)				
e) Fruits (specify) a. b. c.				
f) Meat Products				
Egg				
Meat				
Chicken				
Any other Specify				
g) Milk and milk products				
Milk				
Ghee				
Curd				
Buttermilk				
Butter				
h) Sugar and Jaggery				
Sugar				
Jaggery				

IV: Health and morbidity status of family members (Major and minor illnesses)

1. Did any of your family members experience any of the following major health problems during last 5 years?

Disease	Sufferers (relation to head)	Expenditure (in Rs)
1. Heart attack		
2. Cancer		
3.Tuberculosis		
4. Gynecological problems		
5 Diabetes mellitus		
6. Hypertension (BP)		
7. Others		

2. Minor health problems during last 3 months

Disease	Sufferers (relation to head)	Expenditure (in Rs)
1.Cold and cough		
2. Fever		
3. Diarrhea		
4. Blood in stool		
5. Gastritis		

6. Difficulty in breathing		
7. Drowsiness		
8. Pain in abdomen		
9. Chicken pox		
10. Headache		
11. Joints pain		
12. Others (specify)		
a.		
b.		

3. Nutrition related deficiencies:

Disease	Sufferers (relation to head)	Expenditure (in Rs)

V: Integrated farming systems potentials in ensuring employment and livelihood security.

1.Please rank the following statements in 5 point scale:

0 = no answer 1= strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = strongly agree

Particulars	0	1	2	3	4	5
I am very much aware about the IFS and its practices						
IFS is beneficial to farmers						
IFS creates more employment to the farm family						
IFS utilizes the resources efficiently which are available on farm						
By practicing IFS it has been possible for our family to have a secured livelihood (in terms of income, farm produce, food and nutrition security, employment)						
I would like to continue with IFS in the future						
(The interviewer can ask any further relevant questions by analyzing the on farm situation)						