METHODOLOGY
III. METHODOLOGY

This chapter deals with a brief description of the study area, sampling design, data collection and techniques used for data. It is organized under the following sub-heads.

3.1 Description of the study area
3.2 Sampling frame work
3.3 Database
3.4 Analytical tools and techniques

3.1 Description of the study area:

Karnataka is the eighth largest state in India with an area of 190 lakh ha. It is situated between 11.50 and 19.00 N latitudes and between 740 and 780 E longitudes in the Southern plateau. The state receives an average annual rainfall of about 1139 mm from both south-west and north-east monsoons. The important crops grown in the state are jowar, ragi, maize, bajra and wheat among cereals; red gram, green gram, tur and bengal gram among pulses; groundnut, sunflower and safflower among oilseed crops and cotton, sugarcane and tobacco among commercial crops. Karnataka comprises 30 districts of which 12 districts are located in the northern part of the state and rest in southern part. Chikkaballapur and Dharwad districts of Karnataka were chosen purposively for the present study (Fig 3.1 and Fig 3.2) since these two districts are the major agrarian districts where crops (field crops + vegetable crops), are combined with allied enterprises, inter alia dairy, sericulture, horticulture, poultry by the farmers.

3.1.1. Chikkaballapur District:

Chikkaballapur district is the newly formed district, carved out of old Kolar district in the year 2009. Chikkaballapur district is situated between 13°08'00.00" N latitude, 78 ° 08’01.69” E longitude and 918m altitude and surrounded by Anantapur district on the North, Bangalore Rural district on the South, Kolar district on the East, Tumkur district on the west. Chikkaballapur district falls under eastern dry zone and has a geographical area of 425400 hectares of which the net area sown is 156124 hectares.
The average rainfall is 781.6 mm with a major portion of the rains being received from the south-west monsoon. The major crops grown in district are Maize, Ragi, Redgram, Horsegram, Groundnut, Sericulture and vegetables. It consists of six taluks viz., Chikkaballapur, Chinthamani, Gowribidanur, Bagepalli, Sidlaghatta and Gudibande. There are 26 revenue hobilies, 151 Grama Panchayats and 1505 revenue villages. It has two city municipal councils (Chikkaballapur and Chinthamani), three town municipal councils (Bagepalli, Gowribidanur and Sidlaghatta) and one town panchayath(Gudibande). Two taluks namely Chinthamani and Gowribidanur were selected from Chikkaballapur district based on area under food crops.

Chinthamani taluk is situated at 78°12’36” North latitude and 13°16’38” East longitude. The taluk is 36 km away from Chikkaballapur and 74 km away from Bangalore. Chinthamani taluk consists of 6 hobilies and 339 villages. Location of the study area is shown in Fig.3.1.

Gowribidanur taluk is situated at 13.61 North latitude and 77.52 East longitudes. The taluk is 75 km away from Bangalore. Gowribidanur taluk consists of 6 hobilies and 339. Location of the study area is shown in Fig.3.1.

Demographic features of Chinthamani and Gowribidanur taluks are presented in Table.3.1. Chinthamani and Gowribidanur taluks had a population of 298079 and 290999 respectively in 2011. Agriculture is one of the mainstays of living in these taluks.

Table-3.1: Demographic features and livestock profile of the Study Area

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Chinthamani</th>
<th>Gowribidanur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total populations (2011 census)</td>
<td>298070</td>
<td>290999</td>
</tr>
<tr>
<td>Male population (2011 census)</td>
<td>150614</td>
<td>147049</td>
</tr>
<tr>
<td>Female population (2011 census)</td>
<td>147456</td>
<td>143950</td>
</tr>
<tr>
<td>Sex Ratio (No.of females per 1000 Males) (2011 census)</td>
<td>979</td>
<td>979</td>
</tr>
<tr>
<td>Average rainfall (mm/year)</td>
<td>725</td>
<td>662</td>
</tr>
<tr>
<td>Actual rainfall (mm/year)(2009)</td>
<td>788.3</td>
<td>770.3</td>
</tr>
<tr>
<td><strong>Livestock profile</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cattle population</td>
<td>51208</td>
<td>53464</td>
</tr>
<tr>
<td>Buffalo population</td>
<td>12978</td>
<td>11931</td>
</tr>
<tr>
<td>Sheep</td>
<td>103580</td>
<td>76910</td>
</tr>
</tbody>
</table>
Fig. 3.1: Map showing the study area Chikkaballapur District
3.1.2 Soil type and climate

The type of soils in Chikkaballapur district ranges from red loamy soils to red sandy soils and lateritic soils. The district is generally dry with temperatures ranging from 10°C in winter (December) to 40°C in summer (April and May). The normal rainfall is 743.7 mm with an average rainfall of 781.6 mm during the year 2009.

3.1.3 Cropping pattern

Ragi, Maize, Redgram, Groundnut are the major crops under rain-fed agriculture. Maize is the major crop under irrigated conditions (tube well) also along with vegetables like Tomato, Potato and Beans etc.

The net sown area is 1,56,124 hectares during 2012-2013. Chikkaballapur district annually produces cereals and minor millets like Maize, Ragi, and etc. on an area of 88,503 hectares and Pulses on an area of 5,941 hectares. Ragi is the major crop grown on 45,980 hectares, while Maize is cultivated on 39,139 hectares. Total food grains occupy 1,74,234 hectares, whereas fruits and vegetables occupy 7,200 and 13,700 hectares, respectively.

3.1.4 Livestock population

As per 2007 livestock census Chikkaballapur District has a sizable livestock of about 2.37 lakh cattle, 0.48 lakh buffaloes and about 4.15 lakh sheep. Though the main occupation of the people is agriculture, they have taken up rearing of cows, buffaloes and sheep to supplement their income.

3.1. a. Dharwad District:

Dharwad district is located in the northern transitional belt of Karnataka State. It is situated in the interior of the Deccan peninsula and lies between the Northern latitudes of 15°15’ and 15°35’ and East longitudes of 75° and 75°20’. The geographical area of the district is 4,27,329 hectares and it is bound by Belgaum district on the north, while by Haveri district on the south, by Gadag district on the east and by Uttar Kannada district on the west.
Dharwad district is spread in six taluks, 14 hoblies and 372 inhabited villages, as well as 18 uninhabited villages. The district has six taluks, viz., Dharwad, Hubli, Kalaghatagi, Kundgol, Navalagund and Hubli Dharwad municipal corporation (HDMC). The population of the district as per the 2011 census was 18,47lakhs. Out of the total population in the district, 160674 were in rural areas and rests were in urban and semi urban areas (Table 3.2). Two taluks were selected from Dharwad district based on area under food crops namely Dharwad and Navalagund.

Table-3.1.a: Demographic features and livestock profile of the Area under Study

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Dharwad</th>
<th>Navalagund</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total populations (2011 census)</td>
<td>249993</td>
<td>190208</td>
</tr>
<tr>
<td>Male population (2011 census)</td>
<td>128227</td>
<td>96942</td>
</tr>
<tr>
<td>Female population (2011 census)</td>
<td>121766</td>
<td>93266</td>
</tr>
<tr>
<td>Total No.of households Urban</td>
<td>3565</td>
<td>10722</td>
</tr>
<tr>
<td>Total No.of households Rural</td>
<td>46493</td>
<td>27067</td>
</tr>
<tr>
<td>Average rainfall (mm/year)</td>
<td>865</td>
<td>643</td>
</tr>
<tr>
<td>Actual rainfall (mm/year)(2011)</td>
<td>926</td>
<td>462.9</td>
</tr>
</tbody>
</table>

Livestock profile (2007)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Dharwad</th>
<th>Navalagund</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle population</td>
<td>60436</td>
<td>43522</td>
</tr>
<tr>
<td>Buffalo population</td>
<td>35186</td>
<td>21216</td>
</tr>
<tr>
<td>Sheep</td>
<td>8495</td>
<td>26997</td>
</tr>
</tbody>
</table>

3.1. b. Climate, Rainfall and Soil types

There are three distinguishable agricultural seasons in the district, viz, Kharif (June - September), Rabi (October-January) and summer (February – may). The south west monsoon commences by about the end of the May or early June and it continues intermittently till the end of September. Major soil types in Dharwad district are medium to deep black soils, red sandy loam soils, shallow red soils, sandy soils and sandy loam.
Fig. 3.2: Map showing the study area Dharwad district
The average annual rainfall in the district was 787 mm with a major portion of the same being received from the south west monsoon. The average temperature ranges from 16\(^\circ\) C to 38\(^\circ\) C.

3.1. c. Land use pattern in Dharwad District

The Table 3.4 shows the land use pattern in Dharwad district. The total geographical area of the district was 4,27,329 hectares, out of which the net sown area was 2,58,640 hectares. The total irrigated area was 5,22,50 hectares, out of which 35,445 hectares and 16,805 hectares were irrigated by canals and bore wells respectively. The area not available for cultivation was 25,506 hectares, fallow lands were 26,876 hectares and 35,235 hectares were under forests.

The main food crops grown in Dharwad district are Bengal gram (82720 ha), jowar (51382 ha), Wheat (42901 ha), Cotton (40910 ha) Paddy (27507 ha). The major fruit crops area in the district was 11067 hectares and in the vegetables was 5187 hectares.

3.2 Sampling frame work

3.2.1 Selection of the study area

The present study was conducted in the Chikkaballapur and Dharwad districts because these districts are having differences with respect to farming systems practiced and products produced and in these districts Agriculture is the main income generating source for small and marginal farmers and they also depend on livestock enterprise for their household income.

3.2.2 Selection of the Districts and Taluks

Chikkaballapur and Dharwad districts were purposively selected for the study. Chinthamani and Gowribidanur taluks of Chikkaballapur district were selected based on highest area of food crops. Similarly, Dharwad and Navalgund taluks were selected in Dharwad district to represent various farming systems.
Plate 1: Research scholar Pradeepa Babu B N collecting field data from farmer beneficiary cultivating cotton using ground water irrigation (Dharwad taluk), Dharwad district.

Plate 2: Researcher scholar Pradeepa Babu B N interacting with group of farmers during field data collection in Dharwad district.
Plate 3: Research scholar Pradeepa Babu B N collecting field data from farmer beneficiary cultivating green gram under rainfed situation in Dharwad district.

Plate 4: Research scholar Pradeepa Babu B N collecting field data from large farmer in Dharwad district
3.3. Database

To address the objectives set forth for the study, primary data were collected from 240 randomly selected farmers for the period 2012-13. Three staged random sampling procedure was used for the selection of respondents, on the first phase four taluks were selected, in second phase based on the reconnaissance survey 6 villages in each taluk were considered for selecting the farmers practicing farming systems. In the third phase from each selected village, 10 farmers were randomly selected who are practicing farming systems. The data pertaining to socio-economic parameters, consumption pattern, health, habitat, educational, social network security, rural development schemes, constraints and others were obtained from the sample households through personal interviews.

Table 3.2: Village wise Distribution of Sample Respondents in Chikkaballapur District

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Villages</th>
<th>Irrigated</th>
<th>Rainfed</th>
<th>Total No. of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinthamani</td>
<td>Timmasandra</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Nayanahalli</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Rayapalli</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Badaganarahalli</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Konapalli</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Munaganahalli</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Sub Total (A)</td>
<td></td>
<td>30</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Gowribidanur</td>
<td>Balareddyhalli</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Bandiramanahalli</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Kadaburu</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Basavanapura</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Kurabarahalli</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>B.Bommasandra</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Sub Total (B)</td>
<td></td>
<td>30</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Total (A+B)</td>
<td></td>
<td>60</td>
<td>60</td>
<td>120</td>
</tr>
</tbody>
</table>

Secondary data: The data regarding cropping pattern, land utilization, Government schemes and general information on districts were collected from the District Statistical Department and Rural Development Department.
Plate 5: Farmer engaged in bore well repair in Chikkaballapur district (picture by Pradeepa Babu B N)

Plate 6: Research scholar Pradeepa Babu B N collecting field data from marginal farmer in Chikkaballapur district
Table 3.3: Village wise Distribution of Sample Respondents in Dharwad District

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Villages</th>
<th>Irrigated</th>
<th>Rainfed</th>
<th>Total No. of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dharwad</td>
<td>Kurbagatti</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Lokur</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Mangalagatti</td>
<td>7</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Mugad</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Murakatti</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Tadakod</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total (A)</strong></td>
<td><strong>30</strong></td>
<td><strong>30</strong></td>
<td><strong>60</strong></td>
</tr>
<tr>
<td>Navalgund</td>
<td>Alagawadi</td>
<td>1</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Halakusagal</td>
<td>3</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Hebbal</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Javur</td>
<td>3</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Tiralapur</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Yamanur</td>
<td>10</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total (B)</strong></td>
<td><strong>30</strong></td>
<td><strong>30</strong></td>
<td><strong>60</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total(A+B)</strong></td>
<td><strong>60</strong></td>
<td><strong>60</strong></td>
<td><strong>120</strong></td>
</tr>
</tbody>
</table>

3.4 Analytical tools and techniques

For the purpose of achieving the objectives of the study, data were analyzed using tabular presentation, returns to rupee of investment, optimization of farming using linear programming analysis, minimization of total absolute deviation (MOTAD) technique and regression model.

3.4.1 Tabular analysis

Tabular analysis was used to compute percentages and averages for various socio-economic characteristics of the sample farmers, importance and magnitude of livestock to farmers and costs and returns from various enterprises. Averages and proportions were specially used to examine the farming system followed, employment generated, income and savings of the respondents.

3.4.2 Optimization of farming:

One of the objectives of researcher was to study the optimum utilization of available resources within the farm and to see whether the utilization of various available resources by the farmer is optimum under various combinations of enterprises.
The term optimization is used in linear programming analysis for finding a saddle point. Optimum plans are those farm plans, which satisfy all the resource constraints at the farm level and yield the maximum value of the objective function. The deterministic linear programming was employed to work out the maximum attainable returns by rainfed and irrigated farmers through optimum allocation of various crops and livestock, using available resources. Optimum allocation is defined as one, which, gives physical, technical and resource conditions and shows the activities to undertake and how much of each resource should be allocated to each activity so that the net farm returns are maximized in a year. Linear programming technique was chosen because among the various analytical tools available for allocation of available limited farm resources among alternative enterprises, it is the most powerful and efficient tool for analysis. The traditional tool of budgeting becomes less efficient when the number of constraints and real large and unique solutions are desired.

3.4.2.1 Mathematical formulation of the model:

In linear programming analysis, a linear function of a number of variables (activities) is to be maximized subject to a number of constraints in the form of linear equalities and in-equalities. The linear programming model in the mathematical form for one year can be formulated in the following way.

\[
\text{Maximize } Z = \sum_{j=1}^{n} C_j X_j \\
\text{Subject to the constraints,}
\]

\[
1. \sum_{i=1}^{n} a_{ij} X_j \leq b_i \quad (i = 1 \ldots k)
\]

\[
2. \sum_{i=1}^{n} a_{ij} X_j \geq b_i \quad (i = 1 \ldots k)
\]

\[
3. \sum_{i=1}^{n} a_{ij} X_j = b_i \quad (j = 1 \ldots k)
\]

\[
X_j \geq 0
\]
Where,

\[ Z = \text{Net returns from all crop and allied activities included in the model.} \]

\[ C_j = \text{Net returns from } i^{\text{th}} \text{ activity measured in rupees per acre of land.} \]

\[ X_j = \text{Level of } i^{\text{th}} \text{ activity in acre.} \]

\[ a_{ij} = \text{Quantity of } i^{\text{th}} \text{ input required per unit of } j^{\text{th}} \text{ activity.} \]

\[ b_i = \text{Quantity available of the } i^{\text{th}} \text{ resource} \]

### 3.4.2.2 Objective function:

The objective function for the model in this study is the maximization of the annual net returns to owned resources. The gross returns per hectare of crop and per unit of allied activities were calculated by using the data for sample farmers. Paid-out costs such as hired human labour and FYM, fertilizers, etc. were directly subtracted from the gross returns. For dairying, sheep and poultry activity, gross profits are calculated by deducting variable costs such as value of fodder, feed concentrate and labour from the gross income from dairy, sheep and poultry activity. The maximization of net returns (profit) is subject to the assumption of resource constraints imposed in the model. It is assumed that products and factors markets are perfectly competitive.

### 3.4.2.3 Basic assumptions

Besides the general assumptions of linearity, divisibility, additively and finiteness, the following additional assumptions were made in developing the model.

In this study, the problem of resource allocation is dealt with at the average farm level. Each farm is assumed to be an economic decision-making unit. The farm operator is free to make decisions regarding business limited only by legal and contractual arrangements. The concept of time in the production process is of short-run nature. The model has an operational period of 12 months. All activities or processes such as crop production and marketing, transfer of cash and are terminated at the end of the year which is one planning period.
It is also assumed that each farm is operated with the objective of maximizing net farm returns, subject to the constraints listed already closely related to the above assumption, the study, to start with, is in the static work frame. It is assumed that the yield and price expectation of the farmers are single-valued.

3.4.3 Constraints and requirements:

Some of the important constraints considered in the study are land, labour, consumption, fodder availability and borrowing.

(i) **Land**: Land available for cultivation is considered. Cropping activities are being considered under both rainfed and irrigated conditions and the crops that occupied negligible area are not included in the model. The land available for cultivation includes owned land as well as the leased-in land.

(ii) **Labour**: Agricultural year is divided into two labour periods and wages are indicated by negative values in the objective function for the respective labour hiring activities.

(iii) **Fodder availability**: Ragi and Groundnut enterprises produce fodder, which could be used for livestock. Fodder production was a pre-requisite for livestock to meet at least 50 per cent of the requirement of fodder. This is also included as a constraint.

(v) **Activities in the Model**:

Activities specify the resources, which could be put into various alternative uses. The activities included in the model are;

1. Crop, dairy, poultry, small ruminants rearing activities.
2. Labour hiring activities.
3. Product and labour sale activities.
4. Working Capital
3.4.4 Input-output co-efficient:

The input co-efficient in this study pertained to land, labour, capital, FYM, fodder availability, fertilizer and fodder requirement. Land is classified into dry and irrigated. Labour referred to includes the total labour. Working capital outlay refers to the funds required to meet the cost of seeds, fertilizers, FYM, purchase fodder, feed concentrates, plant protection chemicals and wages to labour.

The input-output co-efficients were derived for the average farms, based on the sample data. On this basis, the optimization exercise was carried out with the same set of constraints. This linear programming problem was solved in computer’s “EXCEL” package using the solver option.

In order to develop risk-efficient farm plans, it was considered appropriate to use MOTAD (minimization of total absolute deviation) technique. The optimal plan that could be obtained with the help of deterministic linear programming technique does not take into consideration the stochastic nature of the enterprises. MOTAD technique can incorporate the risk element associated with the enterprise net returns. The mean absolute deviation of the net returns was considered to represent the risk attached with these enterprise net returns.

Based on the MOTAD model, which aims at providing optimum solutions which minimizes the risk, three alternative models were tried. They have incorporated variations in the income.

Gross income constrained to the actual income of farmer, which is received. For each of the 3 alternative models, the standard deviation could be calculated using the formula,

\[ \gamma = A \left[ \frac{S}{2(s-1)} \right]^{1/2} \]

where \( \gamma \) = Standard deviation,

\( A \) = absolute mean deviation \( (A=2T/S) \),

\( T \) = total negative deviation

\( S \) = no. of risk years taken
This risk MOTAD model was formulated by taking standard deviation for 5 years. The model was solved in EXCEL using solver option.

### 3.4.5 Multiple Linear regression analysis

It is hypothesized that the consumption expenditure incurred by farmer is determined by explanatory variables such as (1) The income of the farm households 2) Education level of family head 3) Average age of the sample farmers 3) Family size of the respondents and 5) Access to irrigation(determined by 2 dummy variables: (1,0), 1 if the farmer has access to irrigation and 0 otherwise. Multiple linear regression model was used as the method of analysis.

Model was fitted as detailed below:

\[
Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 D_1 + u \quad \ldots \ldots \quad (7)
\]

Where,

- \(Y\) = Consumption expenditure of farm household (Rs./farm household/month)
- \(X_1\) = Income of farm household (Rs/farm household/month)
- \(X_2\) = Educational status of family head (in years)
- \(X_3\) = Average age of the sample farmers (in years)
- \(X_4\) = Family size (numbers)
- \(D_1\) = Dummy variable (1, 0)

Dummy variables: Rainfed-0, Irrigated-1

\(a\) = intercept

\(u\) = Error term
3.4.6 Index analysis

3.4.6. a. Education index

Education index shows the educational status of the sample household and it is calculated as\(^1\),

\[
\text{Education index} = \frac{\sum \text{wi} \text{i}}{\sum \text{fi}}
\]

\((i = 0, 1, 2, 3, \ldots, 6)\)

Education attained, i.e., Illiterate=0, Primary school=1, Middle school =2, Metric school = 3, Twelfth standard=4, Graduate=5, and Postgraduate=6, wi= weights (0 to 6) and fi= No. of family members.

3.4.6. b. Social network status index

Social network status index shows the level of participation and access to various sources of information and it is calculated as\(^2\),

\[
\text{Social network status index} = \frac{\sum \text{wi} \text{i}}{\sum \text{fi}}
\]

Social network status attained, i.e. No access to any source =0, Access to TV=1, Access to phone=2, Membership in SHG" S= 3, Member of Milk producers cooperative society =4, Member of Gram panchayat=5, and Member of Taluk panchayat =6, wi= weights (0 to 6) and fi= No. of family members.

3.4.7 Relevancy rating:

The constraints faced by the farmers for their livelihood and subjecting the opinion of farmers to relevancy rating and ranking of the same according to its importance. The farmers were asked to rate the constraints in a four-point relevancy continuum viz., ‘most relevant’, ‘relevant’, ‘less relevant’ and ‘not relevant’. Relevancy coefficient (RC) of the \(i^{th}\) constraint was worked out by using the formula:

\(^1\) Harishkumar 2012
\(^2\) Harishkumar 2012
Total score of all the farmers in $i^{th}$ constraint

\[ RC_i = \frac{\text{(Maximum on the continuum)} \times \text{(Total number of farmers)}}{\text{Total score of all the farmers in i}^{th} \text{ constraint}} \]

The ranking of constraints has been done according to its relevancy coefficient such that the constraint having highest relevancy rating is ranked 1$^{st}$ and subsequent rank given according to the scores obtained.

### 3.4.8 Garrett ranking technique

To capture comprehensively the household livelihood security, Garrett ranking technique is used. The order of the merit given in ascending order was converted into ranks by using the formula.

To capture comprehensively the household livelihood security, Garrett ranking technique is used. The order of the merit given in ascending order was converted into ranks by using the formula.

Accordingly, these ranks were converted to scores by referring to Garrett’s table. Garrett’s formula for converting ranks into per cent was given by

\[ \text{Per cent position} = \frac{100 \times (R_{ij} - 0.50)}{N_j} \]

Where $R_{ij} = \text{Rank given for i}^{th} \text{ item in j}^{th} \text{ system}$ $N_j = \text{Number of items ranked in j}^{th} \text{ system}$

The percentage position of each rank was converted to scores by referring to tables given by Garret and Woodworth (1969). Then for each factor, the scores of individual respondents were summed up and divided by the total number of respondents for whom scores were gathered. The mean scores for all the factors were ranked, following the decision criterion that, higher the value the more important it is in the order of livelihood.

The order of merit was assigned in ascending order considering the magnitude of the respective components as detailed below.
**Economic security:** Merit was assigned based on annual net income of the household as rank one for highest income and four for lowest income among irrigated and rainfed area farmers.

**Food security:** Merit was assigned based on the per capita monthly consumption of food grains as rank one for highest consumption and four for lowest consumption among irrigated and rainfed area farmers.

**Health security:** Merit was assigned based on the possession of Yashasvini health card as rank one for highest number of farm households having the card and four for lowest number of farm households having the card among irrigated area farmers and rainfed area farmers.

**Habitat security:** Merit was assigned based on the value of household assets including dwelling house as rank one for highest value of household assets and four for lowest value of household assets among irrigated and rainfed area farmers.

**Educational security:** Merit was assigned based on the value of indices as rank one for highest value and four for lowest value among irrigated and rainfed area farmers.

**Social network security:** Merit was assigned based on the value of indices as rank one for highest value and four for lowest value among irrigated and rainfed area farmers.

### 3.4.9 Amortization of benefits availed from developmental programs

Some of the developmental programs like Indira Awas Yojana, Bicycle for children studying 8th standard, Subsidy for drip, etc… the benefits are extended over time. Thus, the benefit derived by such beneficiaries is amortized using the formula.

\[
A = \frac{P r(1+r)^n}{(1+r)^n - 1}
\]

Where,

\[A = \text{Amortized benefit per year from particular developmental program.}\]
$P = \text{Total initial benefit received by the beneficiary farmer.}$

$r = \text{interest rate per period, } r \text{ is taken as 2\% since the benefits are from social welfare schemes over a long period of time}$

$n = \text{total number of years of benefit flow, } n \text{ is taken as the total number of years for each program (for eg. Indira Awas Yojana house construction for rural poor’s is taken for 10 years; subsidy for drip is for 4 years, Bicycle scheme for school going children for 10 years).}$

The same concept of amortization was used in calculation of cost and return structure of farm households in mulberry. Mulberry being a perennial crop, costs was worked out separately as establishment and maintenance costs. For working out establishment cost, inputs along with associated cost during the first year of the planting were considered. During the establishment period costs were broadly classified into variable and fixed costs, variable costs included material input and labour costs. The fixed costs included rental value of land, land revenue, depreciation and interest on fixed costs. For arriving at maintenance costs, costs incurred on material inputs and labour were used.

### 3.4.10 Economics of crop production

To study the economics of principal crops, averages and percentages were used. Different concepts of costs and returns used in the study are presented in this section. In the present study all calculations pertaining to the economics of principal crops were made on per acre basis.

**Input and cost concepts:**

The total costs were divided into three broad categories:

a. Variable Costs  
b. Fixed Costs  
c. Cost of cultivation  
d. Total costs
a. Variable costs: The variable costs include cost of seeds, manure, fertilizers, wages of human, machine and bullock labour, plant protection chemicals, irrigation etc. and interest on operational capital and repair and maintenance charges.

i. Seedlings: The cost of purchased seedlings was based on the actual amount paid by the farmers.

ii. Farmyard manure: The prevailing price per ton was used to impute the value of farmyard manure produced on the farm.

iii. Fertilizers and plant protection chemicals: The cost of fertilizers and plant protection chemicals was based on the actual prices paid by the farmers including the cost of transportation and other incidental charges, if any.

iv. Labour: The cost of hired labour was calculated at the prevailing wage rates paid per day (8 hours) in the study area for men, women and bullock and machine labour during the study period. The cost of family labour (human, animal and machinery) was calculated considering the prevailing market rate in this region through imputation.

v. Irrigation cost: The irrigation cost on acre basis is worked as follows;

\[
\text{Cost per acre-inch of water} = \frac{\text{Total amortized cost of irrigation}}{\text{Total number of acre inches of water required}}
\]

The number of acre-inches of ground water extracted for each crop in each season = frequency of irrigation per month * Number of months of crop * Number of hours to irrigate the crop area* average yield of bore well in GPH / 22611. The amortized cost of irrigation is obtained by = The amortized cost of irrigation well + Amortized cost of convenience + Amortized cost of pump set and accessories + Amortized cost of repair and maintenance. Thus, the cost of irrigation for any crop is worked out by multiplying the amortized cost of irrigation with number of acre-inches of water used.

vi. Interest on operational capital: The working capital consists of the expenditure on labour, seedlings, farm yard manure, fertilizers and plant protection chemicals,
irrigation and materials. Interest on operational capital was calculated at the rate of 11.75 per cent per annum (the rate at which commercial banks advance short term loans) and was apportioned to the crop based on the duration of the crop.

vii. Repair and maintenance charges: Repair and maintenance charges of implements and machinery used in the cultivation were computed on the basis of actual expenses incurred by the respondents. The amount was apportioned based on the usage and acreage.

b. Fixed costs: These include depreciation on farm implements and machinery, interest on fixed capital, land revenue.

The measurement and definitions of fixed cost components are as follows.

i. Depreciation charges: Depreciation of each capital equipment and machinery owned by the farmers and used in crop cultivation was calculated using the straight line method as

\[
\text{Annual depreciation} = \frac{\text{Purchase value (Rs.)} - \text{Junk value (Rs.)}}{\text{Economic life of the asset (years)}}
\]

The average life of the asset as indicated by the experts (Agricultural Engineers) was used in computing depreciation. The depreciation cost of each equipment was apportioned to the crop based on its percentage use.

ii. Interest on fixed capital: Interest charges on fixed capital were calculated at the rate of 9 per cent, as the fixed deposits in commercial banks would fetch around this rate of interest. The items considered under fixed capital are implements and machinery. Interest was considered on the value of these assets after deducting their depreciation for the year.

iii. Land revenue: Actual land revenue paid by the farmers was considered.
iv. Rental value of land: In the study area, the practice of leasing in and leasing out is absent in many of crops. Hence, the rental value of land was not considered in the present study.

c. Marketing costs: The actual marketing charges incurred by the farmers in marketing of crop produce were considered. These marketing costs include cost of packing, loading and unloading charges, hamali charges, transportation costs, wastage, market access and miscellaneous charges.

d. Cost of cultivation: It is the sum of variable costs and fixed costs and expressed on per acre basis.

e. Total cost: Total cost is the sum of cost of cultivation per acre and cost of marketing the produce.

**Output and returns:** In the case of most of the crops, the output included the main yield of the crop only and in some cases it included by-product also.

Then per acre returns were calculated by using the below mentioned procedure.

i. Net returns on variable costs: It is the gross returns minus variable costs.

ii. Net returns on cost of cultivation: It is the gross returns minus variable costs plus fixed costs.

iii. Net returns on total cost: It is the gross returns minus cost of cultivation plus marketing cost.

iv. Returns per rupee of expenditure: Worked out by taking the ratio of net returns to total cost

\[
\text{Net Returns per rupee of cost} = \frac{\text{Net returns}}{\text{Total cost}}
\]

This chapter outlined the portrayal of the study area, the sampling procedure followed and techniques used for data analysis.