CHAPTER II

MATERIALS AND METHODS
LOCATION OF DAVANGERE DISTRICT IN KARNATAKA
CHAPTER II

MATERIALS AND METHODS

The methodology followed for the present study has been described as follows. The present study is based on both secondary and primary data.

2.1: Secondary Data:

The secondary data were collected from the Directorate of Economics and statistics, Department of Agriculture Government of Karnataka, Fully revised estimates of area, production and yield of the principle crops in Karnataka, and other published sources. The data were pertaining to area, production and productivity of different crops across the district, area and sources of irrigation, HYV and local Variety areas under selected crops in different districts etc. The period covered was related 1970 to 2002.

2.2: Primary Data:

The primary data were collected by canvassing the interview schedules across the households belonging to different categories of farmers. Several indicators of modern technology such as per hectare HYV seeds, farmyard manure and electricity consumption per hectare were enumerated from the respondents and other variables number of workers employed in crop cultivation and other inputs used, number of farmers belonging to different categories following traditional technology were also be considered for the purpose of comparison. An exhaustive schedule containing questions
particularly on cost and returns, distribution of gains between Modern and Traditional technology, employment generation between Modern and Traditional technology, problems of adopting new technology etc, was designed for investigation. The interview method was followed in collecting the information. Researcher personally carried out field investigation during September/October, 2004 and required data pertaining to agricultural year 2002 to 2003 were collected. The collected data were and tabulated processed.

2.2.1: Selection of the District and Taluks:

For collecting the primary data a multistage sampling techniques has been adopted to choose the sample farmers for the field study. Davangere district is purposively selected, which is producing both Ragi and Jowar, which are important coarse cereals in the Karnataka state. Jowar in the northern districts and Ragi in the southern Karnataka. In the second stage selected two taluks namely Harpanahalli which has the highest acres under Jowar and Honnali which has highest acreage under Ragi in the district. In the third stage villages are selected with the highest area under Jowar and Ragi.

2.2.2: Selection of Sample Village and Farmers:

The highest area of selected crops was the base for the selection of sample villages of each taluk. At the same time, care was taken to ascertain the cultivation of both the traditional and high yielding variety (HYV) crops. The Villages in Harapanhalli and Honnali listed in an descending order based on the area devoted to selected crops and top 4 villages from each taluk were
included in the sampling frame. Thus, the total numbers of 240 farmers are selected from the list of farmers obtained from the village accountant five farmers from three categories (small, medium and large) were included and from each village totally 30 farmers are selected randomly. For the purpose of size wise analysis of the impact of Modern technology an equal number of samples were taken from each size group is given the table 2.1. These are as follows small farmers cultivating below the 5 acres, Medium farmers cultivating up to 6 acres to 10 acres and large farmers above 10 acres. The remaining taluks were observed to cultivate only either local & HYV. In both Jowar and Ragi the requisite sample size was maintained at 120 farmers per crop within the delineated area and variety. The Modern technology and traditional technology for each of the enterprises is given table in 2.2.

Table- 2.1: Sample frame indicating the study Area:

<table>
<thead>
<tr>
<th>SI No</th>
<th>Name of the Taluks and Crops</th>
<th>Name of the Villages</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Traditonal</td>
<td>HYV</td>
<td>Traditonal</td>
<td>HYV</td>
</tr>
<tr>
<td>1</td>
<td>Harapanahalli (Jowar)</td>
<td>1. Harapanahalli</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Chigateri</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Arasikere</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Telagi</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Honnali (Ragi)</td>
<td>1. Ksaba</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Belagutti</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Govinkovi I</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Govinkovi II</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td></td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
Fig: 2.1 Sample Frame (Design) for the Study.
Table-2.2: Crop variety considered under New Technology and Traditional Technology:

<table>
<thead>
<tr>
<th>SI No</th>
<th>Name of the Taluks and Crops</th>
<th>Variety under Traditional Technology</th>
<th>Variety under Modern Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Harpanahalli (Jowar)</td>
<td>• Bili Jola/ White Jowar/ Jawari Jola. • Maldandi • Bijapur Jola</td>
<td>• Pratama • Mahalaxmi-14 • Jk-28 • Hybrid-1 • ITC-501 • CSH-5 • Proagro</td>
</tr>
<tr>
<td>2</td>
<td>Honnali (Ragi)</td>
<td>• Local Ragi</td>
<td>• GPF-28 • Annapurna • Induf-5 • PR-202 • Hybrid-1</td>
</tr>
</tbody>
</table>

2.3: Analytical Techniques:

The concept of technical change defined in terms of productivity index is production of greater output with given quantities of resources or it is an increase in output per unit of input. In the production function context it is a change in the production parameters or an upward shift in the production function (Ruttan, 1960).

In the present study Modern technology (MT) is defined to include cultivation of high yielding verities (HYVs) of crops and the production practices associated with the respective particulars under investigation. On the other hand traditional technology (TT) is defined to include growing of local counterparts of the selected crop by adopting the production practices usually associated with them.
2.3.1: Structural Break in the Production Relations:

Adoption of Modern technology results in changes in output, employment and factor shares. Before actually decomposing the sources of output growth with the introduction of Modern technology it is very much necessary to ascertain whether there was any structural change in production functions defining Modern technology and Traditional technology farms. For this purpose the following dummy variable techniques was employed.

\[ \ln Y = \ln A + bD + U \]  

Where,

\( Y \) = Crop output (Quintals / acres)
\( D \) = Dummy with value '1' for Modern technology farms and '0' for Traditional technology farms.
\( U \) = Error term.
\( A \) = Mean level of input used by Traditional technology farms.
\( b \) = Difference between the mean input use on Modern technology and Traditional technology farms.

In the above equation, if the regression co-efficient of Dummy (Binary) variable is found to be significance then it indicates a significant difference (structural break) in the production relations between the Modern technology and Traditional technology farms production function.

In the present study, the values of the dependent and independent variables in the production function and decomposition analysis were on per acre basis in the case of crop production.
2.3.2: Decomposition Model:

Once the structural break was ascertained between the production functions of Modern technology and Traditional technology farmers, the output growth was decomposition into its constituent sources. For this purpose the output decomposition model (Bisalai an 1977) was used. For any production function, the shifts in the parameters of production function and the changes in the volume of inputs bring about the total change in output. The shift in the intercept measures the neutral component of technology contribution and the shift in the slope measures the non-neutral component of technology and these together constitute the technology contribution to the output growth with the introduction of Modern technology. Another contribution to the total output is due to the dis-equilibrium caused by the new production relations. The relevant productions for current analysis were specified as under.

The per acre Cobb-Douglas type of production function for the Modern technology sample farmers was specified as

\[ Y_2 = A_2 \sum_{j=1}^{n} b_2 U_2 \]

Similarly, the per acre Cobb-Douglas type of production function for the Traditional technology sample farms was specified as
Where,

- $Y_i =$ Crop output (acre) (for $i = 2$ or $1$)
- $A_i =$ Intercept (for $i = 2$ or $1$)
- $X_{ij} =$ Quantity or expenditure on the $j$th input on $i$th farm (for $j = 1$ to $n$)
- $n =$ No of independent variables
- $U_i =$ Error term (for $i = 2$ or $1$)
- $b_{ij} =$ Production elasticity of the $j$th input on the $i$th farm.

In the above equations, subscripts '1' and '2' represent Traditional technology farms and Modern technology farms, respectively.

The above equations were transformed into logarithmic forms and the co-effecients were estimated using the Ordinary Least Squares (OLS) techniques.

\[
\begin{align*}
\ln Y_1 &= \ln A_1 + \sum_{j=1}^{n} \ln X_{ij} b_{ij} + U_1 \quad \text{(5)} \\
\ln Y_2 &= \ln A_2 + \sum_{j=1}^{n} \ln X_{ij} b_{ij} + U_2 \quad \text{(4)}
\end{align*}
\]

Using the above production functions, the Decomposition model for analysing the sources of output growth between Modern technology and Traditional technology farms was derived. The model so derived provided a measure of the percentage contribution of new technology besides giving the contribution of difference in the input use levels between the two technology farms. By subtracting equation (5) from equation (4) the following Decomposition model was derived;
\[ \ln Y_2 - \ln Y_1 = (\ln A_2 - \ln A_1) + \sum_{j=1}^{n} (b_{2j} \ln X_{2j} - b_{1j} \ln X_{1j}) + (U_2 - U_1) \]  

(6)

By adding and subtracting \( \Sigma b_{2j} \ln X_{1j} \) in the above equation and rearranging in the terms,

The following decomposition model was arrived at

\[ \ln Y_2 - \ln Y_1 = (\ln A_2 - \ln A_1) + \sum_{j=1}^{n} (b_{2j} - b_{1j}) \ln X_{ij} + \sum_{j=1}^{n} b_{2j} (\ln X_{2j} - \ln X_{1j}) + (U_2 + U_1) \]  

(7)

When the percentage change in the output between the two technologies is less than 100 percent, the above equation holds good. But when it is more than 100 percent the above equation of \( \ln (Y_2/Y_1) \) will be very much underestimated. Hence a correction factor 'δ' has to be applied and by using the logarithmic rule the modified form of decomposition model is written as:

\[ \Delta Y/Y_1 = [\delta \ln (A_2 / A_1)] + \delta [\sum_{j=1}^{n} (b_{2j} - b_{1j}) \ln X_{1j}] + \delta [\sum_{j=1}^{n} b_{2j} (\ln X_{2j} - \ln X_{1j})] + U_2 - U_1 \]  

(8)
Where,

\[ \delta = \frac{\Delta Y}{Y_1} \times \ln \left( \frac{Y_2}{Y_1} \right) \] and

\[ \Delta Y = Y_2 - Y_1 \] and the values of \( X_{ij} \) and \( Y_i \) are taken at geometric mean levels.

The left hand side of the Decomposition model involves decomposition the natural logarithms of the ratio of the Modern technology output to the Traditional technology output. On the right hand side, the summation of the first and second terms together represents contribution of the component of technology.

The first bracketed expression on the right hand side of the equation is a measure of the percentage change in the output due to the shift in the scale parameter \( b \) of the production function (neutral component of the technical change). The second bracketed expression is sum of the arithmetic changes in the output elasticity coefficient of \( j \)th input, each weighted by the logarithm of the volume of that input (non-neutral component of the technology) on Traditional technology farms. It is a measure of percentage change in the output due to shift in the slope parameters of the production function.

The third structural bracketed expression is the sum of the logarithmic ratio of \( j \)th input used in the Modern technology farm to the input used in the Modern technology farm to the input used in the Traditional technology farm, each weighted by the output elasticities of that input under Modern technology. This expression is measure of the change in the output due to the
differences in the quantity of inputs used between two technology farms, given the output elasticities of these inputs under the Modern technology.

2.3.3: Factor Share Analysis:

The concept of factor share refers to the functional income distribution. It refers to the proportion of the total output or income accrued to the different factors of production. The framework for estimating the factor share effects of the technical change in different enterprises is presented here.

In the Cobb-Douglas framework the Estimated Factor Share (EFS) accrued to the \( j \)th factor under a given technology farm is equal to the Relative Factor Production Elasticity (RFPE) when the return to the scales are different from unity (Brown, 1968) and given by:

\[
EFS = b_j + \sum_{j=1}^{n} b_j \tag{9}
\]

The Actual Factor Share (AFS) is the proportion of the total income \((Y_i)\) for \(i=1\) and 2) accrued to each factor used in the production process and was calculated as

\[
AFS_j = X_j + Y_i \tag{10}
\]

The equality of the EFS and the AFS was tested using the following formula:

\[
\text{Deviation} = \frac{[AFS_j - EFS_j]}{[SEEFS_j]} \tag{11}
\]
The impact of technical change on AFS was studied by calculating the change in the AFS (ΔAFS) as follows:

\[ ΔAFS_j = [AFS_{2j} - EFS_{1j}] + [AFS_{1j}] \] \hspace{1cm} (12)

In the above equations if ΔAFS\(_j\) is greater than zero, it indicated an increase in the Actual Factor Share of the jth input, otherwise it implies a decrease in its Actual Factor Share. If ΔAFS\(_j\) = 0 indicates a constant share of the jth input. Subscripts 2 and 1 indicate Modern technology and Traditional technology in respectively.

Some times the results of the analysis of the change in Actual Factor Share do not reveal the true picture. So the change in the Actual Absolute Factor Share (ΔABFS) was calculated and expressed in percentage.

\[ ΔABFS_j = [ABFS_{2j} - ABFS_{1j}] + [ABFS_{1j}] \times 100 \] \hspace{1cm} (13)

Where,

\[ ABFS_j = AFS_j (Y_i) \] and ‘i’ refers to the technology and it takes the value ‘1’ for Traditional technology and ‘2’ for Modern technology.

2.3.4: Employment Effects of Technical Change:

The employment effects of the technical change in Jowar and Ragi crops are studied by comparing the mean level of employment of human labour between the Modern technology and the traditional technology farms, using the technique of Analysis of Variance.
In this technique, the equality of mean labour between Modern technology and Traditional technology farmers is to be tested.

The Null Hypothesis for the purpose is

\[ H_0: \mu_1 = \mu_2 \]

The alternative hypothesis is

\[ H_a: \mu_1 \neq \mu_2 \]

Where,

\( \mu_1 \) and \( \mu_2 \) represent the population mean level of the employment of human labour of Traditional technology and Modern technology farms, respectively. The test statistics used is

\[
F (k-1, n_1+n_2-k) = \frac{\left( n_1 (\bar{v}_1 - \bar{V})^2 + n_2 (\bar{v}_2 - \bar{V})^2 \right) \div (k-1)}{(V_1^2 - \bar{V}^2) \div (n_1+n_2 - k)}
\]

Where,

\( \bar{v}_i \) = mean levels of human labour employed (for \( i=1 \) and \( 2 \) for traditional and Modern technology respectively)

\( \bar{V} \) = Grand mean

\( n_i \) = Number of observations in \( i^{th} \) group.

\( k \) = No. of classes

\( r \) = No. of rows.

The calculated 'F' values will be compared with the table 'F' values at \((k-1)\) and \((n_1 + n_2 - k)\) degree of freedom.
REFERENCES


