CHAPTER V

RESEARCH METHODOLOGY
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The chapter presents a precise picture of the detail research methods and procedures followed by the investigator during the course of investigation. It contains three major parts. The first part deals with sampling techniques used, the second part covers the empirical measures of different variables and the last part describes the details of data collection and statistical measures adopted for the analysis of data to arrive at valid and reliable interpretations.

5.1 SELECTION OF PROBLEM

One of the most important factors in social research is the selection and conceptualisation of research problem. The generalised concept is that, the proper formulation of problem is more important than arriving at a solution. The selection of research problem interested the researcher to undertake a study on "A study on present farming system and possible scope for inclusion of Social Forestry to increase the socio-economic status of farm families in Orissa" with contention that the work will be the first of its kind and provide enough insight to the administrators in management of Social Forestry programmes. Also the particular problem bears practical value in the present
society and particularly for a sustainable farming system in Orissa. While selecting the problem, due considerations were given to various aspects such as problem demanding solution, manageable size of sample, definition of the concept, research methodology and anticipated consequences.

5.2 PLAN OF WORK

Keeping in view of the wide and valid application of the study, it was felt necessary that a detailed survey of all aspects related to the objectives already enumerated in Chapter-I should be undertaken. Considering the stipulated time period, the area of investigation, sample size, methods of analysis of data, pre-testing of the schedule etc. a detail plan was formulated at pre-survey stage.

5.3 RESEARCH DESIGN

The present project was designed to study the scope for inclusion of social forestry in the farming system for benefit of the farmers. The investigation comes within the perview of survey research design. In the light of the objectives, the techniques of investigation, research materials and tools to be used and patterns of statistical analysis to be incorporated were decided.

5.4 LOCALE

The study was planned at two levels, one was at the level of official i.e. village forest workers of the selected
forest ranges and the other at the micro level with the farmers.
The study was based on the concept of highlighting the role
of social forestry and its inclusion in farming system for the
welfare of the farming community.

5.5 SAMPLING TECHNIQUE

The study envisages investigation into different aspects
of social forestry programme executed in Orissa. All the districts
of the state have been covered under social forestry programme,
while the study is confined to three districts. Out of 13 districts,
only three districts, namely Puri, Sambalpur and Mayurbhanj
covering major agro-climatic zones of the state were selected.
Altogether 150 farmers raising social forestry were selected
randomly and each of them were personally interviewed by
means of a structured schedule specially prepared for the purpose.
Table 38 gives details of the selection of districts and respondents
for microlevel study.

Table 38. District-wise distribution of sample respondents

<table>
<thead>
<tr>
<th>SI. No.</th>
<th>Name of District</th>
<th>No. of Social Forestry Villages selected</th>
<th>No. of ranges selected</th>
<th>No. of villages selected</th>
<th>No. of Respondents selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Puri</td>
<td>12</td>
<td>4976</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>2.</td>
<td>Sambalpur</td>
<td>16</td>
<td>3741</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>3.</td>
<td>Mayurbhanj</td>
<td>8</td>
<td>3952</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>
5 5.1 Selection of district

After a careful consideration and consultation with social forestry officers both at state and district level, it was decided to select three districts, namely Puri, Sambalpur and Mayurbhanj. These districts were selected on the criteria of (i) concentration of social forestry area in the district (ii) positive response of the farmers for the programme (iii) tangible achievements compared to other districts and (iv) favourable opinion of officers about success of social forestry in the districts and (v) visible effect of the programme in the area. On the basis of the above criteria these districts were finally selected for the study.

5 5.2 Selection of social forestry range

The selection of range was done purposively. Three social forestry ranges of each revenue districts totalling to nine were selected covering mostly non-irrigated area of the district. The social forestry ranges of respective revenue districts are indicated in Table 39.

Table 39. District and social forestry ranges under study

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the district</th>
<th>Social forestry ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Puri</td>
<td>a. Puri</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Khurda</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Tangi</td>
</tr>
<tr>
<td>2.</td>
<td>Sambalpur</td>
<td>a. Jharsuguda</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Padiabahal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Sambalpur</td>
</tr>
<tr>
<td>3.</td>
<td>Mayurbhanj</td>
<td>a. Betnoti</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Baripada</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Karanjia</td>
</tr>
</tbody>
</table>
The selection of social forestry ranges for the study was made on the basis of the criteria as have been applied for the selection of district.

5.5.3 Selection of Village

A list of villages in each range was prepared and out of which three villages from each range were selected. Thus a total of twenty seven villages were selected for investigation after carrying a preliminary survey in the beginning with consultation of social forestry supervisors of the respective locations taking into consideration of communication facilities and extent of adoption of social forestry programmes.

5.5.4 Selection of Respondents

The sample of investigation consisted of two categories of respondents i.e. officials and farmers. Considering the time and resource of the researcher, quota sampling technique was followed to select 50 farmers of each district i.e. Puri, Sambalpur and Mayurbhanj. Thus a total number of 150 farmers covering 27 villages over nine forest ranges were selected through random sampling and interviewed with the help of a structured schedule which have been described later on.

Further, to supplement the findings of the study, based on the opinion of the farmers, as much as 50 village forest workers almost covering the selected nine social forestry ranges
were considered as sample for securing information as per requirement of the study. The responses of this category of sample were recorded on another set of schedule specifically developed for them. The procedure followed complete enumeration method resulting selection of all VFWs working in the area under study.

5.6 VARIABLES AND THEIR MEASUREMENT

Independent variables included in the study were selected on the basis of review of literature, discussion with experts and preliminary study conducted in the area of investigation. Only those variables which were found relevant with social forestry programmes were included within the frame work of investigation. A list of variables studied along with the instruments used for their measurement are given below.

5.6.1 Empirical measurement of variables

5.6.1.1 Part-I (Farmers)

(1) **Successful Index** - Successful is the dependent variable in this study. It relates to resultant effect of all independent variables. Successful is operationally defined on the basis of increase in area under Social Forestry (S.F.) or keeping area constant under the programme till harvest of the plantation. Thus farmers increasing area under social forestry or maintaining it were successful and those who decreased the area were not included in the list. The successful index also considered
the level of satisfaction which was calibrated on three point scale of fully, partially and not at all.

(ii) **Gap Index** - Gap index was calculated as per requirements of objective I. It was conceptualised on the basis of review of literature. The gap index in idea or acceptance of social forestry as a component to increase farm productivity was calculated by using the formulas.

\[
\text{Gap} = \frac{\text{Obtainable score} - \text{score obtained}}{\text{Obtainable score}} \times 100
\]

The gap thus refers to the difference between maximum obtainable score and score obtained in term of percentage. Obtainable score is the highest score that can be obtained on a statement. Obtained score refers to the average score obtained by an individual respondent on the statements.

(iii) **Age** - Chronological age of the respondents in terms of completed years.

(iv) **Education** - The variable indicates the level up to which the individual had acquired formal education. For educational status of the respondents, the scoring was as follows.

<table>
<thead>
<tr>
<th>Education level</th>
<th>Score assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Illiterate</td>
<td>0</td>
</tr>
<tr>
<td>b. Primary</td>
<td>1</td>
</tr>
<tr>
<td>c. Middle School</td>
<td>2</td>
</tr>
<tr>
<td>d. High School</td>
<td>3</td>
</tr>
<tr>
<td>e. Intermediate</td>
<td>4</td>
</tr>
<tr>
<td>f. Graduation and above</td>
<td>5</td>
</tr>
</tbody>
</table>
For studying the educational status of farmers, the number of years of formal education attained by them were taken into account. The scoring system developed by Trivedi and Pareek (1963) was followed with necessary modification.

(v) **Family Size** - The size of a family was taken as the number of members living jointly with a common kitchen. The family size was classified into three groups, such as up to 5 members, 6 to 10 members and more than 10 members.

(vi) **Family type** - Family type was operationalised on the basis of whether the members were living jointly with a common kitchen or they have nucleated type of family with a separate kitchen. The score assigned for nuclear family was, one and two for joint family system.

(vii) **Family members at work** - Family labourers consisted of male, female and children who work in the field either part time or full time or not at all. The scoring pattern adopted was as follows.

<table>
<thead>
<tr>
<th>Category of labourers</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Children</td>
<td>1</td>
</tr>
<tr>
<td>b. Female</td>
<td>2</td>
</tr>
<tr>
<td>c. Male</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Extent of Engagement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Not at all</td>
<td>0</td>
</tr>
<tr>
<td>b. Partially</td>
<td>1</td>
</tr>
<tr>
<td>c. Full time</td>
<td>2</td>
</tr>
</tbody>
</table>
For each family, the number of family members belonging to a particular category of labourers was multiplied with the corresponding score and the value so obtained was further multiplied with the corresponding extent of engagement score. The scores for different categories of labourers when added up gave total family score in this respect.

(viii) **Labour utilisation** - In this study, the extent to which labour requirement in farming practices including plantation was met by own family labourers was taken into consideration. The scoring pattern followed was as follows.

<table>
<thead>
<tr>
<th>Extent</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Not at all</td>
<td>0</td>
</tr>
<tr>
<td>b. Up to 25%</td>
<td>1</td>
</tr>
<tr>
<td>c. 25-50%</td>
<td>2</td>
</tr>
<tr>
<td>d. 50-75%</td>
<td>3</td>
</tr>
<tr>
<td>e. 75-100%</td>
<td>4</td>
</tr>
</tbody>
</table>

(ix) **Social participation in formal organisation** - Social participation refers to the degree of involvement of the respondents in formal organisation, either as member or as office bearer. This variable was quantified on the basis of scoring system followed in socio-economic status scale of Trivedi and Pareek (1963) with necessary modification.

<table>
<thead>
<tr>
<th>Formal organisations</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Village committee</td>
<td>1</td>
</tr>
<tr>
<td>b. Village forest committee</td>
<td>2</td>
</tr>
<tr>
<td>c. Youth club/vol. organisation/Radio, T.V., farmers forum</td>
<td>3</td>
</tr>
</tbody>
</table>
Further, the involvement of individuals in formal organisation in term of member or office bearers was measured in assigning score, -

a. Member 1
b. Office bearer 2

(x) Change, agent contact - It refers to the degree to which respondents contact extension personnel for information with specific frequency. The score assigned to different frequencies of contact was -

<table>
<thead>
<tr>
<th>Frequency of contact</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Never</td>
<td>0</td>
</tr>
<tr>
<td>b. Occasionally</td>
<td>1</td>
</tr>
<tr>
<td>c. Monthly</td>
<td>2</td>
</tr>
<tr>
<td>d. Fortnightly</td>
<td>3</td>
</tr>
<tr>
<td>e. Weekly</td>
<td>4</td>
</tr>
</tbody>
</table>

(xii) Participation in extension activity - Participation in extension activities is the extent to which a farmer participates in the extension activities such as training camps, field tours, field days, melas, exhibitions, demonstrations both in the field of agriculture and social forestry programmes. In order to measure the extent of participation in extension activities, each activity was assigned in one score and for magnitude of participation the score was as follows -
Magnitude of participation | Score
---|---
a. Never | 0
b. Once | 1
c. Twice | 2
d. Thrice | 3
e. More than 3 times | 4

The total score obtained for participation in all the activities together indicate the extent of their participation in the extension activities organised by the extension agency.

(xii) Classification of farmers on the basis of land holding - It refers to the total land owned by the farmers used for different purposes, such as for agricultural crop, plantation of trees under social forestry programme, etc. on the basis of total land owned and criteria fixed by State Government of Orissa, the respondents were classified into five categories as stated below.

| Classification of farmers | Possession of land (ha) |
---|---
a. Marginal | Less than 1
b. Small | 1.0 - 2.0
c. Semi medium | 2.0 - 4.0
d. Medium | 4.0 - 10.0
e. Large | Above 10.0

(xiii) Annual family income - Annual family income refers to total amount earned in a year from all sources by all earners and was estimated on the basis of (i) the value of all crops yield and their by-products and (ii) through all other sources like
service, business & animal husbandry etc. On the basis of annual income, the respondents were categorised into four groups as follows.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Annual income range</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Very low</td>
<td>Upto Rs.10,000.00</td>
</tr>
<tr>
<td>b. Low</td>
<td>Rs.10,001-Rs.20,000</td>
</tr>
<tr>
<td>c. Medium</td>
<td>Rs.20,001-Rs.30,000</td>
</tr>
<tr>
<td>d. High</td>
<td>Above Rs.30,000.00</td>
</tr>
</tbody>
</table>

(xiv) Cropping pattern - Cropping pattern was operationally defined as number of crops grown per unit of land on sequence by an individual in a year. Respondents on the basis of cropping pattern i.e. mono, double and triple cropping pattern the frequency of occurrence was recorded.

(xv) Farmers' consideration of present cropping pattern - There is valid reason for cropping pattern to which the farmers have been practising over years. The reaction of the respondents for such consideration was measured against 14 statements on a three-point scale of 'disagree', 'neutral' and 'agree' with assigned scores of 0, 1 and 2 respectively. These 14 statements covered major aspects of continuing farming practices of the area of investigation. These were selected on the basis of opinion of experienced farmers and officials of Agriculture Department working in the concerned areas.

(xvi) Farmers' consideration for use of modern technology - Change in practice depends on a variety of factors. Farmers consider
change mostly on situation, economic and social benefits. The consideration behind such deviation over 20 selected technologies was measured on a three-point scale with scores as shown below.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Not important</td>
<td>0</td>
</tr>
<tr>
<td>b. Important</td>
<td>1</td>
</tr>
<tr>
<td>c. Very important</td>
<td>2</td>
</tr>
</tbody>
</table>

(xvii) Constraints in change of cropping pattern - The responses were categorised under two specific groups of non-diversifier and diversifier. The definition of diversifier has been used to denote farmers who have changed their cropping pattern. The non-diversifiers were operationally defined as those individuals who did not change their farming practices on selected technologies selected for the study. The constraints were classified into five major types such as technological, institutional, administrative situational and socio-economic constraints. Frequency of constraints were recorded both for diversifier and non-diversifier for the study.

(xviii) Means to overcome the constraints - Under this variable the responses were recorded under three-point scale as -

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Not essential</td>
<td>0</td>
</tr>
<tr>
<td>b. Essential</td>
<td>1</td>
</tr>
<tr>
<td>c. Very essential</td>
<td>2</td>
</tr>
</tbody>
</table>
(xix) Idea/Acceptance of Social Forestry

The variable refers to extent of knowledge possessed by the respondents about fundamental aspects of Social Forestry. These fundamental aspects were selected from Social Forestry Scheme formulated and accepted by Government of Orissa. The knowledge level was measured in a simple scale consisting of 'know' and 'do not know' with assigned score of one and zero respectively.

(xx) Role of Extension Agencies in Promoting Social Forestry

For implementation of Social Forestry in the farming system, three organisations were considered important and included in the study. Till date, only Department of Social Forestry and Non-Government organisations are directly involved in the programme. The responses of respondents on the role played by these two organisations as well as expected role of Agriculture Department on 28 statements were recorded.

(xxI) Factors responsible for success of Social Forestry

Rank order analysis was made for identifying the factors in order of importance as perceived by the respondents which are responsible for the success of the social forestry programme. The variables describing success were selected on the basis of opinion of forestry officials on consultation.
(xxii) Sources of Motivation

The term motivation is defined as the process of arousing action, sustaining the activity in the progress and regulating the pattern of activity. This variable in case of selected respondents have been examined over 13 sources of motivation leading to acceptance and sustaining of social forestry programme on a four point scale as.

<table>
<thead>
<tr>
<th>Extent of Motivation</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Not at all</td>
<td>0</td>
</tr>
<tr>
<td>b. Little</td>
<td>1</td>
</tr>
<tr>
<td>c. Much</td>
<td>2</td>
</tr>
<tr>
<td>d. Too much</td>
<td>3</td>
</tr>
</tbody>
</table>

(xxiii) Factors of Motivation

It refers to the rationale of an individual for accepting Social Forestry as a component of farming system to increase the farm productivity. The respondents were exposed to 11 factors of motivation selected on the basis of literature. Responses were measured on a four point scale as follows.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Not at all</td>
<td>0</td>
</tr>
<tr>
<td>b. Little</td>
<td>1</td>
</tr>
<tr>
<td>c. Much</td>
<td>2</td>
</tr>
<tr>
<td>d. Too much</td>
<td>3</td>
</tr>
</tbody>
</table>
(xxic) Awareness about outcome of Social Forestry

Under the present study, awareness refers to consciousness of a respondent with respect to certain outcomes of social forestry programme. For measuring the awareness as many as 15 statements on the outcome of social forestry were exposed to the respondents and their responses were measured. In General '0' score was assigned for 'Do\textquotesingle nt know' or wrong response and '1' for 'know' or correct one. After finding out the total score of individual respondents, they were classified into three groups viz: Low, Medium and High on the basis of mean with ± standard deviation.

5.6.1.2 Part-II (For Village Forest Workers)

The second part of schedule was exclusively designed for V.F.Ws. The schedule contained six distinct aspects covering variables like age, education, experience, perceived role of extension agency, knowledge level and attitude.

(i) Age - Chronological age of the respondents in terms of completed years.

(ii) Education - Attainment of formal education considered to be educational level of respondents.

(iii) Experience - Refers to continuous completion of service in Forest Department. The respondents were requested to record their total length of service in terms of completed years.

(iv) Role of Extension Agency - For proper implementation of social forestry programmes, there are certain specified roles to be played by the village forest workers. As much as 28 such roles were considered valid for exposure of the respondents. The measurement of perception was done on scoring basis as given below.
(v) Knowledge on social forestry - In general, knowledge is an intimate acquaintance of an individual with fact. English and English (1961) has defined knowledge as a body of understand information possessed by an individual or by a culture. Thus, under present study, knowledge refers to the extent of knowledge the village forest worker possessed out of several years of experience in forest department on origin, principles, implementation and extension activities of the Social Forestry project at the time of interview as evidenced by disagree, neutral and agree to 25 statements designed, covering all important aspects of Social Forestry. The respondent's answers were scored zero for disagree, one for neutral and two for agree. The scores obtained by the respondent for each item were summed up and this aggregate score was taken as respondents knowledge score.

(vi) Attitude towards social forestry - An attitude is often defined as to react favourably or unfavourably towards a designated class of stimuli, such as a national or racial group, a custom or an institution. In this concern, Anastasi (1976) stated that attitude can not be directly observed, but must be inferred from overt behaviour, both verbal or nonverbal. Under the present study, attitude was operationalised as the response of the village forest workers representing their supportive or hostile action towards social forestry project. For testing the attitude of V.F.Ws, the scale developed by Singh (1975) was used with necessary modification. In the attitude scale altogether 16 statements
were included, out of which 'eleven' are positive and rest 'five' are negative statements. The responses of the V.F.Ws for each statement on a five point continuum from "strongly agree" to "strongly disagree" were recorded. The score assigned for favourable statements were 4,3,2,1,0 and for unfavourable statements the system of scoring was reversed. The total score for each respondent was obtained by summing up the scores for all the items.

5.7 PROCEDURE INVOLVED IN DATA COLLECTION

5.7.1 Pilot study

Prior to the construction of data collection devices, a pilot study was conducted in the selected areas of investigation. During the course of this pilot study, informal discussions were held with some respondents. The main notion behind the study was to know different important aspects of the farming system and social forestry activities adopted by the farmers. Thus a total of 12% of the sample were interviewed for the pilot study.

5.7.2 Preparation of interview schedule

At the time of preparation of interview schedule for the purpose, besides the information and experience gained through pilot study, frequent discussions were held with different officials of Agriculture and Social Forestry Departments, experienced resource persons working in the said field and a good bulk
of literature were studied. Proper care has been taken to avoid ambiguous and vague questions which unnecessarily will create confusion in the mind of the respondents resulting failure of investigation. Before final data collection, the entire schedules were pretested in the field including farmers and officials in order to ascertain difficulty in recording of data as per schedule. On the basis of pretesting, necessary modifications were incorporated in the final schedule. In case of farmers as well as some village forest workers the investigator had translated the schedule into local languages to obtain the required information without distorting the meaning or idea of the questions.

For officials the schedule consisted of four parts and for farmers it consisted of seven parts dealing with different aspects of the study as per objectives.

5.7.2 Schedule for farmers

Part-I - It deals with background information of the respondents including socio-economic variables. This could provide information about their age, educational attainment, family size and type, family education status, land holding, family labour status, social participation, change agent contact, cropping pattern etc.

Part-II - Consisted of the reasoning of respondents for the cropping pattern they follow, their consideration for using modern technology, constraints they face during shifting of cropping
pattern as well as the ways and means to overcome the constraints.

**Part-III** - Meant for assessing the idea or reasoning of farmers for acceptance of social forestry as a component in the farming system to increase farm productivity.

**Part-IV** - Dealt with successfulness of social forestry programme along with the perception of farmers regarding factors responsible for success and failure of the programme.

**Part-V** - Focused on sources and factors of motivation for acceptance of social forestry programme in the farming system.

**Part-VI** - Was structured to measure the awareness of farmers about some outcomes of social forestry activities.

**Part-VII** - Dealt to identify the roles played by social forestry personnel and Non Government Organisations in implementation of social forestry programme along with the expected roles to be played by Agriculture Extension Agency as perceived by the farmers.

### 5.7.2.2 Schedule for Officials

Part I deals with background information of the respondents. This could provide information about their age, qualification, place of posting, designation and total experience.

In part-II, questions were asked to identify their roles in order of importance for proper implementation of social forestry programme.
Part-III dealt with assessment of knowledge level of village forest workers on various aspects of social forestry like Origin, Principle, implementation and extension aspect of social forestry project.

Lastly, part IV was structured to determine the attitude of village forest workers towards social forestry through a number of statements on a five point continuum ranging from 'strongly agree' to 'strongly disagree'.

5.8 ESTABLISHING NECESSARY RAPORT

Before collection of data, the investigator established necessary rapport to get unbiased information from the respondents. Prior to final data collection, the investigator devoted some days to get acquainted with the farmers, some local leaders and Government Officials. The respondents were convinced about the purpose and importance of the study. It was made clear to them that the study was purely academic nature. All these, helped the investigator to develop a friendly rapport with the respondents and to gain confidence and co-operation of the respondents.

5.9 METHODS OF COLLECTION OF DATA

The final data were collected with the help of structured schedule specifically prepared, incorporating all the items on which information was required (Appendix-I). The schedule for farmers consisted of seven parts and the schedule for
officials consisted of four parts. The actual data collection started in the month of January 1991 and it continued up to February 1992.

In case of first part, the farmers were approached at their residences generally while they were at leisure. The assistance of Junior Agriculture Officers as well as Village Forest Workers were availed to get the responses from farmers. The questions were asked in local language to the farmers in a homely atmosphere and their responses were recorded in the schedule by the investigator. Attempt was made to make each item clear and simple to the farmers for their easy understanding and better response.

In case of second part, the schedules were handed over to the officials and after fifteen days there were collected to compile their responses.

5.10 TABULATION AND STATISTICAL ANALYSIS OF DATA

The data collected from farmers and officials were scored and the score were summed up for each respondent both for independent and dependent variables. The scores were further tabulated in different ways for final analysis in the light of different objectives set forth in the study. The statistical methods used in this study based on the nature of data and type of information required to draw the valid conclusion, are as follows.
5.10.1 Arithmetic mean

The Arithmetic mean \( \bar{X} \) is the quotient that resulted when the sum of all items in the series is divided by the number of items \( (n) \). The formula in terms of symbol is.

\[
\bar{X} = \frac{\sum X}{n}
\]

Where

\( \bar{X} \) = Arithmetic mean
\( X \) = The sum of each individual item.
\( n \) = Number of items.

5.10.2 Percentage

Percentages were used in descriptive analysis for making simple comparisons. For calculating percentages, the frequency of a particular cell was multiplied by 100 and divided by total number of respondents in that particular category to which they belonged.

5.10.3 Rank order

On the basis of mean score rank order was worked out.

5.10.4 't' test

This test was applied in this study to test the significance of difference between means of any two categories of respondents. The formula used for calculating 't' value was as follows.

\[
t = \frac{\text{Difference between means}}{\text{Standard error of difference}}
\]
The significance of 't' was tested by referring to 't' table. If the observed value of 't' was equal to or greater than table value of 't' at \( n_1 + n_2 - 2 \) df. under 0.05 level of probability, it was considered significant.

5.10.5 Critical Ratio Test (CR test)

This test was applied to test the significant difference between two percentages. Critical Ratio was found out by dividing the difference between two percentage of two samples by its standard error,. To find out CR value, the formula used was.

\[
CR = \frac{(P_1 - P_2 - 0)}{\delta P_1 - P_2}
\]

\[
6 D^2 = \sqrt{\delta^2 P_1 - \delta^2 P_2} = \sqrt{PQ \left( \frac{1}{N_1} + \frac{1}{N_2} \right)}
\]

\[
P = \frac{N_1 P_1 + N_2 P_2}{N_1 + N_2}
\]

\[
Q = 1 - P
\]

Where,

\( N_1 \) = Size of 1st sample
\( N_2 \) = Size of 2nd sample
\( P_1 \) = Percentage of 1st sample
\( P_2 \) = Percentage of 2nd sample
\( \delta \) = Standard error of difference of two percentages

The significance of 'CR' was tested as in case of 't' test referring to 't' table. If the observed value of 'CR' was equal to or greater than table value of 't' at \( n_1 + n_2 - 2 \) df under 0.05 level of probability it was considered significant.
5.10.6 *Pearson's coefficient of correlation*

This test was used to find out Zero-order correlation or the extent or degree or the intensity of association between any two variables. It, however, does not measure the dependence of one variable on the other. It is in fact the measure of systematic association between two variables. In different situations, it can vary from a value of +1.0 which means perfect positive correlation through Zero, which means no correlation on down to -1.0, which means perfect negative correlation. The coefficient of correlation was computed with the help of the following formula.

\[
\rho = \frac{\sum xy - (\sum x)(\sum y)}{\sqrt{N(\sum x^2 - (\sum x)^2)} \sqrt{N(\sum y^2 - (\sum y)^2)}}
\]

Where,

- \(N\) = Number of pairs to be correlated
- \(X\ & Y\) = Variables being correlated
- \(\rho\) = Coefficient of correlation
- \(\sum\) = Summation

5.10.7 *Test of significance of Pearson's Co-efficient Correlation*

The coefficient of correlation was tested for their significance by using the formula.

\[
t = r \sqrt{\frac{n-2}{1-r^2}}
\]

Where,

- \(r\) = Coefficient of correlation obtained from sample.
- \(n\) = Number of pairs in the study.
5.10.8 Standard deviation

This was used to classify the respondents into different categories. The formula used for calculating the standard deviation was.

\[ S.D. = \sqrt{\frac{\sum (X - \bar{X})^2}{N}} \]

Where,

\[ X = \text{Value of the variable} \]
\[ \bar{X} = \text{Arithmetic average of the series} \]
\[ N = \text{Number of items in the series} \]

5.10.9. Chi-square test

When the data of research consists of frequencies in discrete categories, the \( x^2 \) test is used to determine the significance between two independent groups. The hypothesis under this test is usually that the two groups differ with respect to some characteristics with respect to the relative frequency. The formula used in this test was as follows:

\[ X^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \]

Where,

\[ O_{ij} = \text{Observed number of cases categorised in ith row of jth column.} \]
\[ E_{ij} = \text{No. of cases expected under Ho to be categorised in ith row of jth column.} \]
\[ \sum_{i=1}^{r} \sum_{j=1}^{k} = \text{Directs one to sum over all (r) rows and all (k) column i.e. to sum over all cells.} \]
The calculated value of Chi-square was tested by referring table C with \((r-1)(k-1)\) degree of freedom. If the observed value of \(X^2\) is equal to or greater than the tabulated value it is considered significant.

5.10.10 Spearman Rank Correlation coefficient

It is a measure of association which requires that both variables be measured in at least an ordinal scale so that the objects or individuals under study may be ranked into ordered series. The formula used to find out the correlation coefficient was

\[
\gamma_s = \frac{\sum x^2 + \sum y^2 - \sum d^2}{2 \sqrt{\sum x^2 \sum y^2}}
\]

Where,

\[
\sum x^2 = \frac{N^3 - N}{12} - \sum T_x \quad \sum y^2 = \frac{N^3 - N}{12} - \sum T_y
\]

\[
\sum d^2 = \text{Sum of squares of the differences between paired ranks.}
\]

\(N\) = Number of observations in each category.

Where \(N=10\) or more a test of significance of is to be done by using a 't' given by

\[
t = \gamma_s \frac{\sqrt{N - 2}}{\sqrt{1 - \gamma_s^2}}
\]

5.10.11 Kendall partial rank correlation coefficient

Where correlation is observed between two variables, there is always the possibility that this correlation is due to the association between each of the two variables and a third variable. In partial correlation, the effects of variation
by a third variable upon the relation between the $X$ and $Y$ variables are eliminated. In other words, the correlation between $X$ and $Y$ is found with the third variable $Z$ kept constant. It requires at least an ordinal measurement. The formula used in this partial correlation was as:

$$
\gamma_{xy,z} = \frac{\gamma_{xy} - \gamma_{xz} \gamma_{yz}}{\sqrt{(1 - \gamma_{xy}^2)(1 - \gamma_{xz}^2)}}
$$

Where,

- $\gamma_{xy}$ = Correlation between $x$ & $y$ variables
- $\gamma_{xz}$ = Correlation between $x$ & $z$ variables
- $\gamma_{yz}$ = Correlation between $z$ & $y$ variables