Chapter–7

Research Methodology

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The deliberation on the methodology has been made to understand the concept, methods and techniques which were utilized to design the study, collection of information, analysis of the data and interpretation of the findings for revelation of truths and formulation of theories. This chapter deals with the method and a procedure used in the study and consists of eight main parts-

A. Locale of Research.
B. Pilot Study.
C. Sampling Design.
D. Empirical Measurement of the Variables.
E. Preparation of Interview Schedule.
F. Pre-testing of Interview Schedule.
G. Techniques of Data Collection.
H. Statistical Tools used for Analysis of Data.

A. Locale of Research

For the study, Krushnaprasadand Brahmagiriblock of Puri district in Odisha was purposively selected. The village namely Malud and Satapada of

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Krushnaprasad block and Brahmagiri and Bentapur of Brahmagiri block were selected by random sampling. The area had been selected for the study because of-

a) There is ample scope for collecting relevant data for the present study,
b) Acquaintance with the local people as well as the local language,
c) The concern area was easily accessible to the researcher in terms of place of residence,
d) The area was very easily accessible to the researcher in terms of transportation and
e) Theclose familiarity of the student researcher with respect to area, people officials and local dialects.

B. Pilot Study

Before taking up actual fieldwork a pilot study was conducted to understand the area, its people, institution, communication and extension system and the knowledge, perception and attitude of the people towards climate change concept. An outline of the socio-economic background of the farmers of the concerned villages, their perception towards change dynamics, had been driven.

Sampling Design

Purposive as well as simple random sampling techniques were adopted for the study. For selection of state, district and block,purposive sampling technique was adopted because the area was ideal for climate change study, convenient for researcher and having the infrastructural facilities and in case of selection of villages and respondents simple random sampling technique

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was taken up. The district Puriand the Block Krushnaprasad and Brahmagiri, were considered. Under the Krushnaprasad block,Malud and Satapadavillage and under Brahmagiri block, Brahmagiri and Bentapur village, were selected. From four villages, 80respondents (20 from each village) were selectedrandomly for final data collection.

Sampling Scheme (Multistage Random Sampling)

The schematic diagram features the sampling scheme of The State, District, Block, Villages and Respondents.

Step	Items	Level	Approach
1	State	Odisha	Purposive
2	District	Puri	Purposive
3	Block	Krushnaprasad, Brahmagiri	Purposive
4	Village	Malud, Satapada, Brahmagiri, Bentapur	Random
5	Respondents	80	Random

Variables and Empirical Measurement of the Variables

Variables comprise the constructed world of reality within which an individual received the stimuli and acts. The socio-personal, agro-economic, socio-ecological and communication variables are such type of variables, which determine the behaviour of an individual. Appropriate operationalization and measurement of the variables help the researcher to land upon the accurate conclusion.

After reviewing various literature related to the field of study and consultation with the respected chairman of Advisory Committee and other experts, a list of variables was prepared. On the basis of the selected

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variables, a schedule was formed. Change in variables refers to change from 1980 to 2010.

a. Independent Variables

Sl. No.	Variables	Notation	Score
1	Age	X_1	Chronological age
2	Education	X_2	Years of Schooling
3	Family Size	X_3	Number of family members
4	Family Education Status	X_4	Year of Schooling/Family
5	No. of Vehicles changed	X_5	In No.
6	Change in Consumption of Kerosene	X_6	Litre/month/family
7	Change in Consumption of Petrol	X_7	Litre/month/family
8	Changing Family Expenditure	X_8	Rupees/Month/Family size
9	Changing Expenditure Allocation on Farming	X_9	1-100 Scale
10	Changing Expenditure Allocation on Education	X_{10}	1-100 Scale
11	Changing Expenditure Allocation on Health	X_{11}	1-100 Scale
12	Change in Listening to Radio	X_{12}	In hours/month
13	Change in Watching T.V	X_{13}	In hours/month
14	Changing Interaction with Input Dealers	X_{14}	In hours/month
15	Changing Interaction with Extension Agent	X_{15}	In hours/month
16	Change in Farm Size	X_{16}	Holding/ Family size (In ha.)
17	Changing Cropping Intensity	X_{17}	In %
18	Changing Cultivable Land	X_{18}	In ha.
19	Change in Fertilizer Application	X_{19}	Kg/Ha.

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- Age (x_1)

In all societies, age is one of the most important determinants of social status and social role of the individual. In the present study, age of the respondent was measured on the basis of their chronological age at the time of investigation.

- **Education (x_2)**

Education is instrumental in building personality structure and helps in changing one's behaviour in social life. Education may be operationalized as the amount of formal schooling attained/literacy acquired by the respondent at the time of interview.

- **Family Size (x_3)**

Family size is operationalized as the members in the individual family.The influence of family members on the decision-making process of farm operation is inevitable. In the present study only those members of the family considered, who were taking the meal in one chullah.

- **Family Education Status (x_4)**

Family education status (FES) helps in providing the opportunities to the respondents to be in contact with outside world and hence seek new ideas and information. Family education status was operationalized as the average educational score of the family.

The method followed by Ray (1967) in computing the family education status was also followed in the present study.

$$FES=\frac{TES}{EFS}$$

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Where,

FES = Family Education Status

TES = Total Education Score

EFS = Effective Family Size

- **No. of Vehicles Changed (X_5)**

Change in number of vehicles a family has including cycles, bycycles, tractor, cart etc from 1980 to 2010.

- **Change in Consumption of Kerosene (X_6)**

Refers to change in consumption of kerosene oil by a farm family in a month, inLitre/month/family, from 1980 to 2010

- **Change in Consumption of Petrol (X_7)**

It is the change in consumption of kerosene oil by a farm family in a month, in Litre/month/family, from 1980 to 2010**.**

- **Change in Family Expenditure**

Expenditure allotment is conceptualized to denote total expenditure are done in different heads by the farmers *viz.* Food, Clothes, Education, Farming (Fertilizer + Fungicide+ Insecticide + Herbicide + Seed + Ploughing of land + Irrigation + weeding) and Health in a month. In the present study Change in Family expenditure is calculated by total expenditure with respect to family size per month from 1980 to 2010.

- **Changing Expenditure Allocation on Farming (X_9)**

It refers to change in expenditure allocation on farming sector from 1980 to 2010. It is calculated in a 1-100 point scale from total expenditure.

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- **Changing Expenditure Allocation on Education (X_{10})**

It refers to change in expenditure allocation on education, from 1980 to 2010. It is calculated in a 1-100 point scale from total expenditure.

- **Changing Expenditure Allocation on Health(X_{11})**

It refers to change in expenditure allocation on healthservices, from 1980 to 2010. It is calculated in a 1-100 point scale from total expenditure.

- **Change in Listening to Radio (X_{12})**

Change in net hours on listening to Radio and digital value has been calculated in change in hours/month, from 1980 to 2010.

- **Change in Watching T.V (X_{13})**

Change in net hours on watching T.V. and digital value has been calculated in change in hours/month, from 1980 to 2010.

- **Changing Interaction with Input dealer (X_{14})**

Change in net hours on interacting with input dealer and value has been calculated in change in hours/month, from 1980-2010.

- **Changing Interaction with Extension agent (X_{15})**

Change in net hours on interacting with extension agent and value has been calculated in change in hours/month, from 1980-2010.

- **Change in Farm Size (X_{16})**

Farm size is a measure of farm business. It is the amount of land possessed by an individual peasant. Farm size is also an indicator of economic status in rural India. It is calculated in Land holding/ Family size (In ha.)

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$$\frac{\boldsymbol{Actualfarmholding}}{\boldsymbol{sizeofthefamily}}$$

Here, Change in Farm size is calculated as change in land holdings/family size, from 1980 to 2010

- **Changing Cropping Intensity (X_{17})**

Cropping intensity has been operationalized as the proportion of total annual cropped area to the size of holding expressed in percentage. The cropping intensity is calculated by the formula

$$\frac{\text{Total annual cropped area}}{\text{size of holding}} \times 100 \quad \%$$

Here Changing Cropping Intensity refers to change value of cropping intensity from 1980 to 2010.

- **Changing Cultivable Land (X_{18})**

It refers to change in cultivable land from 1980 to 2010 and is calculated in hector.

- **Change in Fertilizer Application (X_{19})**

It refers to change in fertilizer application in Kg/ha. from 1980 to 2010.

PREDICTED VARIABLES

- Change in Perceived Effect of Radio (y1)
- Change in Perceived effect of T.V. (y2)
- Change in Perceived effect of Input dealer (y3)
- Change in Perceived effect of Extension agent (y4)
- Change in Productivity (y5)
- Change in Family income (y6)
- Change in Weed diversity (y7)

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- Change in Crop Disease intensity (y8)
- Change in Insect-pest intensity (y9)
- Perceived Climate change effect (y10)
- Perceived Climate change effect on Agriculture (y11)

PREPARATION OF INTERVIEW SCHEDULE

On the basis of the findings of pilot study, a preliminary interview schedule was formed with the help of literature and by the assistance of Chairman of Advisory Committee. The interview schedule consisted of three major parts according to the specific objectives of the study.

a. Pre-testing of Interview Schedule

Pretesting or preliminary testing is the process of an advance testing of the study design after the schedule/questionnaire has been prepared. The object of pretesting is to detect the discrepancies that have emerged and to remove them after necessary modification in the schedule. It also helps to identify whether the questions are logically organized, the replies could properly recorded in the space provided for or there is any scope for further improvement. After conducting pretesting appropriate changes and modification of the interview schedule have been made. The individuals who responded in pretesting have been excluded in the final sample selected for the study.

b. Techniques of field data collection

The respondents were personally interviewed during puja vacation and summer vacation. The items were asked in local language Odia as well as

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English version in a simple term so that the members could understand easily. The entries were done in the schedule by student investigator himself at the time of interview.

Statistical Tools used for Analysis of Data

The role of statistics in research is to function as a tool in designing research, analysing its data and drawing conclusions of their form. Most research studies result in a large volume of raw data, which must be suitably reduced so that the same can be read easily and can be used for further analysis. Clearly the science of statistics cannot be ignored by any research worker, even though he may not have occasion to use statistical method in all their details and ramifications.

After collection of data, data were processed and analysed in accordance with the outline laid down for the purpose at the time of developing the research plan. Processing implies editing, coding, classification, and tabulation of collected data.

The statistical methods used for analysis and interpretation of raw data were –

1. Mean
2. Standard deviation
3. Coefficient of Variation
4. Correlation of Coefficient
5. Multiple Regression Analysis (Step down)
6. Path Analysis
7. Factor Analysis
8. Canonical Analysis

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1. Mean

Measure of central tendency (or statistical averages) tells us the point about which items have a tendency to cluster. Such a measure is considered as the most representative figure for the entire mass of data. The mean is the arithmetic average and is the result obtained when the sum of the value of individual in the data is divided by the number of individuals in the data. Mean is simplest and relatively stable measure of central tendency. The mean reflects and is affected by every score in the distribution.

When the data are expressed in a frequency distribution (grouped), the mean is calculated by using the following formula–

$$X = \frac{\sum_{i=1}^{N} fixi}{N}$$

Where,

x = Mean of the observation.

fi = Frequency of the class.

xi = Mid value of the class.

N = Total number of observation

2. Standard Deviation

Standard deviation (SD) of a set of observation is the square root of the arithmetic mean of the squares of the deviations. The deviations being measured from the arithmetic mean of the distributions. It is commonly denoted by the symbol σ (Sigma). To measure the average deviation from the standard value of the data standard deviation is used. It is less affected by sampling errors and is a more stable measure of dispersion.

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The standard deviation of the data grouped in the form of frequency distribution is computed by using the following formula–

$$\mathbf{S.D.} = \sqrt{\frac{\sum_{i=1}^{N} \mathbf{fixi^2}}{\mathbf{N}} - \left[\frac{\sum_{i=1}^{N} \mathbf{fixi}}{\mathbf{N}}\right]^2}$$

Where,

σ = Standard deviation

N = total No of observation in a particular cell.

X = value of observation in a particular cell

F = Frequency of observation

$\overline{X}$ = mean number of observation

i= any number (e.g. 1, 2, 3) denoting position

3. Coefficient of Variation

A measure of variation which is independent of the unit of measurement is provided by Coefficient of variation. Being unit free, this is useful for computation of variability between different populations. The Coefficient of variation is standard deviation expressed as percentage of the mean and is measured by the formula.

$$\text{CV} = \frac{\boldsymbol{StandardDeviation\ (\sigma)}}{\boldsymbol{Mean}} \times \mathbf{100}$$

4. Correlation of coefficient

When an increase or decrease in one variety is accompanied by an increase or decrease in another variety, the two are said to be correlated and the phenomenon is known as correlation. Correlation coefficient (r) is a measure of the relationship between two variables, which are at the interval

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or rational level of measurement and are linearly related. A Pearson product-moment "r" is computed by the formula.

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

Where,

X and Y	=	Original scares in variables X and Y
N	=	Number of paired scores
∑XY	=	Each X multiplied by its corresponding Y, then summed
∑X	=	Sum of X scores
$\sum X^2$	=	Each of X squared, then summed
$(\sum X)^2$	=	Sum of X score squared
∑Y	=	Sum of Y scores
$\sum Y^2$	=	Each of Y squared, than summed
$(\sum Y)^2$	=	Sum of Y score squared

The range of correlation coefficient is between -1 to +1. This means that -1 is perfect negative correlation and +1 is perfect positive correlation. A perfect correlation is, however, seldom achieved. A correlation coefficient to be acceptable should be statistically significant. Otherwise, we say that no significant relationship exist between the variables.

5. Multiple regression analysis

Generally a number of antecedent variables simultaneously contribute to influence the consequent variables, as in the case under study. It is of immense practical value to know the extent to which the antecedent

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variables, individually or jointly, could predict or contribute towards the consequent variable. This was done by computing multiple regression analysis. If Y is the consequent variable and X_1, X_2, X_3…are the antecedent variables; the multiple regression equation is given by the following formula-

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 \dots\dots$$

Or, $Y = a + \sum bx$

The significance of the b- value was judged by calculating their respective t-values and comparing them to the table, given by Fisher and Yates (1963), with (n-p-1) degree of freedom (where, n = number respondents and p = number of antecedent variables) at 5% and 1% level of significance.

The square root of the ratio of the regression sum of squares to the total sum of squares is known as multiple correlation coefficients and is denoted by R. The square of the multiple correlation coefficients R^2 is called the multiple coefficient of determination and represents the fraction of the variation of Y accounted for by its joint association with the variables X_1, X_2, X_3…

Central to the application of multiple regression analysis is the interpretation of the final fitted model. A significant F- value for R means that the fitted model is adequate. The significance of the F- value was judged by comparing it to the table value, given by Fisher and Yates (1963) with P and (n-p-1) degrees of freedom (where, P = number of antecedent variables and n = number of respondents) at 5% and 1% levels.

Stepwise multiple regression

Stepwise regression is a variation of multiple regressions which provides a means of choosing independent variables that yield the best prediction

possible with the fewest independent variables. It permits the user to solve a sequence of one or more multiple linear regression problems by stepwise application of the least square method. At each step in the analysis, a variable is added or removed which results in the greatest production in the error sum of squares (Burroughs Corporation, 1975).

6. Path Analysis

The objective of doing Path Analysis is to get a clear picture of the direct and indirect effects of the independent variables on the dependent variable. Variables, through which substantial indirect effects are channelled, are also found out.

Singh and Chaudhary (1977), defined path coefficient as the ratio of the standard deviation of the effect due to a given cause to the total standard deviation of the effect i.e. if Y is the effect and x1 is the cause, the path coefficient for the path from cause x1 to the effect Y is $\frac{\sigma x1}{\sigma y}$

It is advisable to do path analysis with only those variables which have significant effects on the dependent variable. This may be done by restoring to multiple regression analysis, and selecting those independent variables whose partial b value are significant. This shall enhance clarity of the path analysis.

7. Factor Analysis

Factor analysis is a very useful and popular method of multivariate research technique, mostly used in social and behavioural sciences. According to Kothari (1996), factor analysis seeks to resolve a large set of measured

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variables in terms of relatively few categories, known as factors. This technique allows the researcher to group variables into factors (based on correlation between variables); the factors so derived may be treated as new variables (often termed as latent variables) and their value derived by summing the values of the original variables, which had been grouped into the factor. The meaning and name of such new variable is subjectively determined by the researcher. Since the factors happen to be linear combinations of data, the coordinates of each observation or variable is measured to obtain what are factor loadings. Such factor loading represent the correlation between the variable and the factor and are usually placed in a matrix of correlations of the variables and the factors. In the Factor Analysis the "Principle Component Method" was followed.

Factor Analysis is used:

- To reduce the dimensionality of large number of variables to a fewer number of factors.
- To confirm the hypothesized factor structure by way of testing of hypothesis about the structure of variables in terms of expected number of significant factor loading.
- Hence in factor analysis specific and error variables are excluded and only the common variables are taken into account. There are some steps in factor analysis:
- We have to collect data then we have to work out the correlation between the variables.
- It is to explore the possibility of data reduction i.e. initial steps of factor are to be explored. The common method of extraction of factors is Principle Component Analysis (P.C.A).

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