

Chapter 6

Research Methodology

Research is a systematic attempt to obtain answers to meaningful questions or events through the application of scientific procedure. It is an objective, empirical, logical analysis and recording of controlled observations that may lead to the development of generalisations, principles or theories resulting to some extent in prediction and control of events out of consequences in cause of specific phenomena. Research is therefore scientific and as such not satisfied with isolated facts, but seeks to integrate and systematise its findings.

Research methodology is the structural configuration of the study for conducting research within the framework of the objectives. It includes methods, tools, techniques and approaches for the research work. Methodology furnishes the building block, back bone of the process of enquiry and reasoning data generation as well as processing. Therefore, Research Methodology is concerned with the objective verification of generalisation which requires logical analyses of problems and devising appropriate procedure to obtain evidence.

The chapter deals with the research methods and procedures followed by the researcher to analyse the problem in the course of investigation. The entire discussions have been made under the following sub-themes.

A. Problem and procedure

1. Selection of problem
2. Plan of work

3. Research design
4. Locale of study
5. Sampling procedure
 - i. Selection of District
 - ii. Selection of blocks
 - iii. Selection of watersheds
 - iv. Selection of respondents
- B. Tools and Techniques for data collection
 1. Pilot study
 2. Preparation of interview schedule
 3. Pre-testing of interview schedule
 4. Field work.
- C. Variables and their measurement
 1. Variables selected for the study
 2. Operational definition
 3. Scaling and scoring technique

D. Statistical tools used

The procedures followed under each sub-theme have been discussed in this section.

A. Problem and procedure

5.1: Selection of problem

One of the most important factors in social research is the selection and conceptualisation of the research problem. To define a problem means to satisfy it in detail and with precision. Each questions and subordinate questions to be answered must be specified. Therefore, the researcher has to pay much attention towards formulation of a realistic, clear and unambiguous problem since the delineation of a problem is often more important and essential than its solution. The research problem entitled **“Impact of Watershed Development Programme on Socio-economic upliftment of tribal people in western undulating zone, Odisha”** was selected keeping in view of the following conditions.

- i. Tribal people have past experience in watershed programme due to the geo physical zones and geographical regions. They usually cultivate valley bottoms to hill tops with different crops
- ii. Watershed Development Programme based on the principle of bottom-up planning. The watershed people actively involved in basic survey, problem diagnosis, prioritisation and assessing interventions
- iii. Each individual family in the watershed area formulates their own programmes. Programme implementation and fund utilisations are exclusively done by the watershed people
- iv. Capacity building, close monitoring and technical guidance were provided regularly by the Watershed Development Team members, Project Implementing Agency as well as related district developmental officials
- v. Watershed beneficiaries are also involved in reviewing the progress of work intermediary for necessary modifications and further solutions, if required
- vi. Provision has been made under Watershed Development fund for use, repair and maintenance of the created assets in post- project period. Each beneficiary involved in the programme has to contribute 5 to 10 percentage of the work executed in their land either in form of cash, labour or materials

Since the programme, designed and implemented by the watershed people, it is apprehended that significant development have been made to the tribal people. The researcher therefore has tried to assess the impact of the Watershed Development Programme for the development of the tribal people and locate the deficiencies for further improvement. The findings will also provide opportunity to the planners, administrators, executives, Watershed Mission as well as District Watershed Review Committee to refine the operational procedure for effective implementation of the programme. Besides, constraints expressed by the Watershed people can be helpful for the implementing agency for necessary solutions to achieve the end results. Hence, the selection of the

problem is of recent demand and useful for the socio-economic development of people in general and tribal people in particular in the watershed areas.

5.2: Plan of work

Considering wide and varied application of the study, it was felt for a detailed survey of all aspects related to the objectives need to be framed for the study. Keeping the stipulated period in view, the area of investigation, sample size, problem and method of analysis of data, a rough plan was prepared prior to actual investigation which was finalised subsequently.

5.3: Research Design

A research design is the outline that guides the researcher in the process of collecting, analysing and interpreting observations to draw inferences. Keeping in view the objective of the study, the researcher tried to include qualitative and behavioural attributes in the study. The present research study comes within the purview of survey research mainly of “Ex-post-facto” in nature. In the light of the objectives and scope of the study, decisions were taken on the techniques of investigation, research materials and tools to be used and pattern of statistical analysis to be incorporated.

5.4: Locale of the study

The study was proposed to be conducted in the Western Undulating Agro-climatic zone of Odisha comprising Kalahandi and Nuapada districts. The focus of the study was to assess the various aspects of development of the tribal in the watershed area due to their participation and involvement in the Watershed Development Programmes.

5.5: Sampling procedure

Both purposive and random sampling techniques were followed to select the respondents for the study. The district Kalahandi and Nuapada were selected purposively. Random sampling technique was followed to select blocks, watersheds and respondents.

i. Selection of districts

Western undulating zone has comparatively more number of watersheds. The tribal people had also past experience in raising crops under watershed areas. Therefore, the districts Kalahandi and Nuapada were selected purposively for the study to get meaningful results.

ii. Selection of blocks

Kalahandi district consists of thirteen blocks and Nuapada having five blocks. Watershed Development Programme is being implemented in all the blocks. Discussions were made at length with the Project Director, DRDA, district level officials; some Project Implementing Agency and Watershed Development Team members about the activities undertaken in different blocks. Emphasis was given to select blocks having less than 35.00% of the irrigation facilities, higher poverty index, higher percentage of the tribal population and better watershed activities undertaken. Thus, two blocks from each district were selected randomly for the purpose of the study.

iii. Selection of Watersheds

A list has been prepared from the records of DRDA about the watersheds covered under Watershed Development Programmes. Discussions were also made with the stakeholders on the list of watershed included in the programme and finalised. Three watersheds from each block under the Watershed Development Programme were selected randomly for the purpose of the study.

The lists of blocks and watersheds selected for the study have been reflected in table 5.1.

Table 5.1: List of blocks and watersheds selected for the study

Sl. No.	District	Block	Watershed Selected	
1.	Kalahandi	Golamunda	Watershed -I	Golamunda Watershed –A
			Watershed -II	Nageswar Watershed

			Watershed-III	Nilakantheswar Watershed
		Dharmagarha	Watershed -I	Chakamelan Watershed
			Watershed -II	Maa Dandapatani Watershed
			Watershed-III	Khambeswari Watershed
2	Nuapada	Nuapada	Watershed -I	Jay Jagannatha Watershed
			Watershed -II	Jay Shri Ram Watershed
			Watershed-III	Jay Hanuman Watershed
		Khariar	Watershed -I	Bada maheswari Watershed
			Watershed -II	Bhimapadar Watershed
			Watershed-III	Kenduguda Watershed

i. Selection of the respondents

The respondents for the study were selected from different categories of watershed people; President and Secretary of the Watershed Association as well as the Chairman of the Watershed Committee have been selected or nominated by the watershed people. These persons had been selected purposively as the respondents for the study due to their active involvement in planning, implementation and guidance as well as involvement in watershed activities as a whole. Besides, six farmers from user groups, three from self groups, three from women category, and one woman member from Watershed Committee were selected randomly. Thus 16 respondents were selected from each watershed having the total sample size of 192. Details of the respondents selected for the study have been presented in table 5.2.

Table 5.2: Details of the respondents selected for the study

Watershed	Preside nt	Chairm an	Secret ary	User grou ps	SHG gro up	Wom en	Comm itee mem bers	Tot al
Golamunda –A Watershed	1	1	1	6	3	3	1	16
Nageswar Watershed	1	1	1	6	3	3	1	16
Nilakanthes war Watershed	1	1	1	6	3	3	1	16
Chakamela n Watershed	1	1	1	6	3	3	1	16
Maa Dandapata ni Watershed	1	1	1	6	3	3	1	16
Khambesw ari Watershed	1	1	1	6	3	3	1	16
Jay Jagannatha Watershed	1	1	1	6	3	3	1	16
Jay Shri Ram Watershed	1	1	1	6	3	3	1	16
Jay Hanuman Watershed	1	1	1	6	3	3	1	16

Bada maheswari Watershed	1	1	1	6	3	3	1	16
Bhimapada r Watershed	1	1	1	6	3	3	1	16
Kenduguda Watershed	1	1	1	6	3	3	1	16
Total	12	12	12	72	36	36	12	192

B. Tools and Techniques for collection of data

Data collection is essentially an important part of the research process so that the inferences and hypothesis on generalisations tentatively held may be identified as valid and verified as corrected. The procedures followed in collection of data are discussed herewith.

i. Pilot study

Prior to selection of the variables and preparation of interview schedule, the researcher made visit to the watershed areas of both the study districts. Discussions and interactions were made with the President and Secretary of the Watershed Association, Chairman and members of the Watershed Committee as well as different categories of the watershed people. Discussions were also made with Project Implementing Agency, Watershed Development Team members, Project Director and Asst. Project Director, DRDA as well district level officials involved in the programme.

In the course of discussions and interactions on each objective under study, reactions, suggestions and guidances of all the stakeholders were recorded. All these collected information helped the researcher to select and finalise the variables to prepare the interview schedule.

ii. Preparation of interview schedule

On the basis of the variables selected, statements were framed under each variable with the experiences gained during pilot study, consultation with experts and referring literatures. In the course of development of the Interview Schedule, many proposed statements were discarded, new

statements added after judging each item with their possible linkage with the objectives set forth in the study. The pertinent questions were taken into consideration whereas questions having less validity and reliability were dropped. Repeated verification and proper measures were sufficiently taken care to avoid vague and ambiguous responses that may distort the information flow. Closed ended questions were put on the schedule to get appropriate responses.

iii. Pre-testing of interview schedule

Pre-testing of the interview schedule was done in order to test the reliability and validity of the schedule. The draft schedule incorporating the tools and techniques under each variable was presumed twice each time on sample respondents. In the first phase, the prepared schedule was pre-tested with 50 tribal farmers, twentyfive from each district being fully associated with the programme. Basing on the reactions and validity of the items, necessary modifications were made in the schedule.

iv. Construction of schedule after pre-testing

The quantification was done for each and every variable after operationalising them. Before final data collection, entire schedule was tested with fifty non-sample respondents of the study area for elimination and alternation, if required. On the basis of the experiences in pre-testing, appropriate changes in the construction of items and their sequences were made. The schedule was then finalised and multiplied. The final form of the schedule is enclosed in the Appendix.

v. Field work

Confidence development with the respondents is the pre-requisite in collection of factual data. Therefore, the researcher had established good rapport with the respondents before interviewing. He convinced the respondents to feel that his opinions were important. The questions as specified in the schedule were asked systematically. Sufficient probing and clarifications were made for a clear understanding of the respondents about the questions to get appropriate response. In some occasions, group discussions with the respondents were also made afterward to confirm the responses received individually. Further, the reactions and suggestions of the respondents beyond the study were also noted and used during

interpretation of data. The interview was continued from third week of January to May 2014 in phased manner.

The information thus collected was tabulated in a master sheet for empirical measurement.

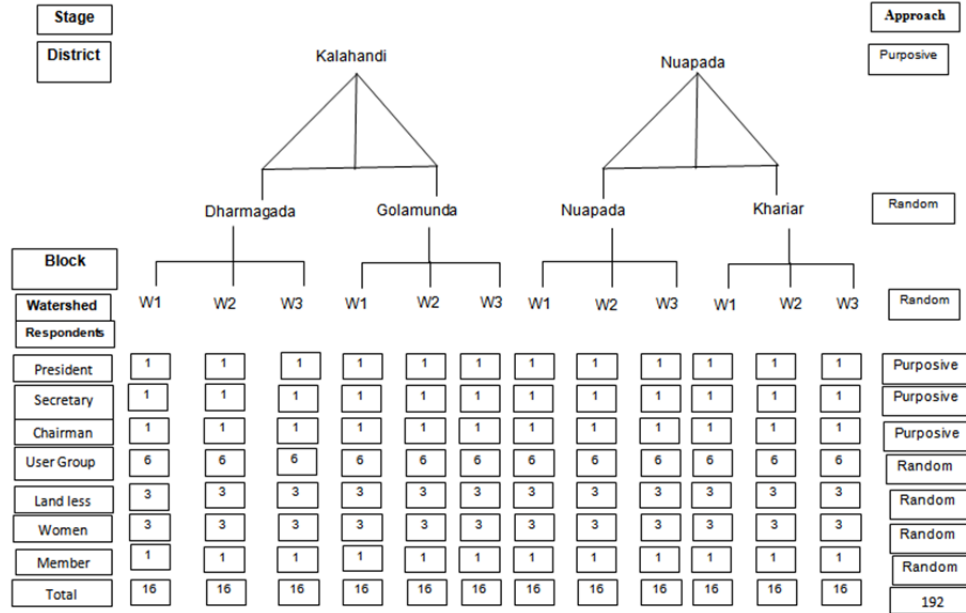


Fig. 8: Sampling Design Level

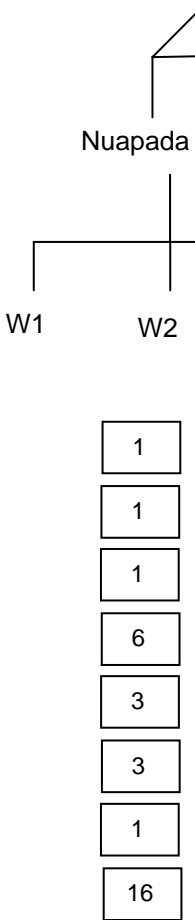
C. Variables and their measurement

Variable is a property that takes different values. Variables used in the study were quantified depending on their relative merit in qualifying the measurement. The variables selected under different objectives are as follows.

C.1: Variables selected for the study

1. Socio-economic profile

- 1.1 Age
- 1.2 Education
- 1.3 Occupation
- 1.4 Family type



- 1.5 Family size
- 1.6 Social participation
- 1.7 Cosmopolitaness
- 1.8 Extension contact
- 1.9 Communication materials used
- 1.10 Land holding
- 1.11 Source of irrigation
- 1.12 Type of house
- 1.13 Crops grown
- 1.14 Livestock possession
- 1.15 Horticultural crops grown
- 1.16 Average annual income
- 1.17 Economic aptitude
- 1.18 Social aptitude
- 1.19 Possession of household materials
- 1.20 Possession of Transport and communication materials
- 1.21 Possession of agricultural implements
- 1.22 Scientific orientation.

2. Knowledge and perception on functioning of Watershed Development Programme

- 2.1 Implementation of the programme
- 2.2 Involvement of project personnel
- 2.3 Knowledge about guideline
- 2.4 Source of information about activities
- 2.5 Knowledge about Institutional arrangement
- 2.6 Knowledge about community organisation
- 2.7 Knowledge about objectives
- 2.8 Knowledge about guidelines
- 2.9 Knowledge about programme development
- 2.10 Knowledge about programme implementation
- 2.11 Knowledge about funding pattern
- 2.12 Knowledge on monitoring and evaluation

3. Extent of involvement

- 3.1 Involvement in watershed activities

- 3.2 Freedom in implementation
- 3.3 Involvement in decision making process
- 3.4 Involvement in formulation of programmes
- 3.5 Involvement in programme implementation
- 3.6 Involvement in fund utilisation
- 3.7 Involvement in monitoring and evaluation.

4. Role of the stakeholders associated with the programme

- 4.1 Community organisation
- 4.2 Technical guidance
- 4.3 Credit and finance
- 4.4 Input supply
- 4.5 Infrastructure support
- 4.6 Policy consideration
- 4.7 Behaviour of the project personnel
- 4.8 Linkages established with related stakeholders.

5. Extent of development

- 5.1 Material possession
- 5.2 Technological
- 5.3 Farm activities
- 5.4 Income
- 5.5 Social
- 5.6 Cultural
- 5.7 Economical
- 5.8 Infrastructural
- 5.9 Environmental
- 5.10 Maintenance of Assets

6. Constraints in effective implementation

- 6.1 Planning
- 6.2 Programme development
- 6.3 Programme implementation
- 6.4 Funding pattern
- 6.5 Monitoring and evaluation
- 6.6 Maintenance of assets
- 6.7 Institutional arrangements
- 6.8 Functioning of the Watershed Association

C.2: Operational definition of variables

1.1: Age

Age has been operationally defined as the number of years completed by the respondents at the time of enquiry.

1.2: Education

Education has been operationalized as the extent of literacy or number of years of formal education attained by the respondents.

1.3: Occupation

Occupation has been operationally defined as the relative continuous patterns of activities that provide respondents a livelihood support and define their social status.

1.4: Family type

The family type is dichotomised into nuclear and joint family. Nuclear family consists of husband and wife with unmarried children. The joint family system denotes husband, wife and married children.

1.5: Family size

It is referred to the number of members of the family staying in a common kitchen.

1.6: Social participation

It refers to the extent of involvement of the individuals in various organisations and institutions functioning in the locality.

1.7: Cosmopolitaness

Cosmopolitaness has been operationalised as the orientation of the respondents to the outside than self-community.

1.8: Extension contact

It refers to the extent of contact made by the respondents with the functionaries of the various developmental departments in relation to their farm activities.

1.9: Communication material used

It refers to the extent of use of various communication materials referred by the respondents for seeking information on farm activities.

1.10: Holding size

It is the possession of land in hectare by the respondents both under irrigated and rainfed situation. It does not include lands either taken on lease or share cropping basis.

1.11: Source of irrigation

It refers to various sources of irrigation available to the respondents in raising crops.

1.12: Type of house

Type of housing has been conceived as the type of dwelling where the respondent lives along with his family members.

1.13: Crops grown

It refers to the extent of area covered under various crops by the respondents for their livelihood.

1.14: Possession of livestock

It has been operationalised as the number of livestock possessed by the respondents for use in the farm operations as well as additional sources of income.

1.15: Horticultural crops

It refers to the extent of area covered by the respondents under various fruit and fuel trees, vegetables, flower, root crops, spices etc.

1.16: Annual income

It has been operationalised as the gross income earned by the respondents including family members per annum from different sources.

1.17: Economic aptitude

It refers to the perception of the respondents for their liking towards various economic indicators like credit, investment, commercial farming etc.

1.18: Social aptitude

Social aptitude in the study refers to the interest and liking of the respondents towards various social activities such as leadership, changeproneness, cosmopolitaness etc.

1.19: Possession of household materials

It refers to the household goods possessed and used by the respondents in the client system.

1.20: Possession of transport and communication

It refers to the kind of transport materials possessed by the respondents for their mobility as well seeking information on farm and household activities.

1.21: Possession of agricultural implements

It has been operationalised as the different type of agricultural machineries and implements owned by the respondents in connection with farm activities.

1.22: Scientific aspiration

Scientific aspiration in the study refers to the extent of perception of the respondents towards improved farming.

C.3: Scaling and scoring technique

i. Scales used for measurement of variables

In the field of behavioural research, scaling attains paramount importance because, it is the scale that converts human feeling into numerical. To ensure maximum objectivity of the study, a number of standard scales developed by different experts have been used with great care as fit to the present investigation. The scales used for the socio-economic variables have been presented in Table 5.3.

Table 5.3: Scale used for socio-economic variables

Sl. No.	Variable	Scale used
1	Age	Trivedi (1963)
2	Education	Trivedi (1963)
3	Occupation	Supe (2007)
4	Family type	Trivedi (1963)
5	Family size	Trivedi (1963)
6	Social participation	Trivedi (1963)
7	Cosmopolitaness	Trivedi (1963)

8	Extension contact	Trivedi (1963)
9	Communication materials used	Trivedi (1963)
10	Holding size	Trivedi (1963)
11	Type of house	Trivedi (1963)
12	Annual income	Summation of income from all sources expressed in monetary terms and classified in different class interval
13	Economic aptitude	Hardikar (1998)
14	Social aptitude	Hardikar (1998)
15	Possession of household articles	Range of value of total possession in monetary terms
16	Transportation and communication materials used	Range of value of total possession in monetary terms
17	Use of implements and machineries	Range of value of total possession in monetary terms
18	Scientific orientation	Hardikar (1998)

Similarly the scales used for other variables have been presented in Table-5.4.

Table 5.4: Scale used for other variables

Sl. No.	Variable	Scale used
1	Knowledge on function of Watershed Development Programme	Supe (2007)
2	Extent of involvement of Tribal people	Supe (2007)
3	Role of stakeholders	Supe (2007)
4	Extent of development	Supe (2007)
5	Constraints of the tribal people	Supe (2007)

i. Measurement of variables

a. Socio – economic variables

	Variable	Score assigned
1.	Age	
	Up to 35 years	3
	36 to 55 years	2
	55 years and above	1
2.	Education	
	Illiterate	1
	Primary level	2
	Middle school	3
	High school	4
	College and above	5
3.	Occupation	
	Primary	1
	Primary + Secondary	2
	Primary + Secondary + Tertiary	3
4.	Family type	
	Joint	2
	Nuclear	1
5.	Family size	
	Up to 5 members	1
	More than 5 members	2
6.	Social participation	
	i. Membership	
	No member	0
	Member	1
	Office bearer	2
	ii. Level of participation	
	Fully	2
	Partially	1
	Not at all	0
7.	Cosmopolitaness	
	Regularly	2

	Occasionally	1
	Never	0
8.	Extension contact	
	Very frequently	3
	Frequently	2
	Some times	1
	Never	0
9.	Communication materials used	
	Very often	3
	Often	2
	Some times	1
	Never	0
10.	Size of holding	
	Landless	1
	Marginal farmer (up to 1 ha.)	2
	Small farmer (1.1 to 2 ha.)	3
	Medium farmer (2.1 to 10 ha.)	4
	Big farmer (Above 10 ha.)	5
11.	Type of house	
	Hut	1
	Thatched	2
	Semi pucca	3
	Pucca	4
12.	Average annual income(Rupees)	
	Up to 25000	1
	25001 to 50000	2
	50001 to 75000	3
	75001 to 1.0 lakh	4
	Above 1 lakh	5
13.	Economic aptitude	
	Very often	3
	Often	2
	Some times	1
	Never	0

	14. Social aptitude	
	Very often	3
	Often	2
	Some times	1
	Never	0
15.	Possession of household articles	
	Gas stove	1
	Chair	1
	Fan	2
	Grinder	3
	Sewing machine	3
	Pressure cooker	2
	Electric iron	2
	Gobar gas plant	4
	Refrigerator	5
	LPG connection	4
	Sofa set	3
	Dinning set	4
16.	Use of transport and communication materials	
	Radio	1
	Radio FM	2
	Bicycle	2
	Moped	3
	TV	3
	Motor cycle	4
	Telephone	4
	Mobile	3
	Car	5
17.	Use of implements and machineries	
	Spade	1
	Desi plough	1
	Iron plough	2
	M.B. plough	2
	Leveler	4

	Thresher	3
	Seed drill	4
	Cultivator	4
	Sprayer	2
	Winnower	2
	Pump set	3
	Weeder	4
	Power tiller	5
	Tractor	6
18.	Social, economic and scientific aspiration	
	Very often	3
	Often	2
	Some times	1
	Never	0
B.	Knowledge and perception about Watershed Development Programme	
1.	Involvement of project personnel	
	Fully involved	2
	Partially involved	1
	Not involved	0
2.	Knowledge about guideline	
	Fully known	2
	Partially known	1
	Not known	0
3.	Information about watershed activities	
	Regularly	2
	Occasionally	1
	Never	0
4.	Opinion about objective and guideline	
	Strongly agree	2
	Agree	1
	Disagree	0

5.	Knowledge and perception about programme development, implementation, funding pattern, institutional arrangement, monitoring and evaluation, community organization.	
	Strongly agree	2
	Agree	1
	Disagree	0
C. Extent of involvement		
1.	Watershed activities	
	Fully involved	2
	Partially involved	1
	Not involved	0
2.	Freedom in implementation of the programme	
	Strongly agree	2
	Agree	1
	Disagree	0
3.	Involvement in decision making process, programme implementation, fund utilisation, monitoring and evaluation	
	Fully involved	2
	Partially involved	1
	Not involved	0
D. Role of stakeholders		
i.	Community organisation, technical guidance, credit and finance, input supply, infrastructure, policy consideration, behaviour of the project personnel	
	Very often	3
	Often	2
	Some times	1
	Never	0

ii. Linkage with stake holders

Strong linkage	2
Moderate linkage	1
No linkage	0

E. Extent of development

Technological, economical, social, infrastructural, cultural, environmental, material possession, farm activities, maintenance of assets

Strongly agree	2
Agree	1
Disagree	0

F .Constraints in implementation

Planning, programme development, implementation, funding pattern, monitoring and evaluation, maintenance of assets, institutional arrangements, functioning of the association

Strongly Agree	2
Agree	1
Disagree	0

D. Statistical measures

Statistical measures provide the investigator with an opportunity of expressing the facts in an empirical way. The statistical measures employed in the study for interpretation of data are explained herewith.

1. Percentage

Percentage was used in description analysis for making simple comparison between two responses. For calculating percentage, the frequency of a particular cell was multiplied by 100 and divided by the total number of respondents in the particular category to which the cell belonged.

$$\text{Percentage} = \frac{\text{Number of respondents}}{\text{Total no. of respondents}} \times 100$$

2. Mean score

It is the arithmetic average and the result obtained when the sum of values of the individuals in the data divided by the number of individuals in the data. Mean is the simplest and relatively stable measure of central tendency. It is used summarily on the essential features of a series and in enabling data to be compared. Mean is better than other averages especially in social and economic studies where direct quantitative measurements are possible.

$$\text{Mean } (\bar{x}) = \frac{\sum fx_i}{N}$$

Where

\bar{x} = The symbol used for mean

Σ = Summation

X_i = Values of i th item

N = Total number of respondents

4. Standard Deviation

Standard deviation is the most widely used measure of dispersion of a series. It is defined as the square root of the average of squares of deviation, when such deviations for the values of individual items in a series are obtained from the arithmetic average.

$$\text{Standard Deviation (SD)} = \frac{\sqrt{\sum fi(xi-\bar{x})^2}}{N}$$

Where f_i = Frequency of the i th item

$(xi - \bar{x})$ = Deviation from the mean

N = Number of respondents

4. Coefficient of variation

When we divide the standard deviation by the arithmetic average of the series, the resulting quantity is known as coefficient of standard deviation

and multiplied by 100; the resulting figure is coefficient of variation. It is used for making comparison and frequently used in the context of analysis of variation.

Coefficient of variation (CV) =

5. Rank order

On the basis of the mean score, rank order was made. The item securing highest mean score was given first rank and the next higher second rank and so on.

6. Score gap

It is the difference between maximum obtainable score and obtained score value for a given variable and when expressed in percentage called as gap percentage.

$$\text{Score gap (\%)} = \frac{\text{Maximum score} - \text{Obtained score}}{\text{Maximum score}} \times 100$$

7. Correlation Coefficient

Karl Pearson’s coefficient of correlation or simple correlation is the most widely used method for measuring the degree of relationship between two variables. This coefficient assumes that there is linear relationship between the two variables which means that one of the variables is independent and the other as dependent. It is also known as product moment correlation coefficient and value lies between +1 to -1 indicating positively or negatively related

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

Where

r = Coefficient of correlation

$\sum XY$ = Sum of product of both variable X and Y

$\sum X$ = Sum of variable X

ΣY = Sum of variable Y

ΣX^2 = Sum of squares of variable X

ΣY^2 = Sum of squares of variable Y

N = Number of respondent

The numerical value of r always lies between -1 to +1. Positive values of r indicate positive correlation between the two variables, i.e. changes in both variables take place in the same direction, whereas negative values of r indicate negative correlation i.e. changes in the two variables taking place in opposite directions. A zero value of r indicates that there is no association between the two variables. When $r=+1$, indicates perfect positive correlation and when it is -1, it indicates perfect negative correlation, meaning there by that variations in independent variable(X) explain 100% of variations in the dependent variable(Y).

8. Test of significance ('t' test)

The coefficient of correlation value has been further tested to find out its significance by using the following formula.

$$t = \frac{r}{\sqrt{1-r^2}} \times \sqrt{N-2}$$

Where

r = Value of coefficient of correlation

N = Number of sample size

The 't' value has been further compared with table value. If observed value found to be more than the table value, it is said to be significant (positively/negatively) either at 0.05 or 0.01 level of significance, otherwise not.

9. Critical ratio test

The test has been employed to know the significant association between two values.

$$C.R = \frac{p_1 - p_2}{\sqrt{PQ \left[\frac{1}{N_1} + \frac{1}{N_2} \right]}}$$

Where $P = \frac{N_1 P_1 + N_2 P_2}{N_1 + N_2} \times 100$

$Q = 100 - P$

N_1 = Size of 1st sample

N_2 = Size of 2nd sample

p_1 = Percent of 1st sample

p_2 = Percent of 2nd sample

10. Index score value

It is also another score gap analysis where the obtainable scores of each of the respondents on a variable were calculated to categorise them in to High, Semi-Medium, Medium and Low. If the value lies within 0-25, put as high, 26-50 semi-medium, 51-75 medium and 76-100 low.

Index score =

$$\text{Index score} = \frac{\text{Maximum obtainable score} - \text{Score obtained}}{\text{Maximum obtainable score}} \times 100$$

11. Multiple regression analysis

Regression is the determination of a statistical relationship between two or more variables. When there are more than two variables, the analysis concerning relationship is known as multiple correlations and the equation describing such relationship as the multiple regression equation. The formula used are

$$Y = a + b_1 X_1 + b_2 X_2 + \dots + b_k X_k$$

Where a is the intercept (i. e. the value of Y)

When all X are 0 and $b(1-----k)$ are the partial regression coefficients associated with the independent variables X_i , represents the amount of change in the Y for each unit change in X_i .

12. Stepwise regression analysis

These options apply when stepwise variable selection method has been specified. Variables can be entered or removed from the model depending on either the significance (probability) of the F value or the F value itself. Stepwise variable entry and removal examines the variables in the block at each step for entry or removal. Therefore, the significance values are generally invalid when a stepwise method (Forward or backward) is used.

$$Y_1 = a_1 + b_{k1}Z_k + b_i Z_i, \quad i = 1-----f \text{ and } i \text{ is not equal to } k$$

Where Z_k is the first Z variable identified in step-1, Z_i variable which corresponds to the i th regression equation, with the largest value of the multiple correlation coefficient R and whose coefficient is found to be significant at the level of significant is chosen as the 2nd Z variable to enter in to the regression equation.

13. Path analysis

Path analysis is an extension of the regression model used to test the fit of the correlation matrix against two or more casual models which are being compared by the researcher. It is used to assess the direct, indirect and residual influence of exogenous or endogenous variables.

The formula used are-

$$r = \sigma_y / \sigma_x$$

r = Coefficient of correlation

σ = Standard deviation

x = Dependant variable

y = Independent variable

14. Rank order correlation

Spearman's Rho produces a rank order correlation coefficient that is similar to the correlation coefficient produced by the Pearson's Correlation

Coefficient test. This test evaluates the degree to which individuals or cases with high rankings on one variable were observed to have similar rankings on another variable. The first step in the process of calculating Spearman's Rho will involve assigning ranks.

With Spearman's rho, the *highest* value is assigned a rank of 1 and ranks are assigned separately for each variable. A solution matrix is created, once ranks have been assigned to each case on both of the variables under consideration. Each of the tied scores is assigned a rank equal to the average of all the tied positions.

The solution matrix includes values for each of the variables and two additional columns that represent the difference between the ranking for the first and second variable (X and Y) and the squared difference in rankings (d^2). Once the solution matrix has been completed, Spearman's rho is calculated using the formula:

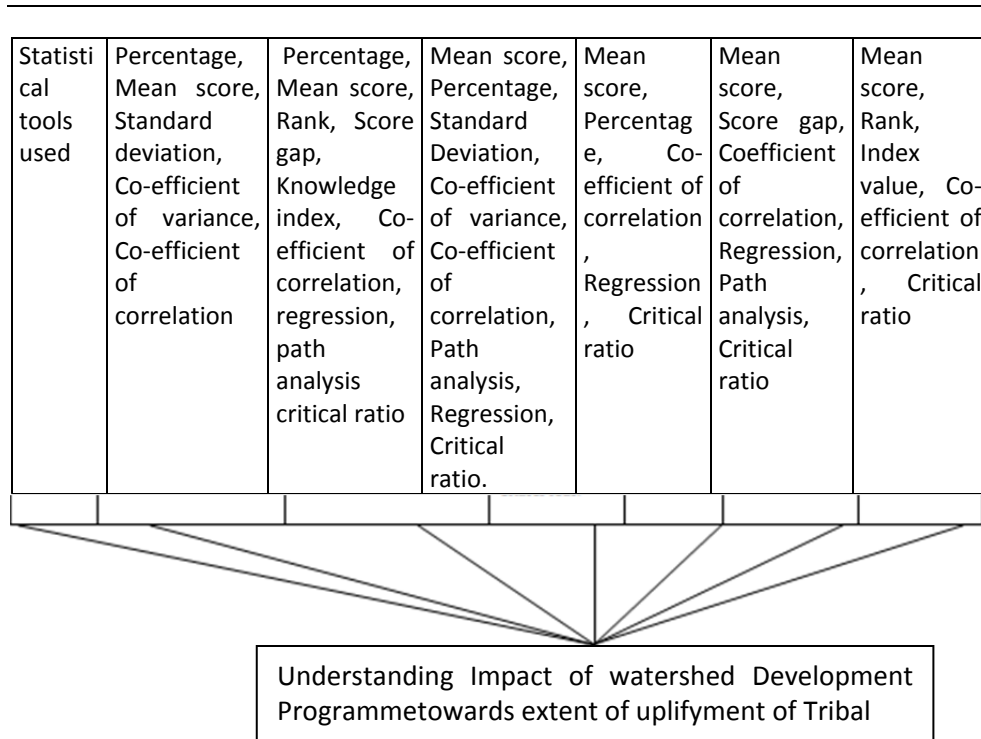
$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

Where ρ = Spearman's coefficient (rho)

d_i = Difference among the ranks of X and Y

n = Number of differential pairs analyse

Objective	Socio-economic profile	Knowledge	Involvement	Role of stakeholders	Extent of development	Constraints
Variable	Age, Education, Family type and size, Social participation, Cosmopolitanism, Extension contact, communication material used, land holding, irrigation source, crops and livestock status, house type, annual income, economic and social aptitude, possession of household articles, transport and communication materials as well as farm implements, scientific orientation	Time of implementation, membership status, involvement of project personnel, knowledge about guideline, sources of information, opinion about objectives and guidelines, knowledge on programme development, implementation, funding pattern, institutional arrangements, monitoring and evaluation and community organization	Watershed activities, freedom in implementation, decision making process, implementation, fund utilisation, monitoring and evaluation	Community organisation, credit and finance, input supply support on infrastructure, policy consideration, behaviour of the project personnel, linkages with stakeholders	Technological, Economical, Social, Cultural, Infrastructure, Environmental, Material possession, Farm activities, Asset maintenance and income.	Planning programme development, implementation, funding pattern, monitoring and evaluation, asset maintenance, institutional arrangements and functioning of the association.



**Fig. 9: Conceptual Framework of the Study
Watershed Development Programme**