Research Methodology

The study of conducting research is Research Methodology.

Research: The word research is composed of two syllables “Re” and “Search”.

“Re” is the prefix meaning ‘Again or over again or a new’ and “Search” is the latter meaning ‘to examine closely and carefully’ or ‘to test and try’.

Together they form, a careful, systematic, patient study and investigation in some field of knowledge undertaken to establish principles / policies.

Research can also be defined as

1. Search for knowledge
2. Systematic and scientific search for getting relevant answers on any taken up specific topic.
3. Scientific enquiry into a subject.
4. Research is a movement from the unknown to the known.
5. It is the voyage of discovery

Acc to Bulmer,

Research is primarily committed to establishing systematic, reliable and valid knowledge about the social world.

Acc. To Clifford Woody,

Research comprises of

- Defining and redefining problems.
- Formulating hypothesis (basic idea)
- Collecting
- Organizing
- Evaluating datas
- Making decisions
- Suggesting solutions
- Reaching conclusions
- Finally, carefully testing the conclusions

To determine whether they fit the formulated Hypothesis.

Research Methods: May be understood as all those methods or techniques that are used by a researcher for conducting a Research depending upon the methods.

(1) **Library Research:** analysis of historical records and documents.

- Statistical compilation, references, abstracts, guides manipulation (handle with skill)

(2) **Field Research:** Observation, questionnaires, personal, Group or telephonic interviews, case study.

(3) Laboratory Research:

Group (team) study, use of audio visual tools.

Research Methodology: is the way do systematically solve the research problem.

In it we study the various steps that are generally adopted by a researcher in studying his research problem logically.

When we talk of Research Methodology, we not only talk of research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or we are not using a particular method or technique so that research results are capable of being evaluated either by the researcher or others.

Steps:

1) Why a particular research study has been undertaken?
2) How the Research problem has been defined?
3) What way and why the hypothesis (basic idea) has been formulated?
4) Why a particular technique of analyzing data is used? (or) How the data were collected?
5) How the collected data were interpreted?
6) What deletion was made?
7) What was the conclusion?

Finally what was the solution for the Research problem?

Importance of knowing the subject – research Methodology:

1) A student preparing himself for a career of carrying out research as his profession –
   - Will be trained better to do research

- Will help him develop disciplined thinking
- Will help him observe the field objectively.
- Will enable thoroughly to understand the logic behind the research problem.
- Will increase the ability to evaluate the results.
- Face the evaluated results with confidence.
- Useful in various fields such as Govt. Business, administration, community development & social work.

To qualify a Research or study:

To be a Good or perfect one,

The Research adapted should process certain characteristics,

It must as far as possible be
1) Controlled
2) Rigorous
3) Systematic
4) Valid
5) Verifiable
6) Empirical
7) Critical

1. Controlled: The research problem should not be affected or influenced by external factors (i.e. variables other than the participating facts).

2. Rigorous: The procedures followed to find answers to questions should be relevant, appropriate & justified. But the degree of rigiour may vary from one problem to another problem.

3. Systematic: The investigation should follow a certain logical sequence (Not in a haphazard manner)

4. Valid & Verifiable: The findings should be valid & can be verified by you or others at any time.

5. Empirical: The conclusions drawn should be based on hard evidence, gathered from real life experiences or observations.

6. Critical: The process of investigation must be foolproof and free from drawbacks. The process adapted and the procedures used must be able to withstand any critical scrutiny.

Types of Research

Research can be classified from the view point or perspectives as,

From the view point

Application	**objective**	**Inquiry mode**
1) Pure Research	1) Descriptive	1) Quantitative Research
2) Applied Research	2) Correlative	2) Qualitative Research
	3) Exploratory	
	4) Explanatory	

1) **Pure Research: (Basic or Fundamental Research)**

Gathering, knowledge is termed as 'pure' or 'basic' research. Just to gather knowledge in order to formulate or generalize theories or policies.

Eg) Research on mathematics.

This types of research adds knowledge to the already existing organized body.

Applied Research: To find an immediate solution for a pressing practical problem.

Eg: Social, economical and political trends prevailing in a country.

Applied Vs Fundamental Based on the objectives of Research:

1) **Descriptive Research:**

- Survey or fact finding enquires of different kinds. It describes the actual prevailing state of affairs, existing at present.
- Otherwise known as ex post facts means existing position of facts / issues.
- Here the variable influencing the research has no control or the researcher has no control over the variables.

Eg: Frequency of shopping, customer preference etc.

2) **Correlative Research**:

- Goes on to discover the existing relationship or interdependence between two or more aspects / variables.
- Otherwise known as comparative study.
- Investigates association between variables.

  Eg: Sum of humour and job satisfaction, (related variable)

Research problem is workers turnover

Analytical Research:

The researcher has to use facts / information already existing and analyze these data to make a critical evaluation.

Eg: document study / historical evidence.

Descriptive Vs Analytical Research:

Explanatory Research:

Attempts to clarify or explain why and how, any particular research problem arises and can be solved.

4. Exploratory Research: Study undertake to explore a new area or an unknown destination.

III. **Based on the Inquiry Mode:**

1) **Quantitative Research:**

- Relates to aspects that can be quantified and expressed in terms of quantity.
- Otherwise known as structured Research.
- In this type of Research, the objectives, design, sample and all the other factors influencing the research is pre determined.

The research problem and its solution will be expressed in terms of quantity and hence statistical and economic analysis is adapted in this type of Research.

Quantitative Research:

- Otherwise known as unstructured research.
- The aspects related to quality / kind or texture.

  Eg: Behaviour science

Apart from the above, other types of Research are,

Conceptual Research: Research related to some abstract idea or theory

- Used by philosophers or thinkers for developing new concepts.

Empirical research

(based on experiments or experience)

- Otherwise known as experimental type of Research.
- The result obtained by adapting Empirical Research is considered to be most powerful (evidence enclosed)

Based on the time consumed to complete a particular research,

a) one time Research: restricted to a single time period.

b) Longitudinal Research: Conducted over several time period.

Qualities of a Researcher

Top 10 qualities of a Researcher

1) **Ananalytical mind:** Constant analysis on a variety of factors.
2) **A people person :** For respondents to get the best out of interviews / focus groups.
3) **The ability to stay calm:** especially when you have pressing deadlines. Keep well focused and think logically there will always be an end point.

4) **Intelligence :** Researcher requires critical analysis, but most of all common sense.

5) **Curiosity:** Have curiosity and be passionate about developing deeper to unearth more insight.

6) **Quick thinker:** Things don't always go as you plan, so you need to be able to think fast.

7) **Commitment:** Research is a tough job, the hours may be long, the deadlines short. '

8) **Excellent written and verbal communication skills:** So that different audience can clearly understand the findings.

9) **Sympathetic:** Having a sympathetic ear when listening to some respondents (cry etc) is a good skill, to have.

10) **Systematic:** Check, check and check again. Spending a proper amount of time for checking always pays.

According to Micheal Foster,

1) Truthful data / facts – desire for accuracy of observation.

2) No expressions like approximately, almost or nearly.

3) Should poccess alert mind. Nature is constantly changing, be keen and watchful to notice such changes, no matter how small or insignificant they may.

4) Scientific inquiry – desire for knowledge – it requires moral courage, Steadfast (constant / not changing) endurance (to tolerate the difficulty, suffer patiently)

- When a research scientist feel defeated or completely lost, he needs immense courage and the sense of conviction (found guilty)

Significance or Importance of Search

1) Doubt is better than over confidence for it leads to inquiry, inquiry leads to invention. Process or the three stages of research to bring out economic policies.

    1) Investigation of prevailing economic structure with the available facts.

    2) Analyse or diagnose the data.

    3) Prediction for future developments.

2) Research encourages scientific and inductive thinking.

    Eg:- Role of Research in :

    1) Econ omics:

    Researches done on applied (production and sales of goods in a profitable manner) economics is increasing in modern days. Govt. & business sectors have become more complex, they face several operational problems to solve this problems, Research is carried on.

    - To frame Govt. economic policies.
    - Govt. budget a formulation depends on the analysis of needs & desires of the people, available of revenues needs research.
    - Decision making – requires proper research.

- Allocation of a countries scarce resource – also needs research.

2) Business Decisions:

- In business sectors there are both planning and operational problems.

a) Problems Research: Investigation of the present structure and development of the market – relating to purchase, production, promotion and sales.

b) Operational Research: Relates to application of logical, mathematical and analytical techniques – to solve market problems – there by minimize cost and profit maximization.

c) Motivational Research: Helps to determine people behavior or consumer response.

All the above three are responsible for business decision making.

3) Social sectors: To gain knowledge on unknown aspects and do something better and more efficiently.

Social scientist gain their knowledge for their own sake and for the development of the society.

1. Formulating the Research problem:-

a) The formulation of a general topic into a specific Research problem thus constitutes the first step in a scientific inquiry.

Two steps are involved in formulating the Research problem,

a) Understanding the problem thoroughly.

b) Rephrasing the same into meaningful terms from an analytical point of view.

1. Identify a broad field or subject area of interest to you.
2. Dissect the broad area into small area.
3. Select what is of most interest to you.
4. Raise Research questions.
5. Formulate objectives
6. Assess your objectives
7. Double check

- The best way to understand the problem is to discuss with his own colleague or guide.
- Examine all available literatures to get himself acquainted (get used to) with the selected problem.
- Review two types of literature

Conceptual literature :

Concerning concepts & theories

Empirical Literature : Concerning studies made earlier which are similar to the one proposed.

- Outcome of the review will be the knowledge so as to pre determine what data or materials are available for operational purposes.
- Next step – the Researcher rephrases the problem into Analytical or operational terms.

PUT THE PROBLEM INTO SPECIFIC TERMS

This step is of greatest importance in the entire research process.

The problem to be investigated must be defined unambiguously or clearly.

Prof W.A. Neiswanger States,

- The statement of the objective of the Research problem is of basic importance because,
  - (i) It determines the data which are to be collected
  - (ii) Characteristics of the relevant data
  - (iii) Choice of techniques to be used in these explorations
  - (iv) Frame a Final report

Step II

Extensive Literature Survey:

- A brief summary of the problem should be written down.
- Make extensive literature survey
- Sources of survey can be, journals, bio-graphics, Govt. reports, books, conference proceedings etc.

  Based on the nature of the problem.
- Earlier study if any which is similar to the study in hand should be carefully studied.
- A good library will be a great help to the researcher at this stage.

Stage III:

Developing Hypothesis : (Development of working Hypothesis)

- State in clear terms the working hypothesis (Basic Idea of the Research problem)
- It is a tentative assumption in order to test to logical or empirical consequences.
- Provide the focal point for research.
- Hypothesis should be very specific and very well limited to the place of research in hand because it has to be tested.
- Hypothesis guides the researched by limiting the area of Research and keep him on the right track.
- It sharpens his thinking and focuses attention on important facets of the problem.
- It indicates the type of data required for the study.
- Type of methods of data analysis done.

How to develop working Hypothesis?

1) Discuss with collogues / experts, about the problems, its origin, its objectives and solutions.
2) Examination of data/ records if available.
3) Review similar studies / similar problems.
4) To secure greater insight into the practical aspects of the problem – conduct personnel investigation or field interviews.

STEP IV:

Preparing the Research Design:

Research design is the conceptual structure within which research is conduction. It constitutes the blue print for the collection, measurement and analysis of data.

The function of the Research design is to provide relevant evidence with minimal expenditure of effort, time and money. It provides an outline of what the researcher is going to do in terms of 1) Framing the hypothesis, 2) its operational implications and 3) finally data analysis

The Research design highlights certain decision,

1) The nature of the study
2) Purpose of the study
3) Location where the study would be conducted
4) The nature of data required
5) From where the data would be collected
6) The techniques of data collection that would be used
7) What time period the study would cover
8) The type of sample design that would be used
9) The method of data analysis that would be adapted
10) The manner in which the report would be prepared

Type of Research Design : 4 types

1) **Sampling Research Design :** Deal with selection of relevant items
2) **Observational Research Design:** Deals with the observations (field observations) that is to be made.

3) **Statistical Research design:** Deals with the information on the data collected & analysed.

4) **Operational Research Design:** How the above three are carried out.

Determining sample Design:

- All the items considered in any field of inquiry constitutes a "universe" or population. Study of the entire population without leaving out a single item is known as "Census Study"
- This type of census study is practically not possible.
- So we select few items from the entire population for our study purpose. The items so selected constitutes what is technically called "sample".
- The way of selecting such a "sample" is known as the "Sample Design".

These samples can be either probability samples or non probability samples.

Probability: Each item in the population has on equal chance of being selected for the study.

1) Simple random sampling
2) Systematic random sampling
3) Stratified random sampling
4) Cluster / area random sampling.

Non Probability sampling: All the items do not have an equal chance of being selected for the study.

The selection depends upon the convenience & judgment of the Researcher.

Mixed sampling: When more than one type of sampling technique is used for a study, it is mixed sampling.

The sample design to be used in a Research study must be decided by the researcher considering the nature of the study.

6. **Collecting the Data:**

"**Gathering appropriate data"** which are made use in Research study.

Data can be collected in several ways either through (1) Experiment (or) (2) through surveys.

- In experimental means, when a researcher conducts a research, some quantitative measurements are observed, based on which, he examines the truth of the underlying hypothesis.
- In case of surveys, data are collected by

    1) By observations
    2) Through personnel interview
    3) Through telephone interviews
    4) By mailing of questionnaires
    5) Through schedules / enumerators

The Researcher should select one of these methods of collecting the data taking in account the

1) Nature of investigation

2) Objective & scope of Inquiry

3) Financial Resources

4) Time frame

5) Desired degree of Accuracy.

6) <u>Execution of the Project: (Putting a plan)</u>

- Important step in Research study.
- See that the project is executed in a systematic manner and in time.

  Eg) If the survey done in a project is via Questionnaire the answers can be machine coded / processed

- If interview were conducted, make sure that the interviewers is well trained – to keep the survey as much as realistic as possible.

8. **<u>Analysis of Data :</u>**

- After the data are collected the researcher turns to the task of analyzing the data the analysis of data require closely related operations, like 'coding, Editing & Tabulation'.
- The wide data collected should be condensed into small manageable groups, for easy analysis.
- Coding: The collected data are transformed into symbols that may be tabulated or counted.
- Editing: Unwanted & irrelevant data will be removed.
- Tabulation: Technical procedure where the data are put in the form of tables.

<u>Research Design:</u>

- The most important step after defining the 'Research problem' is preparing the Research Design
- Research design is the conceptual structure within which the research is conducted.
- It constitutes the 'BLUE PRINT" for collection, measurement and analysis of data.
- Research design provides an answer to the question, what the Researcher is going to do with regards to framing hypothesis, its operational implications and how to analyse the data?

Research Design: - Decisions

Highlights certain decisions,

1) Nature of the study
2) Purpose of the study
3) Location where the study would be conducted
4) Nature of "DATA" required
5) From where the "DATA" can be collected
6) Time period of the study
7) Type of sample design to be used
8) Techniques of data collection
9) Methods of Data Analysis
10) Preparation of Report.

Research Design

May be sub divided into,

1) Sampling design: Deals with, the method of 'selecting items' for the study.

2) Observational design: Relates to the condition under which the observations are to be made.

3) Statistical Design: Deals with the "no of items" selected or the study and how the selected data will be analysed.

4) Operation design: The technique by which the sampling, observational and statistical designs can be carried out.

Research Design – Features :

1) Helps to identify the type and source of information needed for the study.

2) Specifies the methods to be adopted in collecting & analyzing data.

3) Specifies the time schedule of the research and the monetary budget involved.

Concepts Relating to Research Design

1) **Dependent and Independent variables :**

Variables : A magnitude that varies is known as "variable"

Continuous variable : Values that can be expressed even in decimal poins are known as continuous variables

Eg: age (4 years 3 months)

Height (5.2 cm)

Weight (45.3 kg)

Non continuous Variables: Value that can be expressed only in integer values are called Non continuous variables

Eg: No. of students in a class (45)

No. of children in a family (3)

Statistically known as “discrete variables”

Dependent or Endogenous variables :

When the change in one variable depends on the change in other variable, it is known as dependent or Endogenous variable.

Demand ----- Price (independent)

Independent or Exogenous variable

The variable that causes the change in the dependent variable is known as independent or exogenous variable.

Demand (Dependent) ------- Price ,Income

Here demand is a dependent variable while price / income is an independent variable.

Extraneous variable :

The independent variable which is not directly related to the purpose of the study but affects the dependent variable is know as Extraneous variables.

- The influence caused by the extraneous variable on the dependent value is technically known as “Experimental Error”
- A research study or a Research design should always be framed in such a manner that the influence of ‘Extraneous variables’ on the

dependent variable is completely controlled and the influence of the independent variable is clearly evident.

Control:

Good Research design should minimize the effect for Extraneous variables.

Confounded Relationship

The relationship between dependent and independent variable is said to be confounded by an extraneous variables.

Research Hypothesis:

When the formulated hypothesis is tested by adopting scientific methods, it is known as Research Hypothesis.

Experimental & Non Experimental Hypothesis testing:

- When the objective of the Research is to test the hypothesis, it is Research hypothesis.
- Research in which the independent variable are (handled with skill) manipulated, it is experimental hypothesis testing.
- When the variables are not manipulated, it is non experimental hypothesis testing.

Experimental & Control Groups:

- When a group is exposed to usual conditions in an experimental hypothesis, research it is control Groups.
- When the group is exposed to special or certain new conditions, it is experimental groups.

8. **Treatments:**

The different conditions to which the experimental & control groups are subject to is known as treatments.

9**. Experiment:** Fertilizers and crops)

Process of verifying the truth.

Absolute Experiment:

- Determine the fact

Comparative Experiment:

- Determine the impact in comparison with another fact.

10. **Experimental units**

- Pre-determined block to which different treatments are applied.

  Eg : animal testing

Types of Research Design

There are three different types of Research design,

1) **Exploratory Research Design:**

   - Is a "Formulative Research design"
   - Main purpose is the discovery of ideas & insights
   - Should be flexible enough considering different dimensions of the problem under study.

2) **Descriptive and Diagnostic Research Design:**

- Descriptive Research Design is concerned with describing the characteristics of a particular individual or a group.
- Study concerned with narration of facts or characters related to an individual, group or institution are descriptive research studies.
- Diagnostic Research design determines the frequency with which a variable occurs or its relationship with another variables.
- Both the Research designs should be planned carefully.
- Research design should be Rigid (No flexibility)

3) **Hypothesis testing Research Design**:

- Test the hypothesis of causal relationship between two or more variables.
- Adopt procedure that not only reduce bias but enhance reliability – and facilitates deriving Inferences (results) about the Research problem.

Importance of Research Design:

- Facilitates the smooth flow of the various stages of Research.
- Helps yield maximum information with minimum effort, time and money.
- Helps to plan in advance data collecting and analysis techniques.
- Prepare with utmost care to avoid errors.
- Attain reliability

Characteristics of a Good Research Design

- Posses the qualities of being flexible, suitable efficient & economical.
- Should minimize 'bias' and maximize reliability of data collection & Analysis.
- No experimental error should be allowed
- Should yield maximum information
- Research problem should be viewed from different angles or dimensions.

The choice of Research design depends on,

- Nature of the Research problem
- Objectives of the Research problem
- Skills / ability of the Researcher
- Methods of gathering information
- Availability of monetary support
- Time schedule

HYPOTHESIS

A Research hypothesis is a predictive statement, which is capable of being 'tested' using scientific methods, which involves independent and dependent valuables. (eg) the female students perform as well as the male students.

This statement is a hypothesis that can be objectively tested and verified.

It is a proposition that can be put to test in order to examine its validity.

Characteristics of Hypothesis

1) A hypothesis should be precise and clear. If not clear, the inferences will not be reliable.
2) It must be capable of being put to test.
3) It should state the relationship between the variables, in case relational hypothesis.
4) It should be stated in a simple language.
5) It should be consistant and derived from all known facts.
6) Hypothesis must be amenable to testing within a reasonable period of time
7) Hypothesis should explain what it actually to explain. (the solution for the Research problem). The explanation should be on empirical reference.

Concepts Relating to Testing of Hypothesis

1) Null Hypothesis & Alternative

Hypothesis (Statistical Analysis)

Null Hypothesis: Denoted by H0. If both the variables (say male or female) or (Head or Tail) are equally good, it is Null Hypothesis.

Alternative Hypothesis: Denoted by Ha or H1. If one variable is considered superior to other or vice versa or if there is a difference, it is alternative hypothesis.

Mean Population (u) or (p)

Total / No. of variables

Null Hypothesis

Ho : u = 100

Alternative Hypothesis

Ha : u = 100

Ha : u > 100

Ha : u < 100

Aspects to be considered while formulating Null Hypothesis

1) The researcher always tries to reject Null hypothesis since Alternative Hypothesis should be proved.

2) Null hypothesis when it is actually true, when rejected involves great risk, the level of significance should be considered.

3) Null hypothesis should be very specific (No approximation)

The level of significance:

- Important concept of hypothesis testing.
- It is a certain percentage chosen with great 'care, reason and thought'

  (eg) let us consider the level of significance to be 5%. It means the Researcher takes a risk of rejecting Null hypothesis (Ho) by 5% when Ho is actually true.

3. Decision Rule

- The researcher should make a decision, if to accept or Reject Ho.

- The decision rule should be decided on the number of items to be tested and the basic of which to accept or reject.

4. **Type I and Type II Errors**

(i) Researcher may reject Ho, when it is true – Type I Error (which must have been accepted).

(ii) Researcher may accept Ho, when it is false – Type II Error (which must have been rejected)

5. **One tailed and Two tailed Tests**:

(i) One tailed test rejects the Null hypothesis when the sample mean is either greater or lower than the hypothesized value of the population mean.

Two tailed Test: When the sample mean is both greater and lower than the hypothesized value of the population mean.

Procedure for Hypothesis Testing:

1. Testing hypothesis refers whether the formulated hypothesis is valid or not
2. Whether to Accept or Reject Null Hypothesis.

(i) **Making a formal statement:**

- Making a formal statement of the null hypothesis and alternative hypothesis.

(ii) Selecting a significant level of testing

- A pre-determined level of significance should be specified.
- Either 5% or 1% level can be considered for the purpose.

(iii) Deciding the Distribution to use: