

CHAPTER ONE

Research Methods: An Introduction

Research is most frequently used terminology in different academic and business institutions. Research as conscious and creative human activity involves discovering and learning new things. Where there is a problem there is always a research. It is an essential tool for understanding the events and structures of the social world. Research can mean different things to different people. People have defined research differently according to their perception. Here under we will see different definitions and perceptions of individuals about research

1.1. Meaning of Research

Different authors in many ways have defined the word research. *Research* commonly refers to a search for knowledge. Some people consider research as a movement from known to unknown. It is indeed a voyage of knowledge. For some people on the other hand research implies an art of scientific investigation to the state of nature or phenomenon. Authors are increasingly adding new names and definition for different kinds of research. However, to avoid confusion and unnecessary cumbersomeness let us confine ourselves to the definitions of research given by selected authors.

Hertz provided the most simplified definition of research. His definition referred research to the original and creative activities. According to him, ***Research is the application of human intelligence in a systematic manner to a problem whose solution is not immediately available.***

Woody on the other hand defined research as ***an activity comprises of defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deduction and reaching at conclusion to determine whether they fit the formulated hypothesis .***

An author called Klopsteg gives the most comprehensive definition of research. According to him; *“Research is original and creative intellectual activity, carried out in the laboratory, the library or in the field which endeavors to discover new facts and to apprise and interpret them properly in the light of previous knowledge. With constantly increasing understanding, it revises previously accepted conclusion, theories and laws, and makes new application of its findings. Whether it seeks to extend knowledge for its own sake or to achieve results with specific economic or social value, its raison de’tre is its contribution to human welfare.*

According to this definition, research is carried out not only in the laboratory but also it can be carried out in different places like in the library and in the field as well. Research is not only original and creative activity. It will not always discover new facts. It can also revise and verify the validity of previously accepted facts theories and principles, which is the task of academic or basic research.

1.2. Motivation of Doing Research

Research is not a trouble-free duty rather it is time consuming, tiresome and expensive undertaking. Despite these all difficulties many people especially in academic institute would like to carry out research at least once in their life. What are the possible motives of individuals to undertake research work?

The possible motives for doing research can be either one or a combination of the following:

- *Desire to get degree with its consequential benefit.* The graduate and postgraduate students are required to carryout research project as a partial fulfillment to obtain their master and Ph.D. Degree. Research is therefore, a prerequisite to complete their study.
- *Desire to get respect and promotion (to own respect in society).* In academic and research institutions publication is crucial for promotion and academic rank. *“Publish or perish”* is a phrase commonly used in experienced and well-

established academic institutes. This implies an individual should carry out a research activity and publish his findings in scientific or international journal in order to get respect and academic rank. If not the individual will "**perish**" meaning no proportion or academic rank and hence no respect is possible for that individual in the academic environment

- ***Desire to face a challenge in solving the unsolved problem.*** Concern over a particular problem initiates a researcher.
- **Desire to get intellectual joy of doing some creative work.** Doing or participation in some creative activity will give some professional satisfaction to many individuals. Research will give this opportunity.
- **Directive of government.** Government some times gives directives to its employees to carry out a particular study and investigation for better decision-making ground. Ideally any policy before implementation requires detail study and analysis of its impact on different parts of the society.
- **Employment condition.** Some employers set as criteria at least one publication in international journal.

1.3. Types of Research

Like its definition research has been classified differently. Generally research can be classified on the basis of the following traits.

I. On the basis of the outcome of the research: Whether the research tries to solve a particular problem or makes a general contribution to the knowledge, research can be

a) Fundamental Research:

Fundamental research is also called academic or basic or pure research. Such research is aimed at investigating or search for new principles and laws. It is mainly concerned with generalization and formulation of a theory. Fundamental research is organized only for the attainment of knowledge and truth. With change

of time and space, it is necessary to make a change in the fundamental principles in every branch of science; thus, this type of research also verifies the old established theories, principles and laws.

In general, fundamental research is concerned with the theoretical aspect of science. In other words it studies the laws of nature, with out or regardless of the immediate application of its findings.

E.g.,

- The relationship between crime and economic status is an example of pure (academic) research.
- Darwin Theory of Evolution
- Newton's Law of Motion
- Einstein Theory of Relativity

b) Applied research

A research aimed at finding a solution for an immediate problem facing a society, a group or industry (business organization). The results of such research would be used by either individuals or groups of decision-makers or even by policy makers. While pure research discovers principles and laws, applied research discovers their application in solving some social, economical or any other problems.

E.g.,

- The improvement of safety in the working place
- The reduction of wastage in the working places is example of applied research.

Types of Applied researches

Social impact Analysis: - The major purpose of social impact assessment is to estimate the likely consequences of a planned change. Such an assessment can be used for planning and making choices among alternative policies. Researcher conducting social impact assessment examines many outcomes and often works in an interdisciplinary research team.

Potential areas assessed in social impact analysis.

- Community service (School enrolment, speed of policy respond)
- Social conditions (crime rate etc)
- Economic impact (change in income level)
- Demographic consequences (change in the mix of old and young people, population movement in or out of the area)
- Environment impact
- Health outcomes

Evaluation research: - Evaluation research is widely used type of applied research that addresses the question, “did it work?” Evaluation is a process of establishing value judgment based on evidence. Evaluation research measures the effectiveness of a program, policy, or way of doing something. Some example of evaluation research questions is, does the new incentive scheme improve workers job performance? Does the environmental policy improve the environmental problem of the city? Individuals involved in a policy or program may conduct evaluation research for their own information or at the request of outside decision makers.

There are two types of evaluation research; **Formative** and **Summative**. Formative evaluation is built in monitoring or continuous feed back on a program used for program management. Collective evaluation looks at final program outcome.

Applied research being impact analysis or evaluation research uses two tools namely; **Need assessment** and **Cost Benefit Analysis**.

Need assessment: A researcher collects data, to determine major needs and their severity. It is often a preliminary step before deciding on a strategy to help people. A researcher may confirm dilemmas or difficult issues. A good need assessment identifies both the expressed and less valuable needs of a target group, as well as

the more serious or widespread needs. A researcher must trace links among related needs to identify those of highest priority.

Cost benefits analysis. This is commonly used in social impact analysis. Economists developed cost benefit analysis, in which the researcher estimates the future costs and the expected benefits of one or several proposed actions and gives them monetary values

II. On the basis of the purpose (The reason why a research is conducted) it can be-

a) Exploratory research (Pilot Survey)

It is also called preliminary research. As its name implied, such research is aimed at discovering, identifying and formulating a research problem and hypothesis. When there are few or no studies that can be referred such research is needed.

b) Descriptive Research

The main purpose of such research is description of the state of nature or affairs, as it exists at present. In social science and business research we often use the term **ex-post facto research** for descriptive research. The main characteristic of such research is that the researcher has no control over the variables; he can only report what has happened or what is happening.

E.g.

- **What is the absentee rate in a particular office?**
- **What is the qualification of different groups of employment?**
- **Frequency of shopping**
- **Preferences of people**

Ex-post facto studies also include attempts by researchers to discover causes though they cannot control the variables.

Goals of Descriptive research

- To provide an accurate profile of a group
- To describe a processes, mechanism or relationship
- To provide a verbal or numerical picture about a phenomenon
- To find information to stimulate new explanations
- To present basic background information on a context
- To create a set of categories or classify types
- To document information that contradicts prior beliefs about a subject

c). Analytic research

Analytical research on the other hand, goes beyond simple description of the state of nature. When a researcher encounters an issue that is already known and have a description of it, you may begin to ask “why” things are the way they are.

Analytical research uses facts or information already available, and analyzes them to make a critical evaluation of the material. Not only describe the characteristics, but also it analyzes and explains why and how it happened or is happening. The information or facts used here can be either Qualitative or Quantitative.

Goals of analytical research

- To determine the accuracy of a principle or a theory
- To find out which competing explanation is better
- To advance knowledge about an underling process
- To link different issues or topics under a common general statement
- To build and elaborate a theory so it becomes more completes
- To extend a theory or principle into new areas or issues
- To provide evidence to support or refute an explanation or prediction

E.g.,

- How can we reduce the numbers of complaints made by customers?
- How can we expand the range of our services?
- How can we improve the delivery times of our products?

Case studies

Case study is a type of analytical research in which a researcher examine many features of a very few elements in-depth over duration of time. Case can be individual, group, organization, movement, events, or geographic units. The data in case study are usually more detailed, varied and extensive. Mostly data involved are qualitative data about a few cases. In a case study a researcher may intensively investigate one or two cases or compare a limited set of cases focusing on a several factors¹.

Tracer Study

Tracer study is also known as follow up study. It is a type of explanatory research that aims at investigating the subsequent development of individuals after a specified treatment or condition. Tracer study is used to make an investigation on the direction of movements and predicts what is likely to take place to the future. Tracer study is designed to establish patterns of change in the past in order to predict future patterns or conditions by analyzing data collected about subjects and environment. Common example of such study is that a researcher may conduct a tracer study of the former graduates of the Faculty of Business and Economics to know

- Whether all of the graduates are employed or absorbed by the labor market
- Whether there is a mismatch between the training graduates received and the type of jobs they are handling
- Whether there is a new environmental trends that justify the need of change

¹ For more information refer chapter eleven or R.K.Yin (1995).

d) Predictive research

Such research goes beyond explaining why and how things happened. It predicts (forecast) the possible (probability of happening similar situation in other places. It tries to explain about the probability of happening similar thing in the future.

E.g.,

- How would an increase in interest rate affect our profit margin?
- What type of packaging will improve the sales of our products?

III. On the basis of the process of research: That is, on the basis of data used in the research process research can be

a) Qualitative research:

Such research is applicable for phenomenon that cannot be expressed in terms of quantity. Things related to quality and kind. Research designed to find out how people feel or what they think about a particular subject or institution is an example of such research.

b) Quantitative research

Quantitative research is on the other hand is concerned with qualitative phenomenon. It is based on the measurement of quantity or amount. It is applicable for phenomenon that can be expressed in term of quantity.

IV. On the basis of the environment in which the research is carried out research can be

a) Field research

It is a research carried out in the field. Such research is common in social science, agricultural science, history and archeology.

b) Laboratory research

It is a research carried out in the laboratory. These are commonly experimental research.

Such researches are common in medical science, agriculture and in general in natural sciences

c) **Simulation research**

Such research uses models to represent the real world. Simulation is common in physical science, economics and mathematics.

V. On the basis of the time required to complete the research, research can be

a) **One -time research**; It is a research limited to a single time period

b) **Longitudinal research**

Such research is also called on-going research. It is a research carried out over several time periods.

Common objectives of research

Any research activity is designed to discover and answer to questions through the application of scientific procedure. It is an activity aimed at finding out the truth which is hidden and which has not been discovered yet or to verify or reject that the existing phenomenon (theory, principle or law) accepted as true.

Though each research study has its own specific objectives, any research has got the following common (general) objectives.

- To generate new knowledge, principle and scientific law
- To review and synthesize existing knowledge. That is, to verify the validity of the previous work.
- To investigate some existing situation or problem
 - To explain new phenomenon
 - To examine the cause of the problem
 - To examine the nature of the problem
- To provide solution to a problem
- To construct or create a new procedure and new system
- A combination of any one of the above

1.4. Research and Scientific method

For clear understanding of the term research, we better know the meaning of scientific method. The two terms, research and scientific methods are closely related. The researcher is not interested in particular results; rather he is interested in the repeatability and validity of results and their application to more complicated and general solutions.

Research methodology and technique are mostly different from one science to another or can be different from research to research. The philosophy common to all research methodology and technique is called Scientific methods.

As Pearson (1968) put it, “the scientific method is one and the same in the branches (science) and that method is the methods of all logically trained minds”

Steps in scientific method

As we have said scientific method is the philosophy common to all research methodology and technique in any research in any branch of science. The steps in scientific methods are summarized as follows.

1. **Observation:** the first or initial step in the scientific method is a minute and careful observation of the subject matter of research.
2. **Recording:** The next step to observation in scientific method is a careful recording of all information (data) obtained in the first step, i.e., observation.
3. **Classification:** the collected data (information) have to be classified and organized. This is a serious step; according to “*the classification of facts, the recognition of their sequence and relative significance, is the function of science*”. The classification implies systematically arranging and organizing the recorded data on the logical basis so that they will become viable for the analysis and to make generalization.

4. **Generalization:** It is an extension of general laws and principles on the basis of the pattern exhibited by the classified material. This general law is known as scientific law.
5. **Verification:** the scientific method does not stop only at the formulation of general law. The general principle must be also verified. The validity of scientific principles can be confirmed by examination.

Forms of scientific methods

There are six primary forms of scientific methods.

1. **Induction:** the movement of knowledge from particular facts to general rule or principle. To make generalization based on our knowledge from a particular event or assessment.
E.g. Socrates is mortal and Socrates is a man; therefore, man is mortal.
2. **Deduction:** a movement in knowledge from a general rule to a particular case.
E.g. Man is mortal and Socrates is a man; therefore, Socrates is mortal
3. **Historical:** historical method is a back ward movement in knowledge to trace the cause of a phenomenon.
Darwin theory of evolution and Marx's law of economic determinism are example of historic forms of scientific method.
4. **Comparative:** This method is used for the analysis and comparison of two contemporary (coexisting and present) phenomenon. It is always undertaken in order to discover new facts or relations.
Studies of two government or political system
5. **Structural:** a study of what a things, what are its outline and significant feature is a structural study (the composition of a thing)
Anatomy is a structural study
6. **Functional:** in contrast to the structural method, functional method studies the processes and their cause, that is, how and why of a thing.
Physiology is a good example

Methods versus Methodology

In this material most frequently we come across to the term research methods and research methodology and research. Some literature use this terms interchangeably. To avoid confusion the definition and differences of these terms are given as follow. Their usage through out the text is based on these definitions.

Research Techniques: Refers to the behavior and instruments we use in performing research operation such as making observation, recording data, techniques processing data and the like.

Research Methodology: can be understood as all those approaches and techniques that are used in conducting a particular research. Research methodology; thus, refer to the techniques researchers use in performing research operations.

Research methodology can be put into three groups:

- The first group include approaches or techniques of data collection
- The second group consists of those statistical techniques used to established relationship between variables
- The third group consists of those techniques involved in evaluating the accuracy of the result obtained

Methods: is a way to systematically solve the research problem. Method can be understood as a science of studying how research is done scientifically.

It is necessary for the researcher to know not only the research methodology and techniques how to conduct research but also the methods. that is, researcher not only need to know how to develop certain indices or test, how to calculate the mean, the mode, the median or the standard deviation or chi-square or in general how to apply particular research techniques, but they also need to know which of these methodology or techniques, are relevant and what would they mean and indicate the way. Researcher also needs to understand the assumption underlining various techniques.

Generally speaking, one can say that research methods have many dimension and research methodology constitute only a part of the research methods.

1.5. Research Processes

Before starting the details of research methods, it is appropriate to have a brief overview of the research processes. Research processes consist of a series of actions or steps, which are necessary to successfully carry out research activities.

The research processes consist of a number of closely related activities. These activities (steps) can overlap continuously rather than following a strictly prescribed sequence. The first step can determine the nature of the last step to be undertaken. These steps are not separate and distinct. They do not necessarily follow each other in any specific order Kothari (1990).

However, the following order of steps provides a useful procedural guideline regarding the research processes.

- Identification and Formulating the research problem
- Extensive literature survey
- Developing working hypothesis
- Preparing the research design
- Determine sample design
- Collecting data
- Execution of the project
- Analysis of the data
- Hypothesis testing
- Generalization and interpretation
- Reporting the result

CHAPTER TWO

Defining and Formulation of the Research Problem and Hypothesis

In research processes, the first step happens to be identifying and properly defining a research problem. The researcher first must find any social, economic, business problem and formulate it into research problem. The problem identified initially may be stated in broad general way and then gradually the ambiguity will be resolved. The feasibility of a possible particular solution has to be considered before formulating the problem. The best way of understanding a problem is to discuss it with colleagues or those having some experience in the matter.

Problem formulation from the researcher point of view represents translating the managers, social and other problems in to a research problem. In order this to happen the researcher must understand the origin and nature of the management (economic, environmental, and etc.) problems and then be able to rephrase it into meaningful terms from analytical point of view.

What is a Research problem?

A research problem, in general, refers to some difficulty, which a researcher faces (experiences) in the context of both a theoretical or practical situation and wants to obtain a solution for the same.

We say a research problem exist, if the following conditions are met (Kothari 1990)

1. There will be an individual (or group or organization), **I**, to whom the problem can be attributed. The individuals or organization occupied an environment, say **N**, which is defined by values of the uncontrolled variable Y_j .

2. There must be at least two courses of action; say, C_1 and C_2 that can be taken to solve the problem. A course of action is defined by one or more values of the controlled variable.
3. There must be at least two outcomes, O_1 and O_2 of the courses of action of which one should be preferred to the other. In other words, there must be one outcome that the researcher wants to achieve, i.e., an objective.
4. The courses of action available must provide some chance of obtaining the objective, but they cannot provide the same chance, otherwise the choice would not matter.

Thus,

If $P(O_j / I, C_j, N)$ the probability that an outcome O_j will occur, if I selects C_j (course of action) in N then, $P(O_j / I, C_1, N) \neq P(O_j / I, C_2, N)$

In simple word, the choice must have unequal efficiency for the desired outcomes. This condition implies individual or group or organization said to have problem, if "I" do not know what course of action is best. That is, "I" must be in doubt about the solution.

Components of the research problem

The problem is consists of the following components

1. The decision-maker (which can be individual, organization, etc.,) who has some difficulties or problem.
2. There must be some objectives (goals) to be attained at. If one wants nothing then, cannot have a problem. The objective of the decision-maker provides motivation to solve the problem.

Objective can be defined from different perspective

From economics point of view: objective can profit maximization

From Marketing view point - increasing market share, creating product image and prestige, increasing sale and so on can be considered as an objective.

From Management perspective - objective can be motivating workers thereby increase labor productivity

Finance- increase return on investment

3. Alternative courses of action: There must be alternative means to achieve the desired objective.

E.G, to maximize profit we have the following courses of actions,

Profit = TR – TC where, TR represents total revenue and TC refers to total cost of production.

Increasing profit can be achieved

- i. By keeping TC constant and increasing TR, where, $TR = P.Q$. This again can be done either by increasing price (P) and keep constant total output (Q), or by Keeping price constant and increase Q (total output)
- ii. Keep TR constant and decrease TC

Increase market share implies increasing sales relative to other firms. These can be achieved by

- i. Increasing total sale by:
 - Decreasing price,
 - Increasing quality,
 - Changing package,
 - Developing new product line and the like.

4. The environment (or context of the problem) to which the difficulty pertain.

These environmental factors can be;

- Government regulation (exogenous)
- Price factor (Exogenous in competitive market)
- Rate of price change, inflation (exogenous)
- Market place (exogenous)
- Resource available (natural resource)
- Technology (endogenous)

- Level of education and the like etc (endogenous)

These factors may individually or collectively affect the out come of the course of action (and most of the time they are exogenous or uncontrolled variables).

5. A state of doubts as to which course of action is the best. This means that researcher must answer the question concerning the relative efficiency.

2.1. Defining the Problem

Defining the research problem is crucial and very hard part of a research process. It is crucial because, the problem identified will provide us with the topic of the designed research and the objective of the research. It is the most difficult and hard part of the research study because; there is a cause and effect issue. It is commonly difficult to distinguish effect of a problem from the cause of the problem. The researcher should be certain that the problem identified is a cause but not an effect. There is a common say in research that “***The problem clearly stated is a problem half solved***”. This signifies the importance of properly defining the problem. A proper definition of research problem will enable the researcher to find answers to question such as

- What kind of data and information are relevant and needed to be studied?
- What relationship is to be explored among variables?
- What technique has to be used to collect and analyze data? And so forth

Therefore, defining a research problem properly is a prerequisite for any study and a very important step. Even it is more essential than its solution..

Techniques involved in defining a problem

The research problem should be defined in a systematic manner. The technique involved in defining a research problem has a number of steps, which should be under taken one after another.

- i. *Statement of problem in a general way*: First of all the problem should be stated in a broad general way keeping with some practical, scientific and intellectual interest. For that purpose the researcher must immerse him completely in the subject matter, which he wishes to pose a problem.

In social science it is advisable to do some field observation and / or preliminary survey (pilot survey). Then the researcher can himself state the problem or can seek guidance of the subject expert.

- ii. *Understanding the nature of the problem*: the next step is to understand clearly the nature and the origin of the problem. The best way of understanding the problem is:

- To discuss with those who first raised the problem in order to know how the problem originally come in view.
- To discuss it with those who have a good knowledge of the problem concerned or similar other problem.

- iii. *Survey the available literature*. All available literature concerning the problem must be studied and examined before defining research problem.

This means the researcher must be familiar with:

- The relevant theory in the area. Theory has got the following role in overall research studies
 - Theory provides patterns of the interpretation of data
 - It links on study with the other
 - It supplies frameworks within which concepts and variables acquire special significance.
 - It allows us interpret the large meaning of our findings for ourselves and others
- Reports and records and other literature in the concerned area

- Rearview research works undertaken on related problem. This is important especially to learn what data and other material have been used and are available for operational purpose

Knowledge about these all will help the researcher to narrow the problem down himself.

Generally, survey literature will enable researcher to know

- If there are certain gap in the theory
- Whether the existing theory applicable to the problem and consistent with each other.
- Whether the findings of the research do or do not follow a pattern consistent with the theoretical expectation.
- Study on a related problem is also useful for indicating the type of difficulty that may be encountered in the present study.

iv. *Developing ideas through discussion:* Discussion on a problem produces useful information. Various new ideas can be discovered and developed through it. The researcher should discuss his problem with colleagues and others who have enough experience in the same area. Such practice is called ‘**experience survey**’

Peoples with rich experience are in a position to show the researcher different aspects of his proposed study and their advice and comments are usually of high values.

v. *Rephrasing the research problem (reformulation of the problem):* Finally the researcher at this stage should be able to reformulate the problem that has been stated in broad and general way in to working proposition. The researcher should narrow and break down the problem into its components variables and relationship. That is, problem should be expressed as:

a) *a relationship between two or more variable*

b) the problem should be stated either in question form or hypothesis form

Question form is appropriate mostly when the research is descriptive in nature. What important is that when a researcher state the problem in question form the formulated problem should be free from ambiguity and the relationship among variables should be clearly expressed

E.g.,

- *Does a relationship exist between income of university students and score on their exams?*
- *Is there a relationship between employees' age and their productivity?*
- *Does a relationship exist between the men circumcision and sensitivity to HIV virus?*

In above examples, the study's main elements are identified in reasonably clear fashion.

The following points must be considered while redefining the research problem

- Technical terms and words or phrased, with special meanings used in the statement of the problem, should be clearly defined.
- Basic assumptions or postulates (if any) relating to the research problem should be clearly defined.
- A straightforward statements of the value of the investigation, i.e., the criteria for the selection of the problem) should be provided
- The suitability of the time period and the sources of data available must also be considered by the researcher in defining the problem.
- The scope of the investigation or the limits within which the problem is to be studied must be mentioned explicitly in defining the research problem.

Evaluation of the problem

Before the final decision is made on the investigation of the problem, the feasibility of the problem has to be tested with regard to personal suitability of the

researcher and social value of the problem. In short, the research problem should be evaluated in terms of the following criteria.

Is the problem researchable?

Some problems cannot be effectively solved through the process of research. Particularly, research cannot provide answers to philosophical and ethical questions that do not show the relationship existing between two or more variable vividly. Therefore, the problem must be stated in workable research question that can be answered empirically.

Is the problem new?

As much as possible, the research problem needs to be new. One should not target his investigation to the problem that had already been thoroughly investigated by other researchers. To be safe from such duplication, the researcher has to go through the record of previous studies in a given field. However, there are times where by a problem that has been investigated in the past could be worthy of study. A researcher may repeat a study when he wants to verify its conclusion or to extend the validity of its findings in situation entirely different from the previous one.

Is the problem significant?

The question of significance of the problem usually relates to what a researcher hopes to accomplish in a particular study. What is his purpose in undertaking to solve the particular problem he has chosen? What new knowledge does he hopes to add to the sum total of what is known? And what value is this knowledge likely to have? When these all questions are answered clearly by the researcher, the problem should be considered for investigation.

The researcher should show that the study is likely to fill the gaps in the existing Knowledge to help resolve some of the inconsistencies in previous research or to

help in the reinterpretation of the known facts. The findings should become a basis for theory generalization, or principles and should lead to new problems further research.

Is the problem feasible?

In addition to the above-stipulated points, the feasibility of the research problem should also be examined from the point of view of the researcher's personal aspects as stated hereunder.

Researcher Competence: The problem should be in an area in which the researcher qualified and competent. Before indulging into investigation of the problem, the researcher has to make sure that he is well acquainted with the existing theories, concepts and laws related to the problem. He must also possess the necessary Skills and competence that may be needed to develop, administer, and interpret the necessary data gathering tools. What is more, he needs to consider whether he has the necessary knowledge of research design and statistical procedure that may be required to carry out the research through its completion.

Interest and enthusiasm: The researcher has to make sure that the problem really interests him. He must also be truly enthusiastic about the problem. If the problem is chosen properly by observing these points, the research will not be boring; rather it will be love's labor.

Financial consideration: Research is an expensive endeavor, which requires a great deal of money to invest. In this regard, the researcher should ascertain whether he has necessary financial resources to carry on the investigation of the selected problem. An estimate of the expenditure involved in the data gathering equipment, printing, test material, travel, and clerical assistance to be specified. Furthermore, the possible sources of fund must be consulted ahead of time.

Time requirement: Research should be undertaken within a given scope of time, which was allocated, with careful analysis of the prevailing situation. Each and every activity of a research process requires time. Particularly, it is worthwhile to

plan for the time that will be needed for the development and administration of tools, processing and analysis of data, and writing of the research report. While allocating time for research project, care should be taken for the researcher's other engagement or commitments, the respondents' accessibility, the expiry data of the required data.

Administrative consideration: The researcher has to pay to all administration matters that are necessary to bring his study to its full administrative matters that are necessary to bring his study to its full completion. In this regard the researcher should consider the kinds of data equipment, specialized personnel. And administrative facilities that are needed to complete the study successfully. The researcher must assure whether the pertinent data are available and accessible to him.

Hypothesis

Hypothesis form is employed when the state of the existing knowledge and theory permits formulation of reasonable prediction about the relationship among variables.

The word hypothesis is a compound of two words, "hypo" and "thesis". Hypo means, under or below and thesis means a reasoned theory or rational viewpoint. Thus, hypothesis would mean a theory, which is not fully reasoned.

Hypotheses are a set of suggested tentative solution of a research problem, which can be or may not be a real solution.

Research hypothesis differs from research question in that, hypothesis both indicate the question in testable form and predict the nature of the answer. Hypothesis proposes a relationship between two or more variables. In other words, hypothesis is a theory entertained in order to study the facts and examine the validity of the theory. The task of the researcher in this case will be to establish and test such hypothesis.

Establishing a hypothesis should follow rules like:

- The variables must be clearly specified and measurable by some techniques we know
- The relationship between them must be stated precisely.

Importance of Hypothesis

A well-grounded hypothesis provides the following advantages

- Represents specific objective, which determine the nature of the data needed to test the proposition
- Offer basis for selecting the sample, the research procedure, and the statistical analysis needed.
- Keeps the study restricted in scope thereby preventing it from becoming too broad
- Sets a framework for reporting the conclusion of the study.

Criteria of usable hypotheses

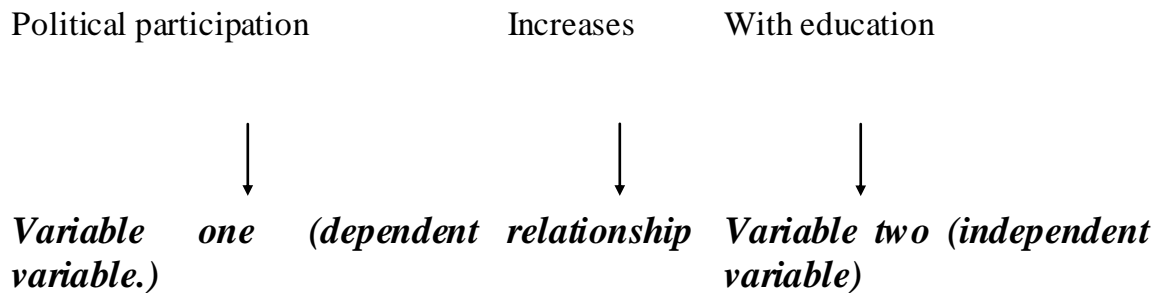
Hypotheses can be useful if and only if they are carefully formulated. There are several criteria used to evaluate hypothesis. These include the following.

- Hypotheses should be clearly and precisely formulated
- Hypotheses should be formulated in such way that, they can be tested or verified (should be testable)
- Hypothesis should state explicitly the expected relationship between variables
- Hypotheses should be limited in scope. Hypotheses of global significance are not usable as they are not specific and simple for testing and drawing conclusions.

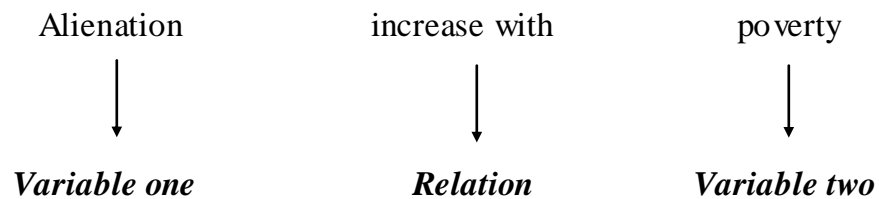
- Hypotheses should be consistent with the known facts. In other words hypotheses should be grounded in a well-established facts, theories or laws.
- Hypotheses should be stated as much as possible in simple terms. The simple statement helps to gain the following advantages
 - i. It becomes easily understandable to others (readers)
 - ii. It become easily testable
 - iii. It provides a basis for a clear and easily comprehended report at the completion of the study.
- The hypotheses selected should be amendable to testing with in a reasonable time.

Some examples of Hypothesis.

Hypothesis: 1



Hypothesis: 2.



The result of the hypothesis test is the substance of our conclusion and expressed as generalization.

Sources of Research problem

There are some important sources of problems, which are helpful to a researcher for selecting a problem. These include the following

Professional experience: One of the sources of problem for beginner researcher is his own experience as a professional in a given field. The day-to-day observation of the incidences is the working place and out of the working environment, which includes the experience of his colleagues, their attitude, home environment, social-economic status and motivation level provide rich sources of the problem.

Inference from theory. A research problem can be derived from a critical look into different theories. In other words application of some general principles involved in different theories to specific situation makes an important starting point of research.

Technological and social changes: Technological and social change directly or indirectly exerts an influence in the function of an organization. All such change brings about new problems for research. For instance, change may affect policy issues in which case they may arouse interest in investigating new policies among the policy analysts or other concerned personalities.

The following points may be considered in selecting a research problem.

- A subject that is overdone should not be normally chosen, for it will be a difficult task to throw any new light to such a case.
- Governmental subjects should not become a choice of an average researcher.
- Too narrow or too vague problems should be avoided.
- The subject selected for research should be familiar and feasible so that the related research material or source of research is within one's reach.

- The importance of the subject, the qualification and the training of researcher, the cost, the time factor are the few points that must be considered in selecting a problem.

CHAPTER THREE

Research Design (Planning the Research Project)

3.1. Meaning of Research Design

A researcher after defining and properly formulating a research problem as a next step he has to prepare a research design or plan of the research work.

Research design is a plan of collecting and analyzing data in an economic, efficient and relevant manner. It is a plan of organizing framework for doing the study and collecting the necessary data.

In other words research design is nothing but the conceptual structure with in which research is conducted. It constitutes the blue print for collection, measuring and analysis of data.

Whatever be the nature of the research design the following general rules should be followed in planning and preparing a research design

- i. Define the nature and scope of the problem
- ii. Specify the related variables (specify the sources and types of information needed)
- iii. Exclude the variable not relevant to the study
- iv. Start with the logical hypothesis.

Generally, the research design includes an outline of what the researcher will do from formulating the hypothesis and its operational implication to the final analysis of data. The design decision should be oriented in answering the following question.

- i. What is the study about?

- ii. Why is the study being made?
- iii. Where will be the study being carried out? Here a researcher is expected to define place and the research target population
- iv. What types of data are required?
- v. Where can the required data be found and what techniques of data collection will be used?
- vi. What period of time will the study include?
- vii. What will be the sample design?
- viii. How will be the data analyzed?
- ix. In what style will the report be prepared?

Need for research Design

Why we need to have a research design? Research design is necessary because:

- It facilitates the smooth sailing of the research operation
- It makes research project as efficient as possible and help to yield maximum information with minimum expenditure, time and effort.
- It helps the researcher to organize his ideas in a form where by it will be possible for him to look for flaws and inadequacies
- Design will be given to others for their comment and critical evaluation. In absence of such course of action, it will be difficult for the critics to provide comprehensive review of the proposed study.

Features of research design

Important features of a good research design can be summarized as follow:

- It is a plan that contain a clear statement of the research problem and specifies the source and types of information relevant to the research problem

- It is a strategy specifying which approach will be used for gathering the data or the relevant information
- Indicate the population to be studied and methods to be used in processing and analyzing the data
- It also tentatively includes the time and cost budgets, since most studies are done under these two constraints.

3.2. Important concepts relevant to research design

- Dependent and:** If one variable depends upon or a consequence of the other variable is called a dependent variable. Is a variable that is to be predicted or explained?
- Independent variable:** is a variable that is expected to influence the dependent variable.
- Extraneous variable:** Independent variables that are not related to the purpose of a study, but may affect the dependent variable are termed as extraneous variable.

E.g., if some one wants to test the relation ship between intensity of light on the level of productivity, other variables like age of workers, heat in the working place or personal problem of worker may as well affect the level of productivity. Since they are not related to the purpose of a study, they are called extraneous variable.

- Control:** A good research design has to minimize the influences of extraneous variable. To do so the researcher uses control as a remedy to minimize the effects of extraneous variable. In experimental research control refers to restrain to experimental condition.
- Confounded relationship:** When dependent variable is not free from the influence of extraneous variable, then the relationship between dependent and independent variables is said to be confounded an extraneous variable.

- vi. **Experimental and control groups:** In experimental research when a group is exposed to usual condition is called control group, but when a group is exposed to special condition is an experimental group.
- vii. **Treatments:** The different condition under which experimental and controlled groups are put are referred to us treatment. The usual study program and the special study program are an example of two treatments in studying the effects new or special study program on performance of students.
- viii. **Experiment:** The process of examining the truth of a statistical hypothesis, relating to some problem, is known us an experiment. E.g., examining the usefulness of a newly developed drug is an example of an experiment. Experiment can be comparative or absolute experiment. If we want to determine the impact of newly developed drug against the existing drug is an example of comparative experiment. But the previous example is an example of absolute experiment.
- ix. **Experimental unit:** the pre-determined plots (or blocks or group) where different treatments are used are known experimental units.

3.3. Forms of research Design

Research design is unique to a methodology. Two broad methodology groups can be used to answer any research problem. These are experimental and non-experimental. The main difference between these two methodologies lies in the control of extraneous variables and manipulation of at least one independent variable by the intervention of the investigator in experimental research.

Take for instance the previous example “The impact of intensity of light in the working places on workers productivity”.

Here the researcher can manipulate the independent variable, i.e., intensity of light. The researcher by changing light intensity in the working place can observe the level of productivity and compare the result recorded.

But in non-experimental research, there is no intervention beyond that needed for the purpose of measurement of the variable in question.

3.3.1. Research design for non-experimental research.

A) Design for Exploratory research study:

Exploratory research is a research aimed at identifying and formulating a research problem or developing working hypothesis. The main purpose of such study is only formulating a problem for further, precise investigation or of developing the working hypothesis from an operational point of view.

The major concentration in such study is on the discovery of ideas and insights. An exploratory study is often used as introductory phase of a large study and results are used in developing specific technique for the larger study. The design for such study is characterized by a great deal of flexibility. Since no clear hypothesis has been developed about the problem, the following forms of research design can be used.

- i. **The survey of concerning literature.** This is the most simple and fruitful method of formulating precisely the research problem or developing hypothesis. Hypothesis stated by earlier works may be reviewed and their usefulness be evaluated as a basis for further research.
- ii. **Experience survey:** This implies the survey of people who have practical experience with the problem to be studied. The objective of such survey is to obtain insight into the relationship between variables and new ideas relating to the problem.

For such purpose people who are competent and can contribute new ideas are carefully selected as respondent and the investigator then interview them

The researcher must prepare an interview schedule, which ensures flexibility in a sense that the respondent should be allowed to raise issues and questions, which the researcher has not previously considered.

It is advisable to send a copy of interview schedule to be discussed to the respondent well in advance.

iii. **Analysis of insight (Examining analogous situation):** is also important method for suggesting hypothesis for research.

It is particularly suitable in areas where there is a little experience to serve as a guide. This method consists of intensive study of selected instances of the phenomenon. For that purpose the existing records may be examined (if any). The unstructured interview may be conducted. The question however is that what type of examples (instances should be selected and studied?

The instances commonly chosen in social science are like

- Cases that provide sharp contrasts or
- Cases having striking features are considered to be relatively more useful to identify problems

Example

- Reaction of stranger
- The reaction of marginalized people
- The study of individuals who are in transition
- The reaction of people from different social strata

iv. **Examination of case histories:** is one of the older methods of research in any branch of science. Case histories that are similar in content are generally available and provide very important area of investigation for exploratory study. However, the result of the investigation of case histories is always to be considered as suggestive rather than conclusive.

B). Research design for descriptive study:

Descriptive researches are those studies, which are concerned with describing the characteristics or function of a particular individual, or of a group or a phenomenon. Most of social researches come under this category.

This study involves the description of the extent of the association between two or more variables. Although association can be used only to infer but not to establish a causal relationship, they are often useful for predictive purpose.

Descriptive research in contrast to exploratory research is marked by the prior formulation of specific research problem (question). Investigator already knows a substantial amount about the research problem, may be as a result of exploratory study, before the project is initiated. Thus, the researcher should be able to define clearly, what he wants to measure and setup appropriate and specific means for measuring it.

In descriptive research the researcher needs to define not only what he wanted to measure but also must find adequate method for measuring it along with a clear-cut definition of population he wants to study. Since the purpose is to obtain complete and adequate information, the procedure to be used must be carefully planned. Thus the design in such study must be rigid and must focus on the following:

- Formulating the objective of the study
- Design the method of data collection
- Select the sample of the study (sampling)
- Collect the data relevant for the study
- Processing and analysis of the data collected
- Reporting the findings

- ***Formulating the objective of the study (what is the study is about? why is it being made?):*** The first step in descriptive study is to specify the objective with sufficient precision to ensure that the data collected are relevant.

- ***Design the method of data collection:*** After formulating the objective of the study next comes planning the method of data collection. First of all the researcher has to determine the relevant and type of data needed to the study. After defining the relevant information needed for the designed study, method of data and technique for collecting them must be devised. Method of data gathering (like, observation, questionnaires, and etc) with their merit and limitation are considered and the best one is selected for the particular study

- ***Select the sample of the study (sampling):*** In most, if not all, studies the researcher takes out sample(s) and then wishes to make statements about the population on the basis of the sample analysis. In short sampling has to be designed. There are different sample techniques among which the appropriate sampling technique would be selected. The sample expected to be representative and yielding accurate information with a minimum amount research effort.

- ***Collect the data relevant for the study (Plan of data collection):*** To obtain data free from errors introduced by those responsible for collecting them, it is necessary to supervise closely the staff or field workers as they collect and record information. As data are collected, they should be examined for completeness, comprehensibility, consistency and reliability.

- ***Processing and analysis of the data collected:*** The data collected must be processed and analyzed. Data processing design includes steps like coding the interview replies, observation, tabulating the data; and performing several statistical computations. To the extent possible, the processing and analyzing procedure should be planned in detail before actual work started.

- **Reporting the findings:** Finally, last of all comes the question of reporting findings. This is the task of communicating the findings to others and the researcher needs to be well planned so that all things relating the research study may be well presented in simple and effective style.

Such design appropriately referred to as a survey design since it takes into account all the steps involved in a survey research.

3.3.2. Research design for experimental research

Experimental studies are those in which the researcher can control and manipulate at least one of the independent variable and test the hypothesis of causal relationship between variables.

Experimental design refers to the framework or structure of an experiment. The study of experimental design has its origin in agricultural research. Planning of such design was made first by Fisher (1960) when he was working at center of Agricultural Research in England. Today, the experimental design being used in researches relating to phenomenon of several disciplines.

Basic principle of experimental design

Fisher has enumerated three principles of experimental design.

1. **The Principle of Replication:** the experiment should be repeated more than once. That is, each treatment is applied in many experimental units instead once. By doing so the statistical accuracy of the experiment is increased. Replication is introduced in order to increase the precision of the study.

Suppose the researcher want to examine the effect of new teaching method on students' performance. The researcher can divide students' population into two groups, and one treatment (old teaching method) will be given to one group and the new teaching method to another group. After treatment the result is

compared in both groups. Applying this principle implies the students population is divided into more than one group and each treatment is given more than once.

- 2. The Principle of Randomization:** This principle of experiment is applied in order to reduce the effect of extraneous factor by randomizing the application of treatments. In other words, this principle indicates that we should design or plan the experiment in such a way that the variation caused by extraneous factor can all be combined under the general headings of “chance“. We can apply the principle of randomization to the above example.

To reduce the effect of extraneous variable, which is intelligence, a researcher can randomly assign students in different groups or we can apply different treatments randomly.

- 3. The Principle of Local Control:** This is also another important principle of experimental design. This is used to measure and eliminate the variability caused by extraneous variable. The extraneous factor, the known sources of variability, is made to vary deliberately over as wide a range as necessary and this need to be done in such a way that the variability it causes can be measured and hence eliminated from the experimental error.

Here the researcher will try to fix the extraneous variable. The students are divided on the basis of their IQ. Students in each IQ level are divided into two groups and each group is given different treatment and results are compared. By doing so the effect of extraneous variable (intelligence) is controlled.

Forms of Experimental design

The experimental design can be classified into two categories.

- 1) Informal Experimental Designs
- 2) Formal Experimental Design

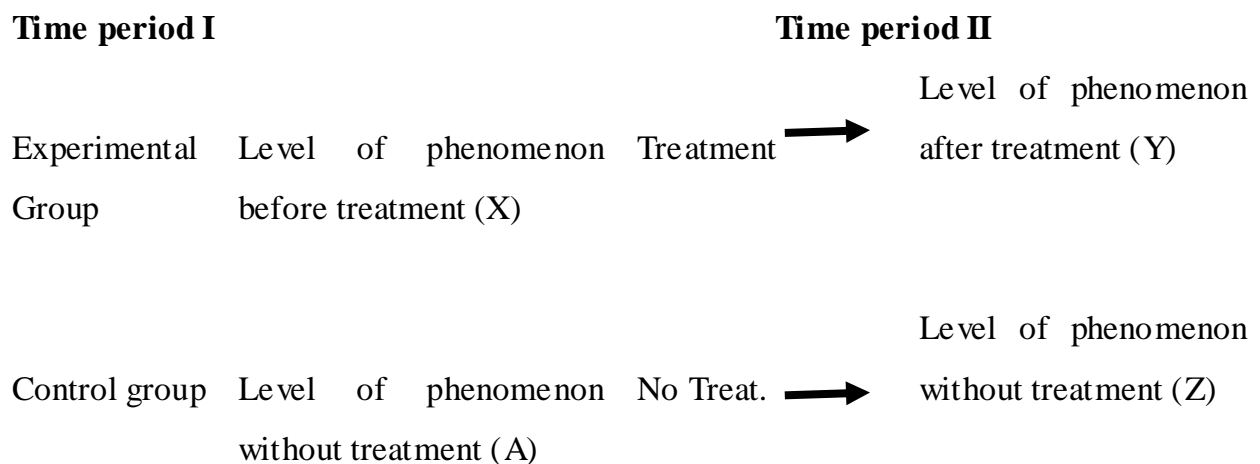
Experimental Group **Treatment introduced** \longrightarrow **Level of the phenomenon after treatment (Y)**

Control group **No treatment** \longrightarrow **Level of the phenomenon without treatment (Z)**

Under this design the basic assumption is that the two groups are identical with respect to their behavior towards the phenomenon considered. That is, there is no group variation receiving different treatments.

If this assumption is not true, there is a possibility of extraneous variation entering into the treatment effect. However, data can be collected in such design without the introduction of problems with the passage of time. In this respect this design is superior to Before- And- After without Control Design.

C). Before And After With Control Design: Under this design two groups are selected and the dependent variable is measured in both groups for an identical time period before the treatment. The treatment is then introduced into the test area only, and the dependent variable is measured in both areas in identical time period after the introduction of the treatment.



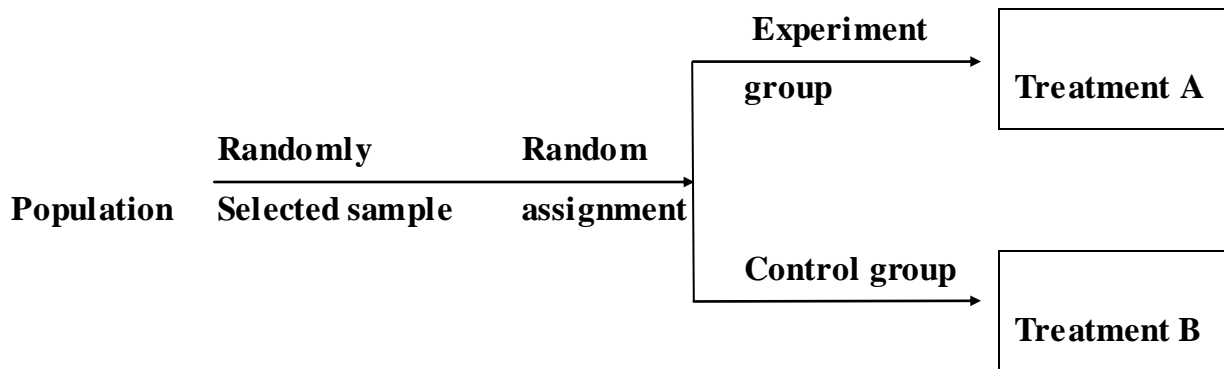
The treatment effect then will be; $T.E = (Y-X) - (Z-A)$

This design is superior to the above two design for the simple reason that it avoid extraneous variation resulting both from the passage of time and from non-comparability of the test and control area.

2). Formal experimental design.

Formal experimental design can have the following forms:

- i. Complete - Randomized-Design (CRD)
 - a) Two Groups Simple Randomized Design
 - b) Random Replication Design (RRD)
 - ii. Random Block Design (RBD)
 - iii. Latin Square Design (LSD)
 - iv. Factorial Design
 - a) Simple Factorial Design
 - b) Complex Factorial Design
- i) Complete Randomized design (CRD):** Involves only two principles Viz., the principle of randomization and the principle of replication. It is the simplest possible design and its procedure of analysis also easier. Such design is generally used when experimental area happens to be homogeneous. Technically, when all the variation due to uncontrolled extraneous factor are included under the heading of “chance variation” Commonly known forms of C.R.D presented shortly
- a) Two Groups Simple Randomized Design:** In this form of design, first the study populations are defined and then from the population a sample is selected randomly. Further, requirement of this design is that item after being selected randomly from the population, be randomly assigned to the experimental and control group (such random assignment of item to two groups is technically describe as principle of randomization). Thus, this design yields two groups as a representation of the population.



In the simple randomized design elements constituting the sample are randomly drawn from the same population and randomly assigned to the experimental and control group, then it become possible to draw conclusion on the basis of samples applicable for the population. The two groups (experimental and control) of such a design are given different treatments of the independent variable. This design of experiment is quite common in research studies concerning behavioral science. The merit of such a design is that it is simple and randomizes the difference among the sample items. But the limitation of it is, that the individual differences among those conducting the treatments are not eliminated, i.e., it does not control the extraneous variable and as such the result may not depict a correct picture.

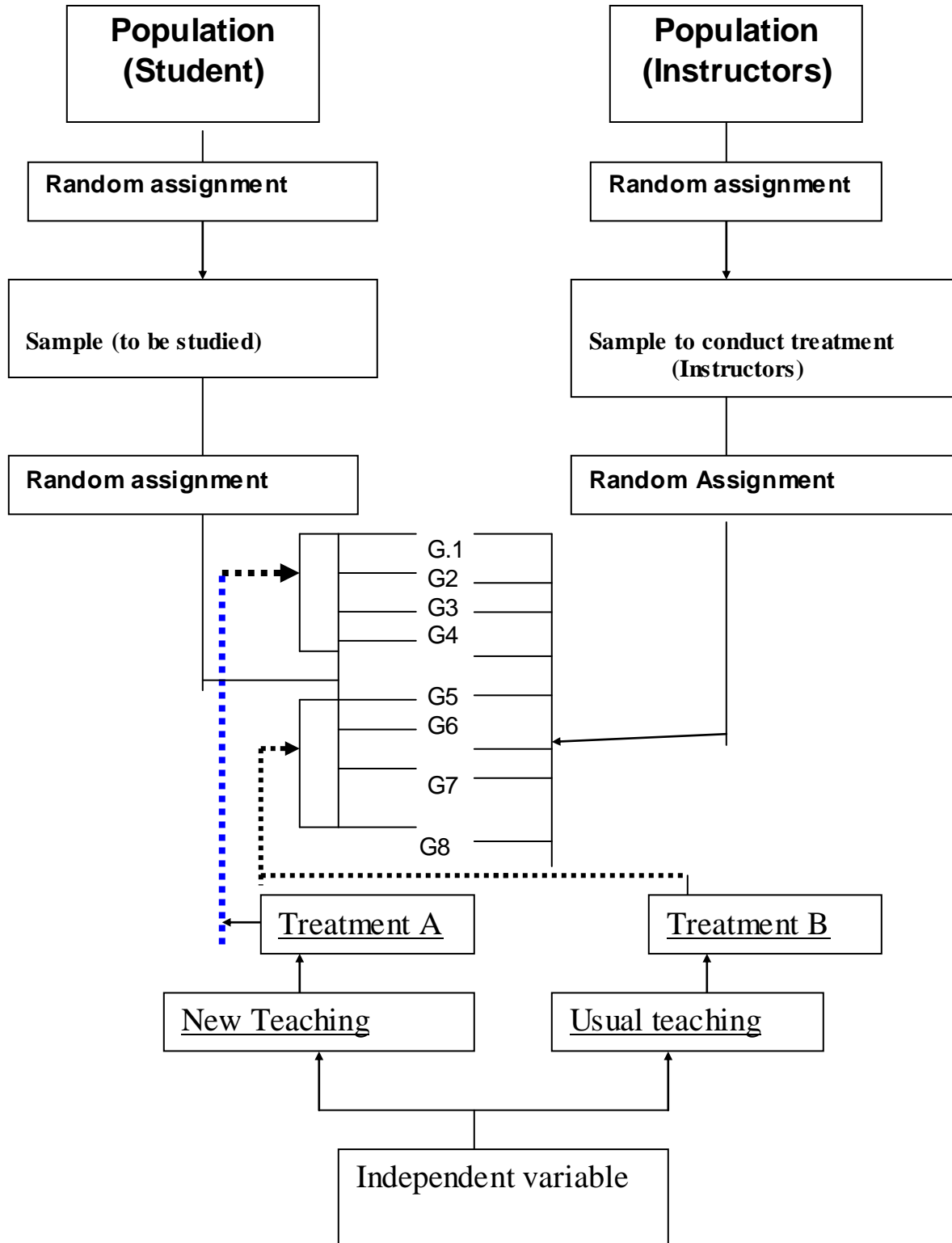
E.g., consider the previous example, suppose the researcher wants to compare the two teaching methods so as to select the superior and effective training system. The researcher randomly selected groups of students and assigned them into two groups randomly.

Two different treatments viz., the usual teaching and the new teaching are being given to the two groups. The researcher hypothesized “**greater gain for the group receiving new training**”. To determine this, he tests each group before and after the training. And then compares the level of gain for the two groups to accept or reject this hypothesis.

The problem in this design is that it does randomize the students' population but not those who will give the treatment, that is, the instructors difference is not randomize.

b) ***Random Replication Design (R.R.D.):*** The limitation of the two group randomized design is usually eliminated within the random replication design. In previous case the extraneous variable was not controlled. In the above example, the effects of the extraneous independent variable, the differences like, the difference of teacher (instructors) in each group was not controlled. Therefore, under the (RRD) approach the teachers' differences on the dependent variable are minimized (reduced) by providing a number of repetitions to each treatment. Each repetition is technically called “Replication”. This situation is depicted in the diagram below.

Chart illustrating RRD of an experimental design



Random replication has two purposes:

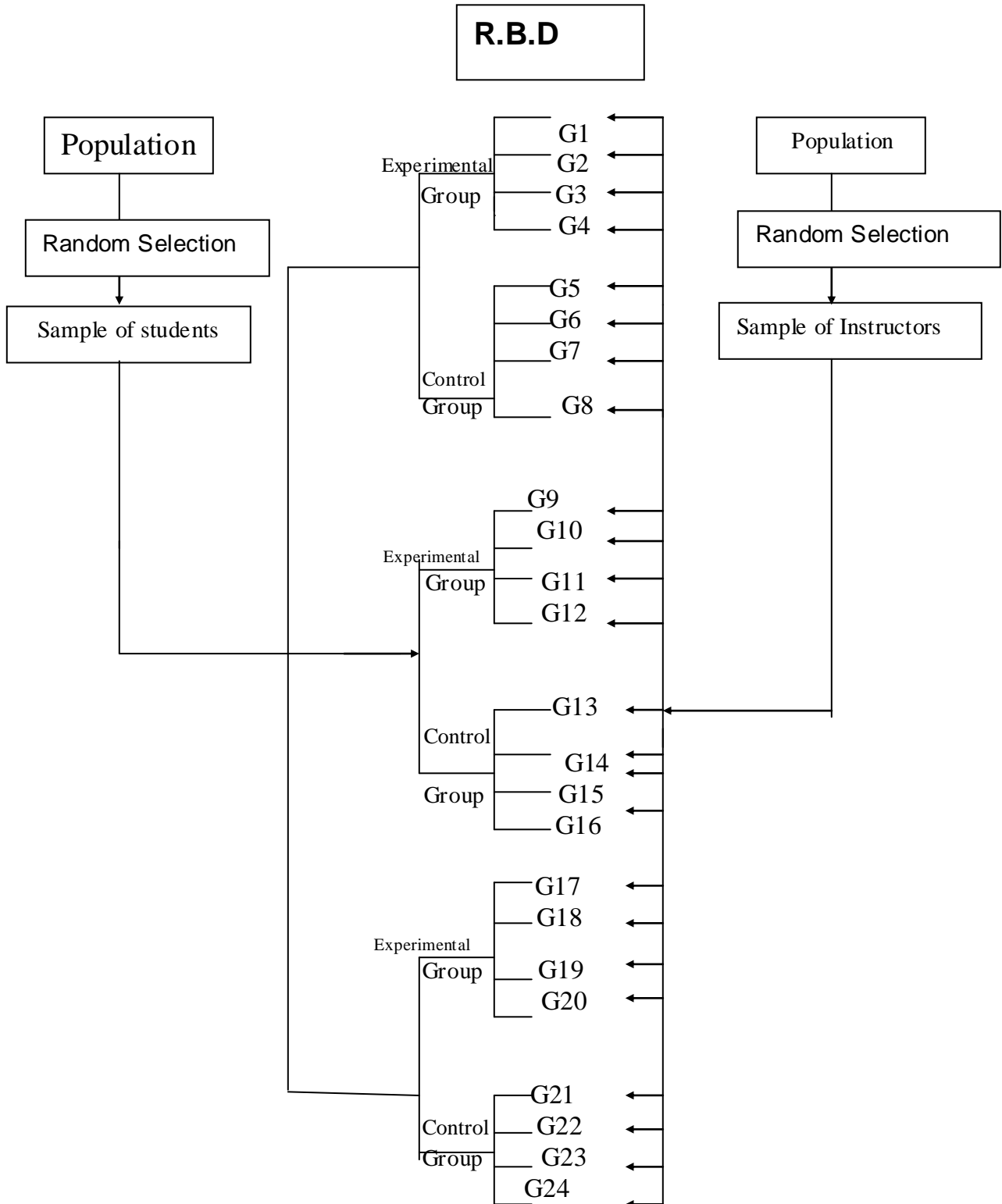
- It provides controls for the differential effects of the extraneous independent variables
- It randomizes any individual differences among those conducting treatment

Generally, the sample is taken randomly from the population available for study and is randomly assigned to, say, four experimental and four control groups. Similarly from the population available to conduct experiment (in our example the population of instructor) sample is taken randomly and randomly assigned to each group. By doing so the limitation of first approach (Two Groups Simple Randomized Design) will be improved and reduced and the effect of extraneous variable on dependent variable is controlled. The underlying assumption in this design is variables relating to both populations (students and instructors) characteristics are assumed to be randomly distributed between two groups.

ii. ***Randomized Block Design (R.B.D)***: Is an improvement over R.R.D. In this design the principle of local control can be applied along with the other two principles of experimental design. Under this approach subjects are first divided into groups (commonly known as block). Within each group (block) subjects are relatively homogenous with respect to some selected variable. The variable selected for grouping the subject is one that is believed to be related to the measures to be obtained in respect of the dependent variable. In above-mentioned example the variable selected to grouping the subjects (students) can be IQ level. Blocks are in general the levels at which we hold the extraneous factor fixed, so that its contribution to the total variability of data can be measured.

The main feature of the RBD is that in each treatment appears the same number of time in each block. The R.B. design is analyzed by two-way analysis of variance technique. The purpose of this randomization is to take care of such possible extraneous factor (say exhaustion, experience from repeatedly taking the test). This situation is depicted in the diagram below.

Chart illustrating RBD of an experimental design



iii. Latin Square Design (L.S.D.): Is an experimental design very common and frequently used in agricultural research.

The condition under which agricultural research is carried out is different from other study. Nature plays important role in agriculture for that matter; research design should try reducing the effect of nature on the result of the investigation.

In a L.S. design the field is divided into a number of blocks equal to the number of treatments. And each block will be again divided into a number of parts equal to the number of treatments. Each of the treatment is used in each of the block only once (whether column or row wise).

For example, consider the research, which tries to see the effect of different fertilizer rates on crop yield (say for different rates of fertilizers). Under this approach the field is divided into four blocks (hence the number of treatments are four) and then each blocks are divided into four parts again, such that each treatment will be applied once in each block.

Blocks			
Block1	Block 2	Block 3	Block 4
A	B	C	D
B	C	D	A
C	D	A	B
D	A	B	C

Where; A, B, C and D are different rates of fertilizers (treatments).

The advantage of this experimental design is that it enables the researcher to control the differences in soil fertility.

iv) Factorial Design: This design is used in experiment where the effect of varying more than one factor is to be determined. They are especially important in several economic and social phenomena where usually a large number of factors affect a particular problem. Factor design can be of two types

a) Simple factorial design: here we consider the effect of varying two factors on the dependent variable. This design is also termed as Two- factor-factorial design. Simple factorial design may be either 2x 2 simple factorial designs or it may be, say 3x4 or 5x3 or the like type.

This can be illustrated graphically as follows

2x2 simple factorial designs

Control variable	Experimental variable	
	Treatment A	Treatment B
Control level 1	Cell 1	Cell3
Control level II	Cell 2	Cell4

In this design the extraneous variable to be controlled by homogeneity is called control variable (level 1 and level 2, IQ level)

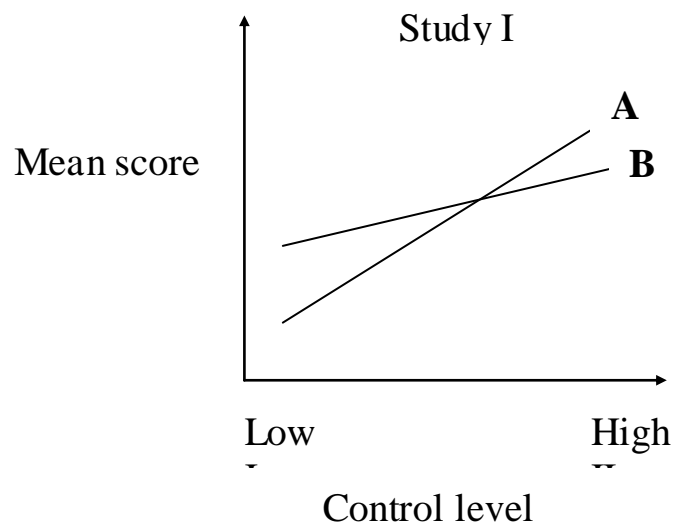
The independent variable, which is manipulated, is called the experimental variable. In above example we have two control and two experimental variables. Subjects are assigned randomly to each treatment in the same manner as in a randomized group design. The averages for different cells may be obtained along with the averages for different row and columns. Averages of different cells represent the means scores for the dependent variable. And the column means represents the main effect for treatment with out taking into account any differential effect due to the controlled variable. Similarly the row means represents the mean effects of levels i.e., the effects of controlled variable or the effects of extraneous variable with out treatment effect.

Here we can study the main effect of treatments as well as the main effect of controlled variable. The advantage of this design is that one can examine the interaction between treatment and controlled variable (level); through which we may say whether the treatment and level are independent of each other.

E.g., the data obtained in case of two simple factorial designs.

Study I data

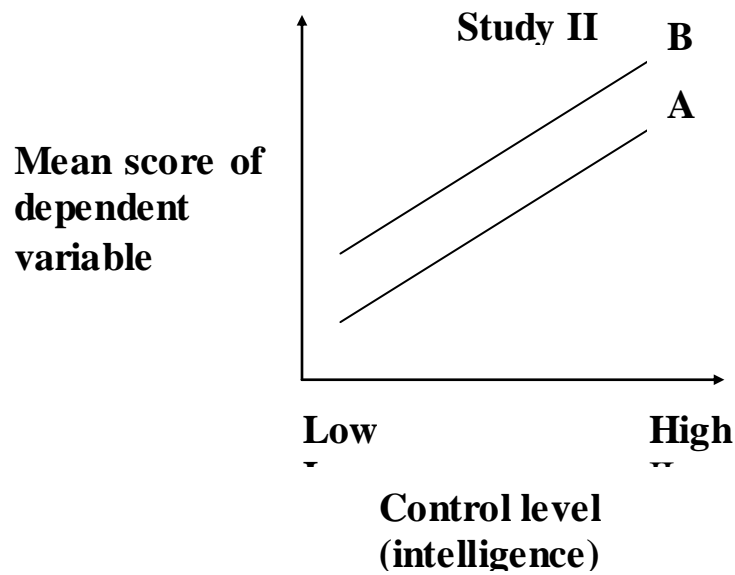
		Training		
		Treatment A	Treatment B	Row mean
Control (Intelligence)	Level I	15.5	23.3	19.4
	Level II	35.8	30.2	33.0
Column mean		25.6	26.7	



- The graph representing study I indicate that there is an interaction between the treatment and the level
- Which means the treatment and the level of intelligence are not independent of each other.

Study II data

		Training		
		Treatment A	Treatment B	Row mean
Control (Intelligence)	Level I(low)	10.4	20.6	15.5
	Level II (high)	30.6	40.4	35.5
Column mean		20.5	30.5	



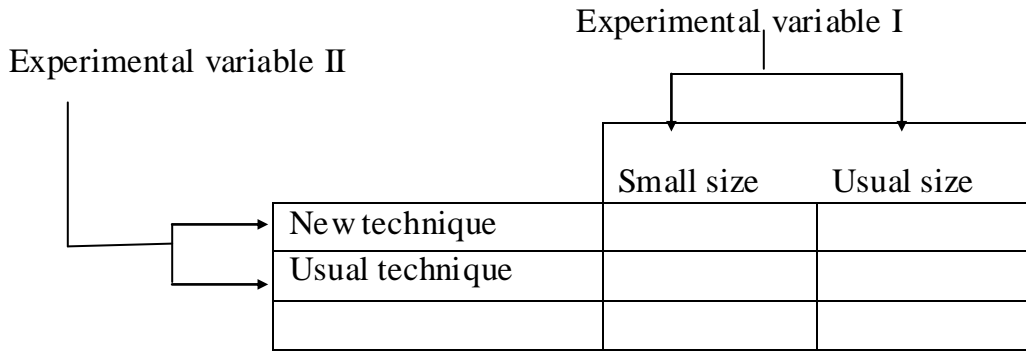
- Where as the graph relating study II shows that there is no interaction effect.
- Which means that treatment and level of intelligence in this study are relatively independent each other

The 2x2 design need not be restricted in the manner as explained above, i.e., having only one experimental and one control variable. It may also be of the type of having two experimental variables and or two control variables.

For example

- If the researcher wants to compare the effect of the size of the class as well as the introduction of the new instruction technique on the learning of a given course.

For this purpose he can conduct a study using 2x2 simple factorial designs. But here we have two experimental variables



- If the researcher uses a design for comparing male and female and senior and junior students in the collage as they relate to the knowledge of certain course. In this case we will have also 2x2 simple factorial designs.

4x3 Simple Factorial Design

The 4x3 simple factorial design will usually include four treatments of the experimental variable and three levels (control variables).

Control variable	Experimental variable			
	Treatment A	Treatment B	Treatment C	Treatment D
Level I				
Level II				
Level III				

This shows that a 2x2 simple factorial design can be generalized to any number of treatments.

- c) **Complex factorial design:** Experiment with more than two variables at a time involves the use of complex factorial design. This design is also called multifactorial design. It considers three or more independent variables simultaneously. In case of three factors design with one experimental variable having two treatments and two control variables, each one of them having two

levels. The design then will be a $2 \times 2 \times 2$, which is complex and its graph will have three dimensions.

The researcher can also determine the interaction between each possible pair of variables; such interaction is called first order interaction. Interaction between variable taken in triplets is called second order.

CHAPTER FOUR

Research Proposal and Guide to Prepare a Proposal

The term "research proposal" is coined from two words, research and proposal. Research has been defined in first chapter.

Proposal lexically means a course of, activity etc. proposed. Therefore, a research proposal can be defined as a written document requesting both authorization and funds to undertake a specific research project. It always includes a statement explaining the purpose of the study or a definition of the problem. It systematically outlines the particular research methodology and details the process that will be utilized at each stage of the research process

In research proposal:

- What information will be required?
- What research procedures will be implemented? Will be clearly specified so that others may understand their exact implications.

4.1 Function of the research proposal

Research proposal may function at least in three ways, namely, as a means of communication, as a plan and as a contract

i. Proposal as a means of communication serves to communicate the investigator's research plan to those who-give consultations and / or disburse fund. Proposal is the primary source on which the graduate students' **thesis or dissertation** committee must base the function of: review, consultation and more importantly, approval for implementation of the research project

In general, the quality of assistance and the probability of financial support will all depend directly on the clarity and justification of the proposal.

ii. Research proposal as plan helps the researcher to organize his idea in a systematic manner and to look for strengths and flaws. A successful proposal sets

out the plan in step-by-step detail. That is, it provides an inventory of what must be done and which materials have to be collected as a preliminary step.

Generally, the acceptability of results is judged exclusively in terms of the adequacy of the methods employed in recording, analyzing and interpreting the data in the planned study

ii. Proposal also functions as a contract. A completed proposal approved for execution and signed by all members of the sponsoring committee, constitute a bond of agreement between the researcher and that committee. An approved grant proposal results in a contract between the investigator (and often the university) and funding sources.

Proposal for thesis and dissertation should be in final form prior to the collection of data. Once document is approved in final form, neither the student nor the sponsoring faculty members should be free to alter the fundamental terms of the contract by unilateral decision.

Importance of the research proposal

The research proposal has the following importance.

- It serves as a basis for determining the feasibility of the research project.
- It provides a systematic plan of procedure for the researcher to follow.
- It gives the research supervisor a basis for guiding the researcher while conducting the study.
- It reduces the probability of costly mistake.

Preparation of a full-fledged proposal is not a one-time endeavor. But, is the result of continuous modification and amendment through discussion with experts in the field.

4.2. General Format and Elements of Proposal

There is no a hard and a fast format in scientific research proposal writing. It varies from one organization to anther and from one country to anther. Some

universities and funding agencies make very specific demand for the format of proposals. Others provide general guidelines for form and content. Though the format varies, the essence expressed in different proposal remains the same.

The major components (elements) of a scientific research proposal

1. Abstract
2. Introduction (background and justification), Objective of the study
3. Literature review
4. Material and methods (methodology)
5. Work plan (time budget)
6. Cost budget
7. References
8. Appendix

Each of them can have their own separate section in research proposal. Some can be merged some on the other hand can be split in to separate section or into further subsections.

1. Title:

- The title should be as explicit as possible and transparent
- It should be clear and short
- It should capture and reflect the content of the proposal. It should enable the readers to understand the concepts of the study

Try to get the title down to one line or two

2. Abstract:

Is summary, which reflects the whole content of the proposal (most of the time less than 300 words?)

Abstract should be concise, informative and should provide brief information about the whole problem to be investigated

The abstract of a proposal should contain the following points

- Title or topic of the research

- Statement of the problem and objective
- Methodology of investigation
- Expected result (tentative only if a researcher starts with a formulated hypothesis)

3. Introduction

This section in research proposal should give the general background of the study and the need for undertaking the study. It reviews the previous work to reveal what is known of the subject.

Some question to be addressed in this part may include:

- What are current and previous studies that have been made on the issues to be studied?
- What is the present gap in knowledge and current trend?
- What makes worth studying?
- Why has the problem not been solved yet?
- What do we intend to fill the gap or solve the problem?

If the researcher finds this section to be very vast he can add (split this section) a section (heading) called “rationale” and/or the problem statement.

4. The Rationale

The Rationale provides some of the reasons for doing the study and its importance. Citations from past research may be relevant here; likewise recent political and economic events, previous efforts to solve the problem that did not succeed can be mentioned. This section of the research proposal can be merged with the above (introduction) section or in the objective part of the proposal or in some cases where wider explanation and justification as to the rationale of the proposed study is needed it can be shown in a separate section.

5. Objectives

In this section, the proposal can indicate what is expected to occur and why, suggest the variables that determine a relationship, or provide an explanation for a

phenomenon that has been observed, which strengthens the proposal and research agenda.

Generally this section should focus on the points

- What is to be achieved by the proposed investigation has to be stated plainly and concisely
- Should be to the point and logically arranged
- Should be stated in a form which shows the relations between variables
- Must clearly state the target of the research activity, i.e., what kind of results are expected or sought from conducting research.

6. Literature review

Literature review means locating literature in a variety of sources reading it carefully and thoroughly organizing it into themes along with the line of investigation.

Objective of the literature review

- To establish a familiarity with a body of knowledge and establishes credibility: A review tells a reader that he knows the research in an area and knows the major issue.
- To show the path of prior research and how a current project is linked to it: A review outlines the direction of research on a question and shows the development of knowledge A good review places a research project in a context and demonstrates its relevance by making connections to a body of knowledge.
- To integrate and summarize what is known in the area. A review pulls together and synthesizes different results. A good review points out areas where prior studies agree, where they disagree, and major questions remain. It collects what is known up to a point in time and indicates the direction for future research.

- To learn from others and stimulate new ideas. A review tells what others have found so that a researcher can benefit from the efforts of others. A good review identifies blind alleys and suggests hypotheses for replication. It divulges procedures, techniques, and research design worth copying so that a researcher can better focus hypotheses and gain new insights.

Types of reviewed literature can be

- Theoretical works and review
- Methodological review
- Original findings and reviews of them

It takes a researcher over year to complete an extensive professional summary review of all the literature on a broad question. Reading or review for research could take place in three stages of the research project. These include the following

1. At the beginning of the research: the objective here is
 - To check what other research has been done
 - To focus your idea, and
 - To explore the context for your project
2. During your research: with the objectives of
 - keeping your interest and up to date with development
 - helping you better understand the method you are using and the field you are researching and,
 - serving as a source of data
3. After your research, with the objectives of
 - seeing what impact you own work has had, and
 - helping you develop ideas for further research project

It is not necessary to have a separate heading for the review of literature in a proposal. In many respects it is more useful to show that such a review has been made by citing useful literature in problem statement (introductory part),

objective, methodology and where ever this information has been helpful in developing the research proposal.

The researcher may decide to have a separate heading for review literature when he wants to develop theoretical frameworks reviewed from different sources, detailed explanation and extensive references of the research outcomes related to the proposed study.

7. Material and Methods (Methodology) or Data and Methodology

The methodologies are the core and the largest part of the scientific research proposal. The methodologies are largely descriptive. This section is an essential prerequisite for validating the results and hence acceptability of the proposal.

An accurate, clear and valid methodology is required so that peers can:

- ◆ replicate the experiments described in an experimental research
- ◆ modify them with the assurance that the modification is different from the original in particular way
- ◆ apply them under different conditions

Methodology should give full details to show how the research activity is going to be carried out. Since this section is the largest and the most important part of the research proposal, researchers are advised to split it in to sub-sections. Such effort makes the proposal transparent and clear to the readers as well as to the reviewing committee and therefore, minimizes the risk of being rejected by a research committee (examiners board).

The suggested sub-sections can be:

- Data (materials)
- Methodology (methods) used

7.1. Data (some authors prefer Materials)

In this subsection of the methodology, information required to attack the problem is explained. Each variable or indicator identified by a researcher is explained and justified to show how it is relevant to the current study. The source of the data, the site (location) of the study and time that will be included (relevant time period) should also be specified. Detailed techniques of sampling, data collection and method of analysis would be left to the next sub section. This is important particularly when a researcher plans to collect primary data to test the basic hypothesis.

7.2. Methods (Methodology)

In this subsection the details of all technical matters will be explained, which includes,

Method of data collection: How the data are obtained from earlier specified sources? There are different methods to collecting primary data. All available methods are expected to be considered by a researcher and the best one is selected. The researcher explains and justifies how his selection of a particular method is relevant and appropriate to his study.

Method of sampling: From which elements are the data collected? The researcher has to specify the elements from which the desired information is collected and how these elements are selected. There are different sampling techniques. The researcher is expected to consider all of them and select the one, which is appropriate for the current study. Justification of his choice of a particular sampling technique is relevant here. The sample size should also be specified with its method of sample size determination.

Method of analysis: Once the information is collected how it will be processed and analyzed should also be explained in this part. Particularly if the researcher uses mathematical models like simple or multiple regression, time series or

liner programming models, he has to show their mathematical derivations and relations briefly to demonstrate their relevancy for the current study.

Method of presenting the outcome: Some times it is worth to mention how the out come of the research will be presented to consumers (general public). This is important if the research is not a part of a particular study program (like, master or doctoral study).

8. Budget of Time:

A timetable explaining how the researcher expects to carry out his project and when each of the important phases will be completed is helpful to both the researcher and the reviewer. It is a plan in terms of numbers of weeks or months and expected completion dates. Commonly researcher presents it in a table form.

The length of time required for postgraduate study (Doctoral study) is determined by the budget of the time presented by students. Thus, researcher should be realist in budgeting his time.

9. Cost budget

Most proposals put together with the expectation that funding will be necessary and an itemized list of items needed to carry out the methodology is listed in some detail. Personal needs, including the principal researcher's time are included.

These are items like:

- Field expenses for data collection
- Pay for consultants where they are necessary
- Travel and all such items needed to be detailed
- A sum of money for contingencies

A carefully developed budget reflects the seriousness of the proposal and the degree to which it is a realistic assessment of what is needed.

9. Reference (Bibliography/ Literature cited)

All works cited in the proposal are listed either alphabetically or numerically at the end of the document usually under the heading of “**References or Bibliography**” Some conservative authors would like to make distinction between references and bibliography as mentioned below.

- **References:** are lists of literature, which have been cited in the text of a document
- **Bibliography:** includes also items, which were not cited but are relevant to the document.

There are several ways of making citation and recording references. The two main systems of referring are:

A) Harvard System: This system uses author’s name, date, and page reference. This system is used mainly by Anthropology, Social science and in life science research. Harvard system is commonly used in business research.

B) Vancouver System: uses in-text number instead of an author, date, and page reference. *The same superscript or bracketed text number is given in the text each time the source is sited.* It is used in the applied science such as chemistry, physics and mathematics. *Example:*

“In an investigation conducted in large factories, Gibbs¹ reported that absenteeism was higher on the night shift than the day”

Or

“In an investigation conducted in large factories, it has been reported that absenteeism on the night shift was measured and found to be significantly higher... Gibbs¹

Harvard System

Since this system is used in business research it is presented in some detail below.

- The reference list must include all published works referred to in the text.

¹ Gibbs, Jennifer M. (1993) ‘Absenteeism in SME’s’, International Small Business Journal, 13 (1), pp. 13-26.

- Each reference to a periodical publication must include, in order, the name(s) of the author(s), the year of publication, the full title of the article, the publication in which it appears, and the volume and inclusive page number
- Reference to a book must give the author or authors' name(s), the year, the title, the edition, if other than the first; the publisher, the city of publication, and the number of the volume (if two or more).

Example of some of the common types of literature citation as J. Hussey & R. Hussey (1997) put it presented here as follows

i.) Citation

Citation under the Harvard system:

In an investigation conducted in large factories, Gibbs (1993) reported that absenteeism was higher on the night shift than the day

Citing more than one authors

A number of research studies have been conducted into the effect of the recession on small business (Smith, 1984; Anderson, 1990; Jones, 1995)...

ii. Referring or listing the cited works

A) Reference for books

Davidson, Alan. B. (1994), the Pursuit of Business, London, Chapman & Halls

B) Reference for Journal article

Porter, Michael E. (1994), competitive advantage of nations, Harvard Business Review, 68(2), pp. 73-83

C) Other reference

It is possible to cite quote or paraphrase unpublished work if they are relevant to the study.

Unpublished works are:

- Personal communication with experts (professionals).
- Unpublished data collected by other researchers
- Unpublished research works
- Public speeches
- Conferences discussion and the like

The researcher should not put such an unpublished work in reference list unless it has been fully approved and a date set for its publication.

Unpublished references are not usually found or catalogued in libraries. And such unpublished reference should be placed in the body of the text, not in the reference list. Use parenthesis to enclose the complete name of the author, the year (if available) and appropriate title, location, or other information needed to establish the authenticity of the reference or help the reader locate it.

E.g.,

“” (David Lee, Cornell University, 1995 personal Communication)

It is also possible to use numbered footnote and will be referred to by using the number as a superscript at the proper position.

9. Appendix (Annex)

It is not mandatory to have this section. If the researcher thinks that having this section will increase the quality of the research proposal he is free to do so.

Information types provided in this section are those additional details, which are difficult to accommodate within the standard headings

Stuffs to be included in appendix:

- Detail Questionnaires and interview schedules
- Detailed experimental design (in experimental research)

- Detailed statistical procedures
- Samples of research materials (chemical and some biological materials)
- Survey and other geographic maps

CHAPTER FIVE

Sources of Information

Any research is based on various types of information. The more information the researcher has about the phenomenon the better will be his investigation, and explanation about it. Without information no investigation will be made.

Just as a building needs bricks and mortar for its construction, similarly, the research requires relevant information.

In order to carry on any research activity, information should be gathered from proper sources. The more valid is the sources of information, the more reliable will be the information received, which in turn, will lead to correct and reliable conclusion.

Different authors have classified the sources of information differently. Some of the most important views are of the following:

- i. **According to P.V. Young:** The sources of information can be classified into:
 - **Documentary sources:** These include books, manuscripts diaries and letters. Documents first written out (not published yet) or not printed are also included here.
 - **Field sources:** The information given by individual, obtained from field experiment, survey and observation

- ii. **According to W. A. Bagley,** the sources of information in the field of social science may be classified into:
 - **Primary source:** Include the actual information received from individuals directly concerning the problem of the study. It also includes observed social phenomenon and facts that may be discovered.

- **Secondary sources of information:** These include all types of published and unpublished, public or private documents and other such types of information.

iii. **According to G.A. Lundberg:** The sources of information may be classified as:

- **Historic sources,** which includes sources representing the past incident, for example, documents, papers and stone inscriptions concerning past articles discovered through excavations.
- **Field sources:** Include information received from concerned persons and also through the observation of their behavior.

Generally, the sources of information are of two types, i.e., **primary sources and secondary sources of information.**

1. Primary sources of information: The information obtained from primary sources is often called as primary data.

Primary data: Are those information gathered by researcher himself and are gathered for the first time, thus, happening to be original. The sources of such information are individuals and the incidence around them.

These data are obtained by means of questionnaires and schedules or some other techniques. In some fields primary data are collected through interview and observation method. The observation method, for collecting primary data, may be either participant or non-participant.

Such data are known as primary because they are gathered by the researcher himself from the field of research directly and for first time.

2. Secondary sources of information: These sources of information are called “secondary data”. Secondary data are those, which have already been

collected by some one and which, have already been passed through statistical process.

Secondary data are information, which are gathered or obtained indirectly. The researcher does not obtain them himself or directly rather he gathered them from published and unpublished material. Secondary data are collected by the individuals and/or institution for their own use through personal diaries, letters and survey documents etc.

The primary sources of secondary data are:

- Personal document such as diaries, letters, photographs and so on.
- Public documents such as books, manuscripts, records, census reports of survey by private and public institution; and various information published in newspapers and magazines.

CHAPTER SIX

Methods of Data Collection: Primary Sources

The task of data collection begins after a research problem has been defined and research design/ plan worked out. Before deciding the method of data collection, the researcher should be aware of the existence of two types of data i.e., primary and secondary data. The researcher has to decide which sort of data he will be using for his study and accordingly he has to select one or the other method of data collection.

The method of collecting primary and secondary data is different. Primary data are to be originally collected, while secondary data; the nature of data collection work is that of compilation.

Collection of primary data

We collect primary data during the course of doing experiment in an experimental research. But in case of non-experimental research a researcher conducts survey to obtain primary data either through:

- Observation
- Direct communication with respondent in one form or another
- Personal interview

There are several method of collecting primary data particularly in survey and descriptive research. Commonly used methods of collecting primary data are discussed below.

- i. Observation method
- ii. Interview
- iii. Self administered Questionnaires
- iv. Schedule (Interview Questionnaires)
- v. Focus Group Discussion (FDG)

- vi. In-depth interview, etc.

6.1. Observation method

Observation is the primary source of information especially in studies related to behavioral science. We all observe things around us, but this type of observation is not scientific observation.

Observation becomes scientific tools and methods of data collection:

- When it serves a formulated research purpose
- When it is systematically planned and recorded
- And it is subject to checks and controls on validity and reliability.

Under this method the researcher should personally and directly observe the condition and incidence of his fields of study. The researcher would not ask anything from respondents.

For example, in a study related to consumers' behavior, the investigator instead of asking the brand of say, wristwatch used by the respondent may himself look at the watch.

Direct observation is the most reliable method for gathering information related to the life style, status, conduct, behavior, language, custom and tradition and the like phenomenon. The observer should be absolutely detached and objective in gathering facts

The main advantages of this method

- Information obtained under this method relates to what is currently happening. It is not complicated by the either the past behavior or future intention or attitude.
- It is independent of respondents and is not demanding the active cooperation of the respondents.

Limitation of observation method

- It is an expensive method
- The information provided by this method is very limited
- Sometimes unforeseen factors may interfere with the observation task
- Some people or phenomenon are rarely accessible to direct observation

The researcher using this method should decide priory:

- What should be observed?
- How the observation should be recorded?
- How the accuracy of observation can be ensured?

6.1.1. Participant Vs Non-participant observation

A) **Participant observation:** The researcher lives in the group or in the community as a member of it and participates in their life. He experiences what the member of the group experience.

Advantages of this approach

- The researcher is enable to record the natural behavior of the group
- The researcher can even gather information which could not easily be obtained if he observe in a disinterested fashion
- The research can verify the truth of the statement made by informant in the context of the study

Limitation of this method

- The observer may loss the objectivity to the extent he participate emotionally
- The problem of observation control is not solved
- It may narrow down the researcher's range of experience.

B) Non-participant observation: The researcher does not participate in the group life but observe as an external spectator. Under such approach the presence of the researcher is unknown to the people.

Advantages of this approach

- Check and control is possible
- Since the observer is not a part of a group he is less subjective
- Wider range of experience can be obtained

Limitation of this approach

- Internal information can not be obtained
- Since the presence of the observer is known, it is very hard to observe the natural behavior of the observed object

The choice between participant and non-participant observation depends up on factors like,

- Purpose of the study (type of the study)
- The cost of the research or availability of fund to carry out the research
- Availability of time (time consideration)
- Accessibility of the group or community (whether it is possible to be a part of a community or that group)
- Convenience to the observer

6.1.2. Control Vs uncontrolled observation

A) Uncontrolled observation: Is the observation, which takes place in natural setting. Here no attempt is made to use precision instruments. The main aim of this type of observation is to get a spontaneous picture of life or person. The main weakness of uncontrolled observation is that of subjective interpretation.

B) Controlled observation: Observation takes place according to definite pre-arranged plans, including experimental procedure. In this observation we use mechanical (or precision) instruments as aids to accuracy and standardization.

Controlled observation takes place in various experiments that are carried out in a laboratory or under controlled condition.

6.1.3. Structured Vs Unstructured

A) Structured Observation: It is structured and preplanned observation technique. This observation is characterized by a careful definition of units, the style of recording the observation information; standardize conditions of observation and the selection of pertinent observation. Such observation is appropriate in descriptive research. The approach followed in the observation process is specified in detail. It includes

- The behavior to be observed
- The unit of observation
- Subject of observation (women, adult, etc)
- Conditions of observation (time of observation, place of observation, approaches of observation, etc
- Style of recording the observed information and the like are predetermined.

In general, such observation has standardize format and is pre-planned

B) Unstructured observation: The observation takes place without the characteristics mentioned above, i.e., with out standardized format and plan. There is no specification of subject of observation, behavior to be observed and no standard format for recording the observed information.

Such observation is very much flexible and commonly used in exploratory research.

Advantage of observation method

The main advantage of this method of data collection is that, information obtained relates to what is currently happening. That is, it is not complicated by either the past behavior or future intention or attitude.

Limitations of observation method

- It is an expensive method
- The information provided by this method is very limited
- Sometimes unforeseen factors may interfere with the observation task
- Some people or phenomenon are rarely accessible to direct observation
- The problem of subjected interpretation of the observed matter is not solved
- Recording problem is not solved either

Some suggested methods of recording the observed information

- Write down on a prepared recording format, which can be, on the spot (during observation or later after each observation).
- Motion picture like video camera or still camera.

6.2. Interview Method

In an interview, the researcher meets people and discusses his social economic or some other problem with them. During the courses of discussion, he gathers facts. An interview is different from Schedules (interview questionnaires). A schedule includes some predetermined questions asked by the researcher in a definite order with out change. But the interview has no such definite form or order of question. The researcher may ask any question on the basis of his insight into the problem. Interview can be either personal **interview** or **interview** through telephone.

6.2.1. Personal Interview

Such method requires interviewer-asking question in face-to-face contact to respondent. The interviewer has to be on the spot and has to meet people from whom the data are collected.

This approach is suitable for intensive investigation. But in certain cases it may not be possible or worthwhile to contact direct the person concerned and the direct personal investigation may not be used. In such case indirect or oral-examination can be conducted under which the interviewer has to cross-examine other person who are supposed to have knowledge about the problem under investigation and the information obtained is recorded

The personal interview can be of two type - **structured and unstructured**

Structured interview: Personal interview method of data collection is usually carried out in a structured and pre-planned way.

Structural interview involves the use of a set of predetermined questions and has highly standardized technique of recording. It is not possible for interviewer to change even the sequences of the questions. The recording formats also are standardized.

Unstructured interview: Such interview is characterized by a flexibility of questions to questioning. It does not follow a system of pre-determined question and standardize techniques of recording information. The researcher is allowed much greater freedom to, if it is needed, supplementary questions or at times he may omit certain questions. Interviewer can change the sequences of question and he has also freedom in recording the response to include some aspects and exclude the other. Unstructured interview is much more difficult and time consuming than that of the structured one.

It also demands deep knowledge and greater skill on the part of interviewer. This approach is used in exploratory research whereas the structured interview is used in descriptive research. Because it is more economical, provide a safe basis for generalization and requiring relatively lesser skill on the part of the interviewer.

Merits of the personal interview method

- More information in greater depth can be obtained
- Interviewer by his own skill can overcome the resistance, in any, of the respondent
- There is greater flexibility and the opportunity to restructure questions specially in unstructured interview
- Personal information can be obtained easily
- Sample can be controlled more effectively and non is minimum under this approach
- The interviewer can control which person will answer the question
- Misinterpretation of the answer for questions is easily avoided
- It is possible to collect supplementary information about the respondent and environment, which is often of great value in interpreting result.

Weakness of the personal interview

- It is very expensive method specially when large and wide spread geographical sample is taken
- There is still the possibility of the bias of interviewer as well as that of the respondent. Because the supervision and control of interview is still problem
- Certain group of respondent (such as important official) may not be easily approachable under this method.
- This method is relatively more time consuming specially when the sample is large

- The presence of the interviewer may over stimulate the respondent, sometimes he even give imaginary information to make the interview interesting

6.2.2. Telephone Interview

This method collecting information involves contacting respondents on telephone itself..

Strength of such method

- It is flexible compared to mailing method
- It is faster than other method
- It is relatively cheaper than personal interview
- Recall is easy and callback are simple and economical
- There is a higher rate of response
- Replies can be recorded without causing embarrassment to respondent
- Easy access to those respondent who are highly officials and can not be contacted personally
- No field staff is required
- Wider distribution of sample is possible

Weakness of this method

- Little time is given to respondent for considering possible answer. Mostly the interview will not exceed five minutes at most
- Surveys are restricted to respondents having telephone
- Cost consideration may restrict extensive geographical coverage
- There is high possibility of biasedness from the side of the interviewer
- Since questions have to be sort and to the point, probes are difficult to handle

Prerequisites of interview

For successful implementation of the interview method; interviewer should be carefully selected, trained and briefed. Moreover,

- Interviewer should be honest, sincere, hardworking, impartial and must possess the technical competence and necessary practical experience
- Occasional field checks should be also made in advance so that appropriate action must be taken if some of the selected respondent refuse to cooperate or are not available when an interviewers calls up on.
- Interviewer has to try to create friendly atmosphere of trust and confidence so that the respondent may feel at ease while talking and discussing with the interviewer
- Interviewer must ask question properly and completely. At the same times the interviewer must answer legitimate questions if any asked by the respondent.
- The interviewer should not show surprise or disapproval of a respondent's answer, instead he must keep the direction of interview in his own hand.

Basic principles of Interviewing

Interviewers should follow the following principles while conducting interview

- Ask only one question at a time
- Repeat the question if necessary
- Listen carefully to the subjects answer
- Observe the subjects facial-expression, gesture and tone of the voice
- Allow the subject sufficient time to answer the question

6.3. Collection of data through Questionnaires

Questionnaire is a list of structured questions, which will be present, mailed or e-mailed to selected respondents to obtain reliable response from them. The objective is to find out what a selected group of respondents do, think or feel.

This method of data collection is used when the subject of study is very wide and direct observation is not possible. It is also used for such things, which cannot be known through direct observation (ideas, preference, motive, and so on).

In this approach a questionnaire present or sent to the respondent to answer the question and give back or sent back the questionnaire.

Types of Questionnaires

Questionnaires can be of the following type:

- ◆ Interview Questionnaires (Schedules)
- ◆ Mail Questionnaires (Self administered questionnaires)
- ◆ Questionnaires through Internet (Through electronics media)

6.3.1. Mail Questionnaires

This method of data collection is very popular especially for large study. The questionnaires are sent by post to the person concerned with a request to answer the question and return them back.

Questionnaires are mailed to respondents who are expected to read and understand the question and write down the answer.

Advantage (strength) of this method

- Low cost even for larger sample size and widely spread geographically
- It is free from bias of the interviewer. Answers are in respondents' word.
- Respondents have adequate time to give well though answers
- Respondents, who are not approachable, can be reached conveniently (especially, in mail and e-mail).

Limitations

- Low rate of return
- It can be used only for literate respondents
- The control over the questionnaire may be lost once it is sent

- There is inbuilt inflexibility
- The slowest method of all

Guide to question construction

The questionnaires should be very carefully constructed. In constructing questionnaires both questions and statements can be used to get information about the problem from respondents.

A) Forms of questions

Questions in a questionnaire can have either open or closed end form.

Open-end questions: The respondent is asked to provide his own answer to the question. His answer is not in any ways limited. E.g., the respondent might be asked, “What do feel the most important issue facing your community”?

The problem associated with such form of questioning is that, it is not possible to get uniform answers and hence is difficult to process.

Closed ended questions: The respondent is asked to select his answer from among a list provided by the researcher (yes, no, I don't know, etc). Closed ended questions are very popular in survey research since they provide a great uniformity response and because they are easy to process.

The major shortcoming of closed-ended questions on the researcher's structuring of response is that the checklist or the provided list of answers may not include all possible answers.

For example: In asking about “The most important issues facing your country?” the researcher may provide a checklist of issues, but in doing so he might overlook certain issues that respondent would have said were important.

To limit this shortcoming the following guidelines are helpful.

- The response categories provided should be exhaustive they should include all the possible response that might be expected.

- Often the researchers support this effort by adding a category leveled like “others (please specify)”
- The answer categories must be mutually exclusive; the respondent should not feel compelled to select more than one.

B) Make items clear

i. Make questionnaires item clear: Questionnaire items should be clear and unambiguous. Often the researcher become so deeply involved in the topic under examination that opinion and perspective are clear to him but may not be clear to his respondent. So question items should be precise so that the respondent knows exactly what the researcher want to an answer to be.

ii. Avoid double –barreled questions: Researcher often asks respondent for a single answer to combination of question.

E.g., “What do you think about the services like food and transportation provided by CBE office during the second phase of your CBTP program?”

Some respondent may want to answer as good to the transportation service and bad to the food service.

As a general rule whenever the word “and” appears in a question statement, the researcher should check whether he is asking a double-barreled question.

iii. Respondent must be competent to answer

The researcher should ask himself whether the respondents are able to answer the desired questions. Question should be relevant to most of respondents. Short items are commonly considered as the best (long and complicated item should be avoided).

iv. Avoid Negative items:

The researcher should avoid negative items as much as possible: The appearance of negation in a question creates condition to easy misinterpretation.

E.g., “Ethiopia should not recognize the new Government of Somalia”. Large portion of respondents will read over the word “not” and answer on that basis. Some will agree the statement when they are in favor of recognition, while others will disagree when they oppose it

C) General questionnaire format

The format of a questionnaire is as important as the nature and wording of the question asked. If the layout of the questionnaire is not appropriate it can confuse respondents and in the extreme, can lead respondents throwing the questionnaire away. Therefore, as a general rule, the questionnaire should be spread out and organized. The researcher should maximize the white space in his instrument. Putting more than one question in one line, leads to the probability of skipping the second question in case of some respondents.

i. Format for responses

A variety of methods are available for presenting response categories for respondents to check in answering a given question.

For closed-ended question: From experience boxes adequately spaced are the best. Most of the time closed-ended questions are followed by contingent. That is, the second question (contingent) imposed up on the response to the first one.

E.g., Have you ever....

Yes

No

If yes: How you.... (Open end question) or Have you ...

Yes

No

The proper use of contingent questions can facilitate the respondents' task in answering questionnaires and can also improve the quality of the data produced.

For open-end question: Enough space should be provided so that the respondent could write in all his answers and thoughts. This will avoid ambiguity in interpreting the response.

ii. Ordering questions in questionnaires

The order in which questions are asked can affect response as well as the overall data collection activity. The appearance of one question can affect the answers given to the subsequent ones. Some researchers attempt to overcome this effect by randomizing the order of the questions. Randomized question rather appears to the respondent chaotic and may be confusing because he will be forced continuously change his attention from topic to another.

The better solution is sensitivity to the problem. The researcher should be in a position to estimate what effect it will have on the next question.

iii. Opening question:

Opening question is also very important. The researcher should avoid the following type of question as opening question in a questionnaire.

- Question that put too great strain on the memory or intellect of the respondent
- Question of personal character
- Question related to personal wealth etc.

The best way to determine the question-sequence is with the help of a pilot survey, which likely produces good rapport (harmony) with most respondents.

iv. Questionnaire format

Questionnaires of different research can have different formats. Commonly used formats of questionnaires contains the following parts

Instruction: Every questionnaire, whether it is self administered by the respondent or administered by an interviewer, should contain clear instruction and introductory comment. If a questionnaire has different parts it needs to have general instruction for the whole questionnaire and specific instruction for each parts of a questionnaire Here the researcher will instruct (tell) the respondent to indicate their answer by putting a check mark in the box or his appropriate answer if needed.

General instruction: Every self-administered questionnaire should begin with basic instruction. It is useful to begin by telling the respondent that he is to indicate his answer to some questions by putting a check mark or an X in the box or his appropriate answer when it called for.

Specific instruction: Some question may require special instruction to facilitate proper answering. In closed end question it is often the case that more than one answer will apply for respondent. If the researcher wants a single answer he should make clear in the question. This is done mostly when the main question can be followed by a parenthetical note “please check the one best answer”

Introduction: If the questionnaire is arranged into content subsections then it is useful to introduce each section with short statement concerning its content and purpose

v. Mail distribution and return

The basic method for data collection through the mail has been a transmission of a questionnaires accompanied by a letter of explanation and a return envelope. The respondents then complete the questionnaire and return it to the research office through the mail, using the envelope provided for that purpose.

Alternative method is that in some cases it is possible to further facilitate this process through the use of a self-mailing questionnaire. The questionnaires are constructed in such a way that the research office’s return address and postage are

printed on the questionnaire itself. Up on completion, then it can be dropped in the mail without requiring an envelope.

However, the post office has special requirement regarding the form of materials that can be mailed; thus, researcher should plan this approach properly and count with it. These methods simplify the assembly of mailing pieces since it is unnecessary to include a return envelope and the respondent cannot lose the return envelope. It has a certain “TOY VALUE”. To some extent the respondent may want to complete the questionnaire so that he can then play with a cover.

vi. Monitoring the return

As questionnaires are returned to the researcher, he should under take a careful recording of methodological data. He should label a return rate graph. The day on which questionnaires were mailed should be labeled day one on the graph. It is usually best to complete two graphs. One should show the number returned each day raising then dropping. Another should report cumulative number or percentage. This will show the picture of his successful data collection.

vii. Follow-up-mailing

Following up mailings is strongly recommended, as it is an effective approach for increasing return rate in mail survey. Follow up will be done by sending another mail to the respondents. In practice, three mailing (one original and two follow-ups) seems the most efficient. The timing of follow-up mailings is also important—two or three weeks are a reasonable gap between mailings.

Follow-up mailings may be administered in a number of ways

- Respondents are simple sent a letter of additional encouragement to participant
- Better method is to send a new copy of the survey questionnaire with the follow-up letter to all respondents

- If the individuals in the survey sample are not identified on the questionnaires returned, in such case the researcher should send his follow-up mailings to all initial members of the sample, thanking those who have already participated (returned) and encouraging those who have not yet do so.

viii. Acceptance response rate

The percentage return rate that should be achieved in a mail survey is:

- A response rate 50% is adequate for analysis and reporting
- A return rate at least 60% is good and a response rate of 70% or more is very good.
- But we should bear in mind that the body of inferential statistics used in connection with survey analysis assumed that all members of the initial sample complete and return their questionnaires.

6.3.2. Interview Questionnaires (Schedule)

Schedules are particular types of questionnaire. These methods are very much like collection of data through questionnaires, with little difference, which lies in the fact that schedules are being filled in by enumerators (interviewers) who are specially appointed for the purpose.

Enumerator along with schedule (questionnaires), goes to the respondent, put to them the questions from the Performa in the order of the questions are listed and record. The replies in the space meant for the same in the Performa (questionnaires).

Here we consider both schedule and interview questionnaires are similar and the same. The questionnaires are either delivered by hand to be answered by respondents or the trained interviewer will read the question to respondent and record the answer given. But mostly the interviewer read the question and records the answers given by respondent.

Importance of Interviewer

There are a number of advantages in having questionnaires administered by an interviewer rather than by the respondent himself.

- Interview survey attains higher response rate than mail survey. A properly designed and executed interview survey ought to achieve a return rate of at least 80-85%.
- The presence of interviewer generally decrease the number of “don’t knows” and “no answers”.
- The interviewer can be instructed to probe for answer, “if you had to pick one of the answer, which do you think would come closest to your feelings?”
- Interviewer can also provide a guard against confusing questionnaires item. (Clarification must be strictly controlled).
- The interviewer can observe as well as ask question.

General Rule for Interviewing

The manner in which the interview would be conducted will vary by survey population and will be affected by the nature of the survey. Nevertheless, it is possible to provide some general guidelines that would apply to most, if not all, interviewing situations.

i. Appearance and Demeanor (behavior or conduct): As a general rule, the interviewer should dress in a fashion fairly similar to that of the people he will be interviewing. Richly dressed interviewer will probably have difficulty in getting good cooperation from poor respondent. And poorly dressed interviewer will have similar difficulties with richer respondent.

ii. Familiarity with questionnaires: If the interviewer is not familiar with the questionnaires, the study suffers and unfair burden is placed on respondent. And the interview would take more time than necessary.

- The interviewer must study carefully question by question, and he must practice reading it allowed.
- He must be able to read the questionnaires item to respondent with out error.
- The interviewer must be familiar with the specification prepared in connection with the questionnaires

iii. Record responses exactly: No attempt should be made to summarize, rephrase or correct bad grammar. The response should be written down exactly as given.

iv. Probing for response: These are required to open ended questions responses Sometimes the respondent will respond to a question with an inappropriate answer. In this case the interviewer may use appropriate verbal probes like, “how is that” “to what way” or the better probes (interrogation) is that, “anything else”. But such probes should be neutral.

v. Interviewer should be trained: Even if there is fortunate enough to organize an interviewing team comprised of intelligent, experienced interviewer, careful interviewer training is essential. Every survey and every questionnaire differ from one another; interviewers must be retrained for each new survey. The amount of time required for training is depending up on the scope and the nature of the survey.

E.g., normal household survey may require about two weeks, one week a classroom instruction and practice, and another week of practice in the field.

The interview training touches the following points:

General description: The training begins with the general comments about the nature of the survey and its ultimate purpose. If the interviewers understand why the survey is being conducted and can see that it is an important undertaking, they will be more diligent and careful in their work. The general description of the training should include

- The sponsor of the survey
- The primary purpose of the study
- How the sample of the respondent was selected
- How the questionnaires was designed
- How the data will be processed and analyzed
- If they can understand how they fit in the overall process.

These will probably help them to feel more a part of the research team and will respond accordingly

Studying the questionnaires and specifications: Interviewers and the supervisors or principal researcher should subsequently go through the entire questionnaire step by step.

- The purpose of item should be explained
- All possible ambiguities should be discussed and resolved
- Much of the discussion during this activity will take the form of “what do I do if the respondent says...”
- There will be examination, which also involves an examination of specifications.

Practice the interviews in class (pre-test): Once the questionnaires and specifications have been studied in detail, the session should be organized around series of practices. Two or three interviews should be conducted in front of the whole class. The best beginning will be for the principal researcher to interview the supervisor. This interview should serve as a model for the interviewers. The class should be encouraged to discuss and ask questions

Practice interviewers in the field (Pilot survey): This part of the training should be exactly like the real interview. Assignments of respondents’ and/ or addresses should be made just as will be done in final survey. The interviewer would be given exactly the materials they will use in the final survey in the field. (Respondents should not be told that they have been selected for training purpose).

About 5 interviews will be enough as training. Upon compilation interview practice, the interviewers bring back the questionnaires to the supervisor and the supervisor go through completed questionnaires with him to locate and discuss any problem and to answer any new question the interviewer may have.

Difference between questionnaires and schedules

Mail Questionnaires	Schedules
Generally sent through mail to respondents	They are filled out by a research worker or enumerators
Data collection is relatively cheap	It is more expensive, since money has to be spent in appointing, train the enumerators
Non response is usually high	Non-response is generally low
It is not always clear who replies	The identity of the respondent is known
It is very slow method	Information is collected well in time
Personal contact is impossible	Direct personal contact is established
Useful only for literate respondent	Information can be gathered even form illiterate respondent
Wider and more representative sample distribution is possible	It is difficult to sent enumerator to wider area
The success of this method depend up on the quality of the questionnaires	Success of this method depends on the honesty and competence of enumerator
No observation	Observation method can also be used

CHAPTER SEVEN

Method of Secondary Data Collection

Secondary information is information, which has already been collected by some one and which, have already been passed through statistical process. The researcher does not obtain them directly rather he gathered them from published and unpublished material.

Why a researchers use data from secondary sources? In most cases researchers use secondary data for different reasons like;

Secondary data may solve problem: If adequate data are available from secondary sources, primary data collection will not be necessary.

Search costs are substantially lower than primary sources. It is cheap and less time consuming than primary sources. A comprehensive search of secondary sources can almost always be made in a fraction of the time and cost required for collection of primary data

It has also important supplementary use, these includes:

- It helps to define the problem and formulate hypothesis about its solution. The assembly of available secondary data (information) always provides a better understanding of the problem and it may suggest reformulation and solution not considered previously.
- It will help to plan the collection of primary data. Examination of the methods and techniques employed by other investigators in similar studies may be useful in planning the present one.
- It will help to define the population and select the sample in primary data collection.

However, the researcher must be careful when using secondary data, particularly as the only sources of data. Secondary data to be useful, it must be:

- Available
- Relevant to the information needed
- Accurate and sufficient to meet data requirement.

Before using secondary data, we must see that they possess the following characters.

1. Reliability of the data

The reliability can be tested by finding answers to the following questions about the said data:

- Who collect the data? (How is the reputation of the collector?)
- What were the sources of the data?
- Were they collected using proper method?
- At what time were they collected?
- Was there any bias of the collector?
- What level of accuracy was desired?
- Was it achieved?

2. Suitability

The data that are suitable for one inquiry may not necessarily be found suitable in another inquiry. The researcher must very carefully scrutinize the definition of various terms and units of collection used at the time of collecting the data from the primary sources originally. The object, scope and nature of the original inquiry must be studied. If the researcher finds difference in these, the data will remain unsuitable for the present inquiry and should not be used

3. Adequacy

If the area and scope of the study is narrower than the area of present study the data are considered as inadequate. Because of the fact that information will be

missed and the researcher needs additional sources to make it complete and usable. .

Secondary data may be obtained either from:

- Internal (with in the company or organization)
- External sources (outside sources)

Internal secondary data: All companies or organizations or any other organs keep record of the every course of conducting business or any other activities.

- Orders received are filled
- Cost are recorded
- Sales' people reports are submitted. Such and the like data are some of the many sources of information collected by the company for other purpose and are useful to the researcher

External sources of secondary data: The major sources of external information are:

- Government (federal, state, local)
- Trade association and trade press
- Periodicals
- Institution (research, academic)
- Commercial services and the like

The secondary sources of information can be classified into

- i. Personal Document
- ii. Public document

7.1. Personal document

These include the entire published and unpublished information document by the individuals for different purpose:

- Personal documents are not written in scientific manner (style) nor do they have an objective basis.
- They generally represent some ideas, values and feeling etc.

In spite of being subjective unscientific they have been very much useful in social research. Personal documents have been classified in to four types

1. Biography / Autobiography

Some great political, business leaders, social reformers and eminent persons write their own autobiographies or some other people (biographer) write their biography. Such persons provide useful information concerning, social, economical, political, religious and cultural conditions and incidents of their time. Even, in some cases it is possible to get some information, which could not be known from any other sources.

Autobiographies are life histories, life experience and incidents of prominent individuals written by them. Biographies are life history, experience and events of some prominent person written by some biographer

Autobiography/ biography can be written for different purpose. It can be written in order to preserve specific feelings, incidents and events of writer's life. Such autobiography has objective basis and are useful source of information, if it is available indeed. Autobiography can also be written in order to publish and get financial benefit and popularity. Such autobiographies are less reliable as they are full of exaggeration and are full of deliberate distortion of facts.

3. Diaries:

Many educated people have a habit of writing diaries concerning their social relationship and life incidents. Most of the dairy writer has no intention to publish them. Some people daily write diaries to include program of the day.

Diaries are written with different intentions. Some write diaries to remember important incidents of their life. Some on the other hand write diaries to note things, which they cannot tell to anyone. They may write it to release their tension. Diary writing is a confidential and private performance. Therefore, if they are available they can be considered as a reliable.

4. Letters

Letters are often used by researchers as evidence especially in studies like, history and sociology and psychology. Most people write a number of letters during the course of their lives. Letters are the medium of expressions of feelings likes and dislikes attitudes, desires, emotion, ambitions and important incidents of life. Letters are in general, personal and very reliable. Thus, they constitute one of the most reliable sources of information about the inter relationship, such as, friendship, love, marital affairs, family tension and divorce and the like.

Limitations

- Difficult to collect private letters
- The letters do not provide detailed and complete description of incidents
- If letters of only one person is secured, they hardly provide scientific data since no comparable information is available.

5. Memories

Some people are interested in writing down memories for their travels, participation in different activities. Such memories provide useful information in social research

Limitations of personal documents

- Difficult in collection.
- They are rarely recorded and more seldom preserved
- Problem associated with the reliability of data: There is almost no criteria to judge their validity since they are written from subjective view point.
- It is not possible to arrive at some definite conclusion say about a social problem on the basis of personal document.

7.2. Public and Official document

In many research studies these sources of information are commonly and widely used. Public documents are information gathered from some governmental or non-governmental institutions.

Public document can be either unpublished or published documents. Unpublished documents are like reports of some big companies, confidential records of government departments and non-governmental organization.

Published document are those published documents in the general interest of the public. Such documents may be prepared by government or any other organs.

Some common public documents are of the following types

1. **Records:** These are the most important sources of secondary data. Most government and non-government institution preserves many types of records consisting of important information. For instant each police department keeps record of criminals. Company records like no employees, wage paid, growth rate sale etc.
2. **Census report and statistics:** A very important source of data collection is census report and the annual digest of statistics and statistical report of various state departments and national bodies. These reports are reported by experts and, therefore, their data are highly reliable. The data collected in these reports are arranged according to the administrative objective,
 - Health (concerning birth and death rate, number of hospitals, number of beds, number of doctors and the like)
 - Economic and related data: Annual production, average income, foreign trade, wage, hours of work, price level (inflation rate), interest rate, exchange rate etc.)
 - Education (number of schools, students, teachers, number of graduates and the like)

The Importance of census data can be summarized as:

- **Political importance:** It provides population statistics about the whole country and this information help government in formulating various plan and policies
- **Economic importance:** Economic plan of the country is based on population statistics. It provides data concerning income, expenditure and the like.
- **Sociological importance:** It also shows social condition, social evils, customs and tradition etc.
- **Commercial importance:** Commercial plans (business plans) require different types of information and statistical data. This is very much supplied by census report. Based on this information they will estimate the consumption (demand) and supply of different commodities.

3. **Journals and magazines:** These are common and widely used sources of information. Information obtained from these sources is very much reliable.

4. **Newspapers:** Published news (discussion on contemporary issues, reports of meetings and conferences) is very important sources. Economic news paper usually report data like,

- Daily stock price
- Exchange rate
- Interest rate
- Daily commodity price
- Price indices (report on quarterly basis)

5. **Other documents:** Under this category we can have information sources like, television, film, radio and public speech. The investigator, however, should be

capable of sorting out the reliable material and distinguish it from unreliable one.

Generally, information through secondary data is relatively easy to obtain but difficult to use them in social science. Thus, the information should be carefully judged before using it.

Judgment of such information involves

- Verification of reliability of facts before using them in any study.
- Verification of honesty, ability, methods and tools of the investigator himself.
- Verification of the method of data collection
- Verification of representative-ness of sample used in the primary data collection
- The organization for collection of data should be scrutinized as well

After all this preliminary arrangement, the investigator should select some facts and verify them so that he may have some idea about the reliability of total secondary data. Beside reliability, the adequacy of facts should be judged before utilizing them in social research.

Adequacy is evaluated by verifying whatever the collected secondary data have an objective identical with the study. The unit of available data should be verified so that adequacy of facts may be observed.

CHAPTER EIGHT

Sampling Design and Procedure

The statistical investigation can take two forms. The researcher studies every unit of the field of study (survey) and draw conclusion by computing the sum of all units. This type of survey is called census survey. Or the researcher study only a unit in the field of survey and this type of survey is called sample survey. In sample technique of survey some unit are taken as representative of the whole field of domain and the conclusion of the sample is extended to the whole population. In this chapter emphasis is given to the second form of investigation as it was commonly used in most research works.

Some fundamental definitions

Before going to details and uses of sampling it is appropriate to be familiar with some basic definitions concerning sampling

Population: Is the theoretically specified aggregation of survey elements from which the survey sample is actually selected.

Sampling Frame: Is the list of elements from which the sample is drawn

Sample: A subset or some part of a larger population

Sample design: Is a definite plan for obtaining a sample frame

Sampling: Is the process of using a small number or part of a larger population to make conclusion about the whole population.

Element: Is unit from which information is collected and which provides the basis of analysis

Statistic: Is a characteristic of a sample

Parameter: Is a characteristic of a population.

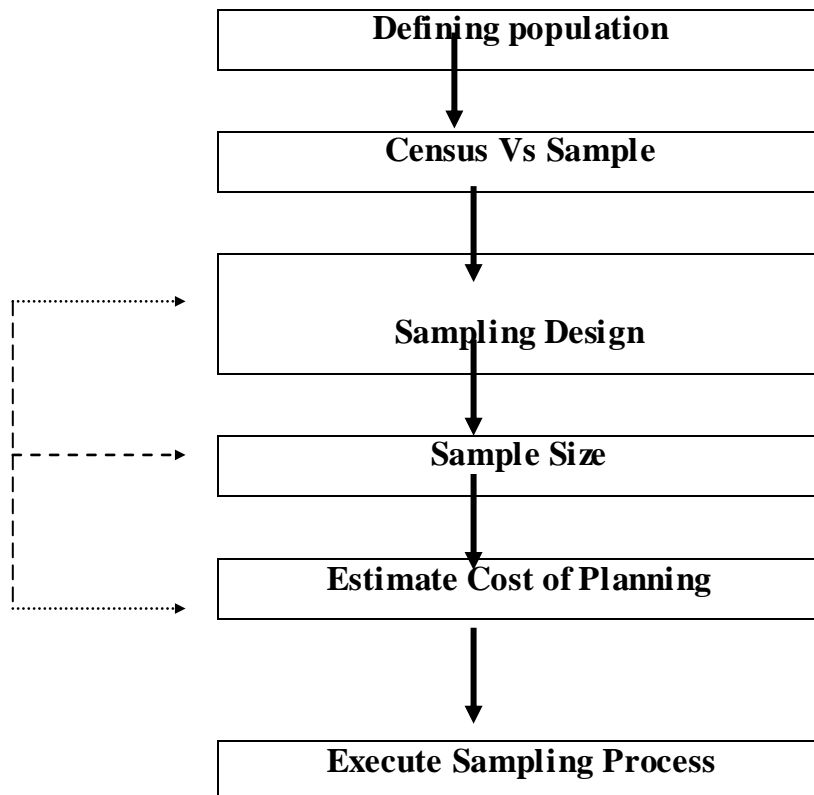
E.g., when we work out certain measurement like, mean from a sample they are called statistics. But when such measure describe the characteristic of the population, they are called parameter(s)

- *Population mean (μ) is a parameter*
- *Where as the sample mean (x) is a statistics*

The precision and accuracy of survey result are affected by the manner in which the sample has been chosen. Strict attention must be paid to the planning of the sample. Regardless of the type of project to be conducted, the process of selecting a sample follows well-defined activities.

8.1. Steps involved in sample planning (Sampling procedure)

The first thing that the sample plan must include is a definition of the population to be investigated. This involves the following procedure



i. Defining the population

The first thing the sample plan must include is a definition of the population to be investigated. Defining the target population implies specifying the subject of the study. Specification of a population involves identifying which elements (items) are included, as well as where and when. If the research problem is not properly defined then defining population will be difficult

For example, a financial institution considering making a new type of loan plan available, might acquire information from any one or all of the following groups-

Which element	Where	When
All depositors	Designated bank	For the last 12 months
Depositors who have borrowed money	Designated bank	For the last 12 months
All people who have borrowed money	Specified geographic area	For the last 12 months
All people	Specified geographic area	For the last 12 months

From researcher point of view, each group represents a distinct population. Thus, the researcher must begin with careful specification of his population.

ii. Census Vs Sample

Once the population has been defined, the researcher must decide whether the survey is to be conducted among all members of the population or only a subset of the population. That is, a choice must be made between census and sample

Advantages of census

- **Reliability:** Data derived through census are highly reliable. The only possible errors can be due to computation the
- **Detailed information:** Census data yield much more information.

Limitation of census

- **Expensiveness:** Investigating each elements of the population is expensive to any individual researcher
- **Excessive time and energy:** Beside cost factor, census survey takes too long time and consumes too much energy.

Need for sampling

The use of sample in research project has the objective of estimating; testing and making inference about a population on the basis of information taken from the sample

Sampling can save time and money (it is economical than census). Sampling may enable more accurate measurement, because sample study is generally conducted by trained and experienced investigator. Sampling remains the only way when population contains infinitely many members. It usually enables to estimate the sampling error and, thus, assists obtaining information concerning some characteristics of the population.

If the choice of sample units is made with due care and the matter under survey is not heterogeneous, the conclusion of the sample survey can have almost the same reliability as those of census survey.

Sampling technique also enables researchers to obtain detailed study, as the number of sample units is fairly small these can be studied intensively and elaborately.

Limitations of sampling technique

- **Less accuracy:** In comparison to census technique the conclusion derived from sample are more liable to error. Therefore, sampling technique is less accurate than the census technique.

- **Misleading conclusion:** If the sample is not carefully selected or if samples are arbitrarily selected, the conclusion derived from them will become misleading if extended to all population.
 - *In assessing the monthly expenditure of university students if the selected sample contains more rich students, our result (conclusion) will be erroneous if it extended to all students*
- **Need for specialized knowledge:** The sample technique can be successful only if a competent and able scientist makes the selection.
 - *If it is done by average researcher the selection is liable to error*

A beginner researcher commonly asks himself when and where sampling technique is appropriate to his study. Sampling technique is used under the following conditions.

- **Vast data:** When the number of units is very large, sampling technique must be used. Because it economize money, time and effort
- **When at most accuracy is not required:** The sampling technique is very suitable in those situations where 100% accuracy is not required, otherwise census technique is unavoidable.
- **Infinite population:** If the population is unlimited sampling technique is imminent.
- **When census is impossible:** If we want to know the amount of mineral wealth in a country we cannot dig all mines to discover and count. Rather we have to use the sampling technique.
- **Homogeneity:** If all units of the population are alike (similar) sampling technique is easy to use.

Essentials of an ideal sample

An ideal sample should fulfill the following four basic characteristics.

Representative-ness: An ideal sample must represent adequately the whole population. It should not lack a quality found in the whole population.

Independence: Each unit should be free to be included in the sample

Adequacy: The number of units included in the sample should be sufficient to enable derivation of conclusion applicable for the whole population. A sample having 10% of the whole population can be considered.

Homogeneity: The element included in the sample must bear likeness with other element.

iii. Sample design

Operationally, sample design is the heart of sample planning. Specification of sample design includes the method of selecting individual sample unit involves both theoretical and practical considerations. Sample design should answer the following

What type of sample to use? Different types of samples are considered, examined and appropriate sampling technique is selected.

What is the appropriate sample unit? Is a single element or group of elements of the defined population are subjected to selection in the sample? Sampling unit can be

- Primary sampling unit: Units selected in the first stage of sampling
- Secondary sampling unit: A unit selected in the second stage of sampling

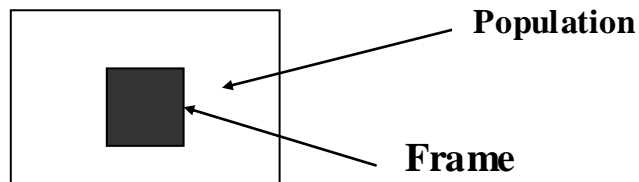
What frame (list of sampling unit) is available for the population?

In actual practice the sample will be drawn from a list of population elements, which can be different from target population that has been defined. Sample frame is the list of elements from which the sample is drawn. It is a physical list of the population elements. Ideally the sample frame should identify each population element once only once. It should not include elements not in the defined population

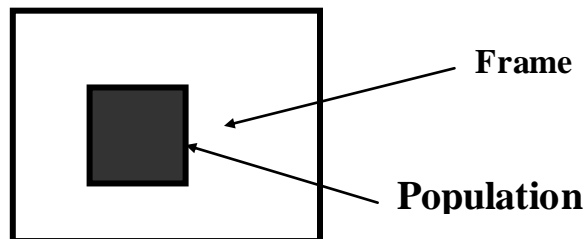
The most widely used frame in survey research is a telephone directory. Using such a frame, however, may lead to error arising from exclusion of:

- **Groups with no telephone**
- **Voluntary unlisted**
- **Involuntary unlisted**

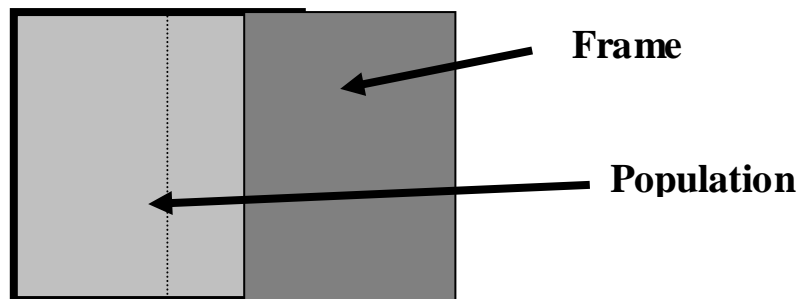
Incomplete frame



Too complete



Complete frame



How are refusals and non-response to be handled? The sample plan must include provision for how refusals and non-response are to be handled. Whether

additional sampling units are to be chosen as replacement and if so, how these are to be selected. And the like should be planned wellhead.

iv. Sample size determination

A researcher is worried about sample size because of the fact that sample size (number of elements in sample) and precision of the study are directly related. The larger the sample size the higher is the accuracy. The sample size determination is purely statistical activity, which needs statistical knowledge. There are a number of sample size determination methods.

Personal judgments: The personal judgment and subjective decision of the researcher in some cases can be used as a base to determine the size of the sample.

Budgetary approach is another way to determine the sample size. Under this approach the sample size is determined by the available fund for the proposed study.

E.g., if cost of surveying of one individual or unit is 30 birr and if the total available fund for survey is say 1800 birr , the sample size then will be determined as,

Sample size (n) = total budget of survey / Cost of unit survey, accordingly, the sample size will be 60 units (1800 / 30 = 60 units)

Traditional inferences: This is based on precision rate and confidence level. To estimate sample size using this approach we need to have information about the estimated variance of the population, the magnitude of acceptable error and the confidence interval

- **Variance or heterogeneity of the population:** It refers to the standard deviation of the population parameter. The sample size depends up on the variance of the population. If the population is similar (homogenous) small sample size can be enough.

E.g., Predicting the average age of collage students Vs predicting average age of people visiting a given supermarket at a given day.

If information about variance is not available a researcher is expected to estimate it. Estimation of the variance or standard deviation is not an easy undertaking. The researcher can carry out either pilot study for the purpose of estimating the population standard deviation or he can use the rule of the thumb. According to the rule of the thumb standard deviation is one-sixth of the range

E.g., If the households yearly average income is expected to range between 1500 and 24000 birr, using the rule of the thumb the standard deviation will be $1/6(22500) = 3750$ hence range equal 22500 (24000-1500)

- **Magnitude of acceptable error:** The magnitude of error (range of possible error) indicates how precise the study must be. It is acceptable error for that study. The researcher makes subjective judgment about the desired magnitude of error.

E.g., to estimate the average income of household one may allow an error says ± 50

- **Confidence interval:** In most case (research) 95% confidence level is used. That is, it is assumed that 95 times out of 100 the estimate from sample will include the population parameter.

Once the above concepts are understood and determined the size of sample is quite simple to determine. It is determined based on the following relationship.

- i) For mean $n = (ZS/E)^2$ and
- ii) For proportion $n = Z^2 p.q / e^2$

Where Z represents standardization value indicating a confidence level

E represents acceptable magnitude of error \pm an error factor

S represents sample SD or an estimate of the population SD

p and q are proportion and n represent sample size

*E.g., the household yearly income expected to range from 1000 – 25000. The SD based on rule of thumb, range = 24000 * 1/6 = 4000*

Suppose we want to study the household monthly expenditure on food.

- *We wish to have a 95% confidence level*
- *Acceptable range of error of no less than 20 birr.*
- *And the estimated value of the SD is 200*

I.e. $Z^1 = 1.96$

$E = 20$

$S = 200$

*$n = (ZS/E)^2 = (1.96 * 200/20)^2 = 384.16$ or 385*

If the range of error (E) is reduced to 10-sample size will increase.

- **Bayesian Statistics.** This is the selection of the sample size, which maximizes the difference between the expected value of information (EVI) and cost of sampling. That is, marginal cost of information (MCI) should be equal to Marginal value of information (MVI).

Optimum sample size implies MVI = MCI

Determination of optimum sample size requires comparing the weighted cost of additional information against additional expected value of information.

The main reason why a large sample size is desired is that sample size is related to random sampling error,

v. Cost of Sampling

The sample plan must take into account the estimated cost of sampling. Such costs are of two types, overhead costs and, variable costs. In reality however, it may be

¹ $\mu = X^* \pm 1.96 \sigma \div \sqrt{n}$ at 95% confidence level. Where, μ = Population Mean, X^* = Sample Mean, σ = Standard Deviation, n = Sample size, $\sqrt{\quad}$ = square root.
Also, $Z = 2.58$ at 99%, $Z = 1.96$ at 95%, $Z = 1.65$ at 90%.

difficult and even for some people not reasonable to separate sampling cost from over all study cost.

vi. Execution of sampling process

The last step in sample planning is the execution of the sample process (procedure). In short the sample is actually chosen. The actual requirement for sampling procedure

Sample must be representative: When it is a representative, a sample will be relatively small pieces of the population that mirror the various patterns and subclasses of the population.

Sample must be adequate: A sample is adequate when it is of sufficient in size to provide confidence in the stability of its characteristics.

8.2. Sampling Techniques

Sampling techniques are basically of two types namely, non-probability sampling and probability sampling.

8.2.1. Non-probability

Non-probability sampling technique does not give equal chance that each element of the population will be included in the sample. Units are selected at the discretion of the researcher. Such samples derive their control from the judgment of the researcher. Some of the disadvantages of non-probability sampling are of the following:

- No confidence can be placed in the data obtained from such samples; they don't represent the large population. Therefore, the result obtained may not be generalized for the entire population.

- Non-probability sampling depends exclusively on uncontrolled factors and researcher's insight, and there is no statistical method to determine the margin of the sampling errors.
- Sometimes such samples are based on an absolute frame, which does not adequately cover the population.

The advantages of non-probability sampling on the other hand is that it is much less complicated, less expensive, and a researcher may take the advantage of the available respondents with out the statistical complexity of the probability sampling. More over it is very convenient in the situation when the sample to be selected is very small and the researcher wants to get some idea of the population characteristics

Non-probability sampling can be adequate if the researcher has no desire to generalize his findings beyond the sample, or if the study is merely a trial run for larger study (in preliminary research).

There are number of non-probability sampling.

- **Quota Sampling**
- **Judgment sampling**
- **Snowball sampling**
- **Convenience sampling**

1. Quota sampling

Under this sampling approach, the interviewers are simply given quotas to be full-filled from the different strata (groups).

E.g., an interviewer in a particular city may be assigned say 100 interviews. He will assign this to different subgroups (say 50 for male respondents and 50 for female respondents).

Even though quota sampling is not probabilistic, the researcher must take precaution to keep from biasing selection and makes sure that the sample is as representative and generalize-able as possible.

2. Judgment (Purposive or deliberate) sampling

In this approach the investigator has complete freedom in choosing his sample according to his wishes and desire. The experienced individual (researcher) select the sample based upon his judgment about some appropriate characteristics required from the sample members

The intent is to select elements that are believed to be typical or representative of the population in such a way that error of judgment in the selection will cancel each other out. The researcher selects a sample to serve a specific purpose, even if this makes a sample less than fully representative.

The Consumers Price Index (CPI) is based on a judgment sampling. That is, based on prices of basket of goods and services purchased by average households.

The key assumption underling in this type of sampling is that, with sound judgment of expertise and an appropriate strategy, one can carefully and consciously choose the element to be included in the sample. Its advantage is its low cost, convenient to use, less time-consuming, and as good as probability sampling.

However, its value depends on entirely on the expert judgment of the researcher Weakness of this approach is that without an objective basis for making the judgment or without an external check, there is no way to know whether the so-called typical cases are, in-fact, typical and its value is entirely depends on the judgment of the researcher.

3. Snowball Sampling

It is also known as **Multiplicity sampling** or **Multi-stage Sampling**

The term snowball comes from the analogy of the snowball, beginning small but becomes bigger and bigger as it rolls downhill. Snowball sampling is popular among scholars conducting observational research and in community study.

The major purpose of snowball sampling is to estimate characteristics that are rare in the total population. First initial respondents are selected randomly but additional respondents are then obtained from referrals or by other information provided by the initial respondent.

E.g., consider a researcher use telephone to obtain referral. Random telephone calls are made; the respondents (answering the call) are asked if they know someone else who meets the studies respondent qualification. Like “whether they know the some one who survived the September eleven terrorist attack in New York “

SAY,

A researcher wants to study the impact of the September Eleven Terrorist attack on the social life and life style of the survivals .

Major advantages of this type sampling are that it substantially increases the probability of finding the desired characteristic in the population and lower sampling variance and cost.

4. Convenience Sampling

This is a "hit or miss" procedure of study. No planned effort is made to collect information. The researcher comes across certain people and things and has transaction with them then he tries to make generalization about the whole population. This sampling technique is not scientific and has no value as a research technique. However, as it is characterized by "hit or miss" method sometimes hits are secured. In general, the availability and willingness to respond are the major factors in selecting the respondents. Commonly such a sample is taken to test ideas or even to gain ideas about a subject of interest.

8.2.2. Probability Sampling

All probability samples are based on chance selection procedures. Chance selection eliminates the bias inherent in the non-probability sampling procedure, because this process is random.

The procedure of randomization should not be thought as unplanned or unscientific. It is rather the basis of all probability sampling technique.

Probability sampling is the most preferred type of sampling because of the following characteristics

- The sample units are not selected based on the desecration of the researcher
- Each unit of the population has some known probability of entering the sample
- The processes of sampling is automatic in one or more steps of selection of units in the sample

There are number of probability sampling some of them are discussed bellow

- Simple Random Sampling
- Systematic Sampling
- Stratified Sampling
- Cluster Sampling
- Multi-stage Sampling

1. Simple Random Sampling

It is the basic sampling method in every statistical computation. Each element in the population has an equal chance of being included in the sample. It is drawn by a random procedure from a sample frame. Drawing names from a hat is a typical simple random sampling technique. The sampling process is simple because it requires only one stage of sample selection.

Selecting random sample is made in such a way that. Each element in the sample frame is assigned a number. Then each number is written on separate pieces of paper, properly mixed and one is selected. If say the sample size is 45, then the selection procedure is repeated 45 times. When the population is consists of a large number of elements table of random digits or computer generated random numbers are utilized.

2. Systematic Sampling

Systematic sampling involves only a slight difference from simple random sampling. The mechanics of taking a systematic sample are rather simple. If the population contains N ordered elements, and sample size of n is required or desired to select, then we find the ratio of these two numbers, i.e., N/n to obtain the sampling interval.

E.g., Say the population size $N= 600$ and the desired sample size is 60 ($n = 60$), then the sample interval will be $600/60 = 10$

Random number at the 10 interval will be selected, i.e., if the researcher starts from the fourth element then 4th, 14th, 24th etc, elements will be selected.

Systematic sampling assumes that the population elements are ordered in the same fashion (like names in the telephone directory). Some types of ordering, such as an alphabetic listing, will usually be uncorrelated with the characteristics (say income family size) to be investigated. If the arrangement of the elements of the sample is itself random with regard to the characteristics under study, systematic sampling will tend to give result close to those provided by simple random sampling. We say close for the reason that, in systematic sampling all elements of the population do not have the same or equal chance of being included. Systematic sampling may increase representative-ness when items are ordered with regard to the characteristics of interest

E.g., if the populations of customer group are ordered by decreasing order of purchase volume, a systematic sample will be sure to contain some high-volume and some low-volume customers.

The problem of periodicity occurs if a list has a systematic pattern, that is, if the list is not random in character (like cyclical or seasonal pattern).

E.g., consider collecting retail store- sale volume, if the researcher is to choose a sampling interval of seven days, his choice of day can result in sampling that would not reflect day-off- the week variation in sale.

2. Stratified Sampling

This method of sampling is a mixture of deliberate and random sampling technique. If population from which the sample to be drawn does not constitute a homogeneous group, stratified sampling technique is used in order to obtain a representative sample. Under this technique, the population is divided into various classes or sub-population, which is individually more homogeneous than the total population. The different sub-populations are called strata. Then certain items (elements) are selected from the classes by the random sampling technique. Since each stratum is more homogeneous than the total population, we are able to get more precise estimate for each stratum. By estimating more accurately each of the component parts of population (sub population), we get a better estimate of the whole population. In other words the population will be broken into different strata based on one or more characteristics say, frequency of purchase of a product or types of customers (credit card versus non-credit card), or the industry. Thus, we will have strata of customers, strata of industry etc.

Suppose a researcher wishes to collect information regarding income expenditure of the male population of, say Jimma Town.

First we shall split the whole male population in the town into various strata on the basis of, say special professions like :

- *Class of service giving people*
- *Business men*
- *Shop keepers*

From these different groups the researcher will select elements using random sample technique.

The following questions should be considered in the context of stratified sampling

How to form strata?

We can say that strata can be formed on the basis of common characteristics of the items (elements) to be put in each stratum. Various strata are formed in such away as to ensure element being more homogeneous with in each stratum.

Thus, strata are purposively formed and are usually based on past experience and personal judgment of the researcher.

How should items (elements) be selected from each stratum?

The usual method for selection of items for the sample from each stratum is that of simple random sampling. Systematic sampling can also be used if it is considered more appropriate in certain situation.

How many items to be selected from each stratum (sample size)?

Stratified sample size can be made proportionate to its size in which case the sample that is drawn from each stratum is made proportionate to the relative size of that stratum.

E.g., suppose P_i the proportion of population included in stratum i and n represents the total sample size, the sample size of stratum i will then be $p_i * n$

Stratified sample size can also be made disproportionate to its size. That is, the sample size from each stratum is made based on other circumstance such as based on the relative variance of stratum.

Here we take large sample size from more variable strata (heterogeneous).

$$n_i = n * N_i \sigma_i / N_1 \sigma_1 + N_2 \sigma_2 + N_3 \sigma_3 + \dots N_k \sigma_k$$

Where $\sigma_1, \sigma_2, \sigma_3, \dots, \sigma_k$ denote the standard deviation of the k strata, $N_1, N_2, N_3, \dots, N_k$ the size of the k strata, n_i denote the sample size of the k strata and n the total sample size.

Generally, the procedure in Stratified sampling can be summarized as follow:

- The entire population is first divided into a set of strata (sub-population groups), using some external sources, such as census data
- Within each stratum a separate random sample is selected
- From each separate sample, some statistics (mean) is computed and properly weighted to form an over all estimated mean for the whole population
- Sample variances are also computed within each separate stratum and appropriately weighted to yield a combined estimate for the whole population.

4. Cluster sampling

This technique will sample economically while retaining the characteristics of a probability sampling. In cluster sampling the primary sampling unit is no more the individual elements in the population rather it is say manufacturing unit, city or block of city, etc.

After randomly selecting the primary sample unit (city, part of city), we survey or interview all families or elements in that selected primary sample unit. The area sample is the commonly used type of cluster sampling.

E.g., suppose we want to estimate the proportion of machine-parts in an inventory, which are defective. Assume that there are about 20000 machine parts in the inventory. They are stored in 400 cases of each containing 50 parts each.

Now using a cluster sampling, we would consider the 400 cases as clusters. From this cluster we randomly select say n cases and examine all the machine-parts in each randomly selected case.

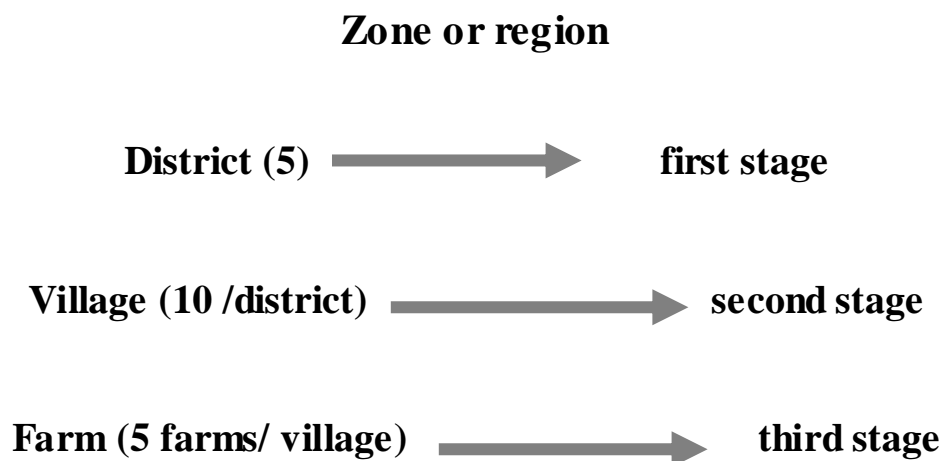
Cluster sampling clearly will reduce costs by concentrating survey in selected cluster. But it is less precise than random sampling. Cluster sampling is used only because of the economic advantage it possesses.

5. Multi-stage sampling

Items are selected in different stage at random. Multi stage sampling is a further improvement over cluster sampling.

E.g., If we wish to estimate say yield per hectare of a given crop say coffee in Jimma zone. We begin by random selection of say 5 districts in the first instance.

Of these 5 districts, 10 villages per district will be chosen in the same manner. In final stage we will select again randomly 5 farms from every village. Thus, we shall examine per hectare yield in a total of 250 farms all over that region.



There are two advantages of this sampling technique. It is easier to administer than most sampling technique. A large number of units can be sampled for a given cost

because of sequential clustering, whereas this is not possible in most sample design.

Multi-stage sampling is relatively convenient, less time consuming and less expensive method of sampling. However, an element of sampling bias gets introduced because of unequal size of some of the selected sub-sample. This method is recommended only when it would be practical to draw a sample with a simple random sampling technique.

8.3. Sampling Error and Non Sampling Error

Sampling study subjected to sampling and non-sampling errors, which are of random and/or of a constant in nature. The error created .due to sampling and of which the average magnitude be determined are called sampling error, while others are called sampling bias.

8.3.1. Sampling Error

Sampling error is the difference between the result of a sample and the result of census. It is the difference between the sample estimation and the actual value of the population.

These are errors that are created because of the chance only. Although the sample is properly selected, there will be some difference between the sample statistics and the actual value (population parameter). The mean of the sample might be different from the population mean by chance alone. The standard deviation of the sample might also be different from the population standard deviation. Therefore, we can expect some difference between the sample statistics and the population parameter. This difference is known as sampling error. To illustrate this let us take a very simple example. Suppose an individual student has scored the following grades in 10 subjects (Consider these subjects as population); 55, 60, 65, 90, 55, 75, 88, 45, 85, 82. Say, a sample of four grades 55, 65, 82, and 90 are selected at random from this population to estimate the average grade of this student. The mean of this sample is 73. But the population mean is 70. The

sampling error is therefore, $73 - 70 = 3$. However, the variation due to random fluctuation (sampling error) decreases as the sample size increases though it is not possible to completely avoid sampling error.

8.3.2. Systematic Error (non-sampling error)

Systematic sampling is also called sampling bias. Such error can be created from errors in the sampling procedure, and it cannot be reduced or eliminated by increasing the sample size. Such error occurs because of human mistakes and not chance variation. The possible factors that contribute to the creation of such error include inappropriate sampling frame, accessibility bias, defective measuring device, and non-response bias or defects in data collection.

- 1. Inappropriate sampling:** If the sample units are a misrepresentation of the population; it will result in sample bias. This could happen when a researcher gathers data from a sample that was drawn from some favored locations. It occurs when there is a failure of all units in the population to have some probability of being selected for the sample.
- 3. Accessibility bias:** In many research studies, researchers tend to select respondents who are the most accessible to them. When all members of the population are not equally accessible, the researcher must provide some mechanism of controlling in order to ensure the absence of over and under-representation of some respondents.
- 4. Non-response bias:** This is an incomplete coverage of sample or inability to get complete response from all individuals initially included in the sample. This is due to the failure in locating some of the individuals of the sample element or due to their refusal to respond. In some cases, respondents may intentionally give false information in response to some sensitive question. For instance, people may not tell the truth of their bad habit and income.

Maximizing accuracy requires that total study error be minimized.

$$\text{Total error} = \text{sampling error} + \text{Non-sampling Error}$$

Total error is usually measured as total error variance, also known as mean square (MSE)²

$$(\text{TE})^2 = (\text{SE})^2 + (\text{NE})^2$$

Generally, non-sampling errors occur in a sample survey as well as in census survey where as the sampling error occurs only in a sample survey. Preparing the survey questionnaire and handling the data properly can minimize non-sampling error.

8.5. Central Limit Theorem and Sampling theory

If a sample is taken from a normal (normally distributed) population $N(\mu, \sigma_p)$ the sample distribution of mean would also be normal with $\bar{x} = \mu$ and standard deviation = $n^{1/2} * \sigma_p$

Where, μ = the mean of the population

σ_p = Standard deviation of the population

S = Standard deviation of the sample

n = number of item in the sample

If sample is from a normal population, the means of samples drawn from such a population are themselves normally distributed

When sample is not from a normal population, the size of the sample plays critical role. When n is small, the shape of the distribution will depend largely on the shape of the parent population. But when as n gets larger ($n > 30$), the shape of the sample distribution will become more and more like a normal distribution.

The theorem that explains this sort of relationship between the shape of the population distribution and the sample distribution of the mean is known as *THE CENTRAL LIMTE THEOREM*. This theorem assures that the sample distribution of the mean approaches normal distribution as the sample size increases.

The significance of the central limit theorem lies in that it permits us to use sample statistics inference about population parameters with out knowing anything about

² For more information refer Zikmund (1998)

the shape of the frequency distribution of that population other than what we get from the sample.

Sampling theory

Sampling theory is the study of the relationship existing between a population and sample drawn from the population. Sample theory is applicable only to random samples. The theory of sampling is concerned with estimating the property of the population from those of the samples and also with gauging the precision of the estimate.

This sort of movement from particular (sample) towards general (population) is what is known as statistical induction or statistical inference. In simple word from the sample we attempt to draw inference concerning the population.

In order to be able to follow this inductive method, we first follow a deductive argument that is we imagine a population and investigate the behavior of the sample drawn from this population applying the law of probability

The methodology dealing with all this is known as sampling theory. Sampling theory is design to attain one or more of the following objectives

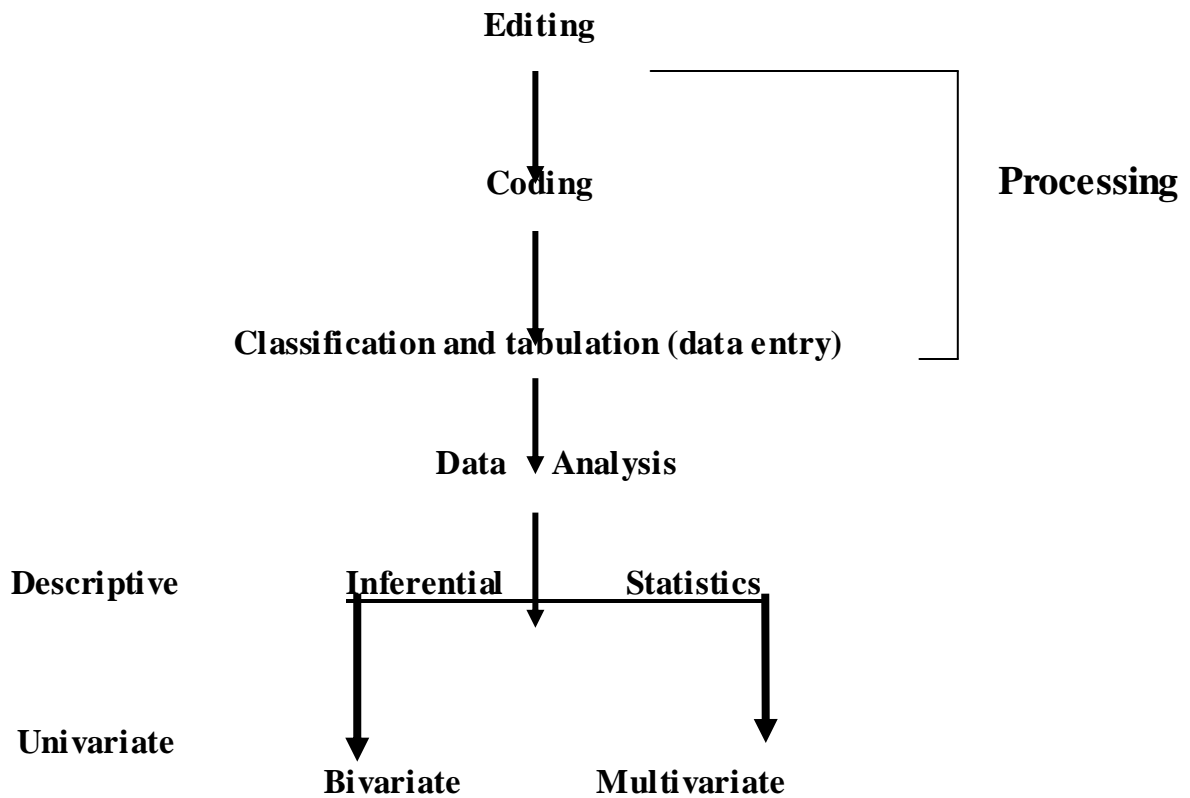
- ***Statistical estimation:*** Sampling theory helps in estimating unknown population parameters from knowledge of statistical measurement on sample studies. In other words, to obtain an estimate of parameter from statistic is the main objective of sample theory (estimate can be point or interval)
- ***Testing of hypothesis:*** It enables us to decide whether to accept or to reject the stated hypothesis. That is, observed differences are actually due to chance or whether they are really significant.
- ***Statistical inference:*** Sampling theory helps in making generalization about the population from the studies based on samples drawn from it. It also helps in determining the accuracy of such generalization

CHAPTER NINE

Overview of Data Processing and Analysis

The goal of any research is to provide information out of raw data. The raw data after collection has to be processed and analyzed in line with the outline (plan) laid down for the purpose at the time of developing the research plan. Response on measurement instruments (words, check mark etc.) conveys little information as such. The compiled data must be classified, processed, analyzed and interpreted carefully before their complete meanings and implications can be understood.

Generally stages in data processing and analysis can be summarized as:



There are two stages of data analysis, data processing and analysis. Some authors do like to make difference between processing and analysis. However we see them separately these terms briefly

9.1. Data processing

Data possessing implies editing, coding, classification and tabulation of collected data so that they are amendable to analysis.

Editing: Is a process of examining the collected raw data to detect errors and omission (extreme values) and to correct those when possible

- It involves a careful scrutiny of completed questionnaires or schedules
- It is done to assure that the data are
 - Accurate
 - Consistent with other data gathered
 - Uniformly entered
 - As complete as possible
 - And has been well organized to facilitate coding and tabulation

Editing can be either field editing or central editing

Field editing: Consist of reviewing of the reporting forms by the investigator for completing what has been written in abbreviation and/ or in illegible form at a time of recording the respondents' response

This sort of editing should be done as soon as possible after the interview or observation.

Central editing: It will take place at the research office. Its objective is to correct errors such as entry in the wrong place, entry recorded in month

Coding: Refers to the process of assigning numerical or other symbols to answers so that responses can be put into a limited number of categories or classes. Such classes should be appropriate to the research problem under consideration.

There must be a class of every data items. They must be mutually exclusive (a specific answer can be placed in one and only one cell in a given category set)

Coding is necessary for efficient analysis and through it several replies may be reduced to a small number of classes, which contain the critical information required for analysis

E.g., Closed end question

1 Yes

2 No

Or

Less than 200 001

201- 699 002

1500 and more 006

Coding is used when the researcher uses computer to analyze the data otherwise it can be avoided.

Classification: Most research studies result in a large volume of raw data, which must be reduced into homogeneous group. Which means to classify the raw data or arranging data in-groups or classes on the basis of common characteristics?

Data Classification implies the processes of arranging data in groups or classes on the basis of common characteristics. Data having common characteristics placed in one class and in this way the entire data get divided into a number of groups or classes.

Classification according to attributes: Data are classified on the basis of common characteristics, which can either be descriptive (such as literacy, sex, honesty, etc) or numerical (such as, weight, age height, income, expenditure, etc.). Descriptive characteristics refer to qualitative phenomenon, which cannot be measured quantitatively: only their presence or absence in an individual item can

be noticed. Data obtained this way on the basis of certain attributes are known as statistics of attributes and their classification is said to be classification according to attributes.

Classification according to class interval: Unlike descriptive characteristics the numerical characteristics refer to quantitative phenomenon, which can be measured through some statistical unit. Data relating to income, production, age, weighted, come under category. Such data are known as statistics of variables and are classified on the basis of class interval. For example, individuals whose incomes, say, are within 1001-1500 Birr can form one group, those whose incomes within 500-1000 Birr form another group and so on. In this way the entire data may be divided into a number of groups or classes or what are usually called, class interval. Each class-interval, thus, has an upper as well as lower limit, which is known as class limit. The difference between the two-class limits is known as class magnitude. The number of items that fall in a given class is known as the frequency of the given class. All the classes with their respective frequency are taken together and put in the form of table are describing as group frequency distribution or simply frequency distribution. Classification according to class intervals usually involves the following problems.

- How many classes should be there? What should be their class size (magnitude)? The answer is left to the skill and experience of the researcher. However, the objective should be to display the data in such a way as to make it meaningful to the analyst. Concerning the class size, each group is expected to have equal size. Multiples of 2.5 and 10 are generally preferred while determining the class size. Some statistician adopts the following formula.

$$i = R / (1 + 3.3 \log N)$$

Where, I = class size

R = Range (i.e, difference between the value of the largest item and smallest item among the items to be grouped.

N = Number of item to grouped

Some problems in processing

Don't know (DK) Responses: During data processing, the researcher often comes across some responses that are difficult to handle. Don't know (DK) is one example of such responses. When the DK response group is small, it is of little significance. But when it is relatively big, it becomes a matter of major concern.

How the DK responses are to be dealt with by researcher?

Prevention is the best!

The best way is to design better types of question. Good rapport (understanding) of interviews with respondents will result in minimizing DK response.

But what about the DK responses that have already taken place?

One way to tackle this issue is to estimate the allocation of DK answers from other data in the questionnaire

The other way is to keep DK responses as a separate replay category if DK response happens to be legitimate, otherwise we should let the reader make his own decision.

9.2. Analysis

Data analysis is further transformation of the processed data to look for patterns and relations among data groups.

By analysis we mean the computation of certain indices or measures along with searching for patterns or relationship that exist among the data groups. Analysis particularly in case of survey or experimental data involves estimating the values

of unknown parameters of the population and testing of hypothesis for drawing inferences.

Analysis can be categorized as

- Descriptive Analysis
- Inferential (Statistical) Analysis

9.2.1 Descriptive analysis: Descriptive analysis is largely the study of distribution of one variable. Analysis begins for most projects with some form of descriptive analysis to reduce the data into a summary format. Descriptive analysis refers to the transformation of raw data into a form that will make them easy to understand and interpret.

Descriptive response or observation is typically the first form of analysis. The calculation of averages, frequency distribution, and percentage distribution is the most common form of summarizing data.

The most common forms of describing the processed data are:

- Tabulation
- Percentage
- Measurements of central tendency
- Measurements of dispersion
- Measurement of asymmetry
- Data transformation and index number

Tabulation: Refers to the orderly arrangement of data in a table or other summary format. It presents responses or the observations on a question-by-question or item-by-item basis and provides the most basic form of information. It tells the researcher how frequently each response occurs

This starting point of analysis requires the counting of responses or observations for each of the categories. E.g., Frequency tables,

Need for tabulation

- It conserves space and reduces explanatory and descriptive statement to a minimum
- It facilitate the process of comparison
- It facilitate the summation of items and the detection of errors and omission
- It provide basis for various statistical computation,

Percentage: Whether the data are tabulated by computer or by hand, it is useful to have percentages and cumulative percentage. Table containing percentage and frequency distribution is easier to interpret. Percentages are useful for comparing the trend over time or among categories

Measure of central tendency: Describing the central tendency of the distribution with the mean, median or mode is another basic form of descriptive analysis.

These measures are most useful when the purpose is to identify typical values of a variable or the most common characteristics of a group. Measure of central tendency is also known as statistical average. Mean, median and mode are most popular averages.

Mean (arithmetic mean) is the common measure of central tendency

Mode is not commonly used but in such study like estimating the popular size of shoes it can be used

Median is commonly used in estimating the average of qualitative phenomenon like estimating intelligence.

Measurement of dispersion: Is a measurement how the value of an item scattered around the true value of the average.

Average value fails to give any idea about the dispersion of the values of an item or a variable around the true value of the average.

After identifying the typical value of a variable the researcher can measure how the value of an item is scattered around the true value of the mean. It is a measurement of how far is the value of the variable from the average value. It

measures the variation of the value of an item. Important measures of dispersion are:

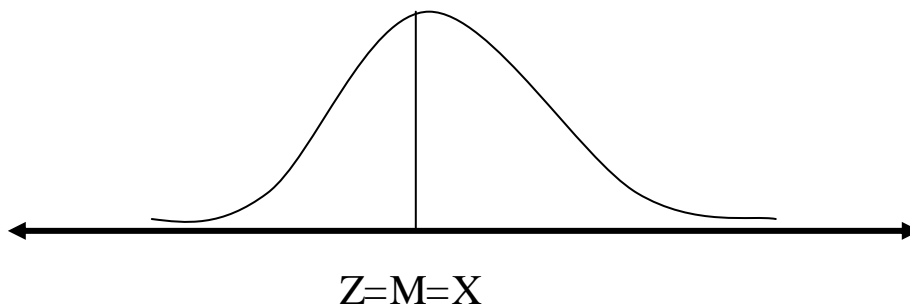
Range: Measures the difference between the maximum and the minimum value of the observed variable

Mean deviation: It is the average dispersion of an observation around the mean value. $\sum(X_i - \bar{X})/n$

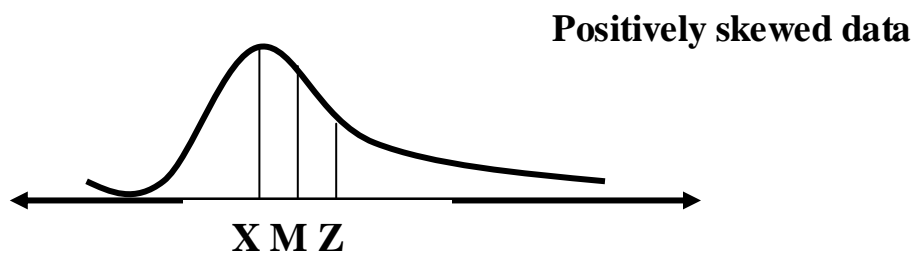
Variance: It is mean square deviation. It measures the sample variability.

Measurement of asymmetry (skew-ness): When the distribution of items is happen to be perfectly symmetrical, we then have a normal curve and the relating distribution is normal distribution. Such curve is perfectly bell shaped curve in which case the value of **Mean = Median = Mode**

Under this condition the skew-ness is altogether absent. If the curve is distorted (whether on the right or the left side), we have asymmetric distribution this indicates that there is a skew ness.



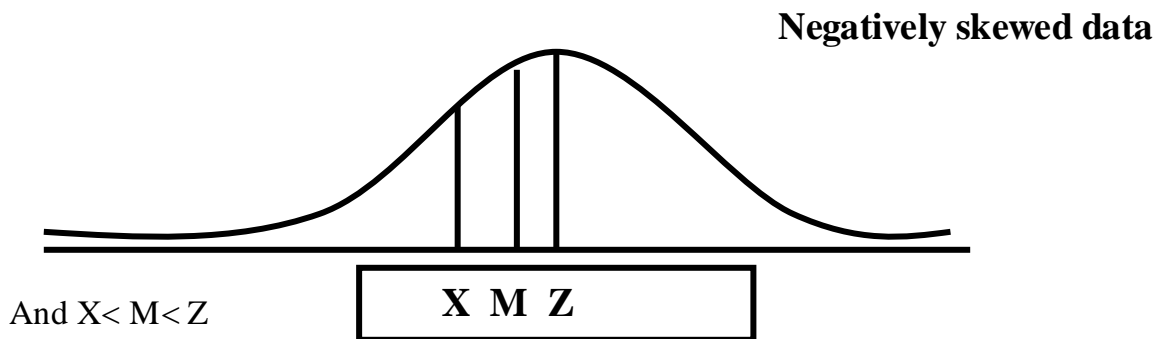
If the curve is skewed on the right side we call it positive skew ness



X is mean, M and Z is mode

In such case $Z < M < X$

But when the curve is skewed toward left, we call it negative skewness.



Skewness is, thus a measurement of asymmetry and shows the manner in which the items are clustered around the average. In a symmetric (normal distribution) the items show a perfect balance on either side of the mode, but in a skewed distribution the balance is skewed one side or distorted. The amount by which the balance exceeds on one side measures the skewness.

Knowledge about the shape of the distribution is crucial to the use of statistical measure in research analysis. Since most methods make specific assumptions about the nature of distribution.

Data transformation: It is the process of changing original form of data to a form that is more suitable to perform a data analysis that will achieve the research objective. The researcher often modifies the value of scalar data or even create new variable

Index numbers: Most of the time, financial information (price, value of output, interest rate, and exchange rate) will be adjusted for possible price changes by using index numbers (like CPI, PPI).

An index number is a number, which is used to measure the level of a given phenomenon at some standard date.

- Index numbers measure only the relative changes.
- Different indices serve different purposes

- Commodity index serves as a measure of changes in the phenomenon on that commodity only
- Some index numbers are used to measure cost of living (CPI)
- In economic sphere they are often termed as economic barometer

Scores of observation are recalibrated so that they may be related to certain base period or base number. Most commonly used index number to reduce the influence of price change on our observation is CPI

Researcher also uses index numbers to make comparison between observations. When series (data) are expressed in same units, we can use, averages for the purpose of comparison. But two or more series are expressed in different units; statistical average cannot be used to compare them. By converting numbers in to index number we can make comparison between two or more series.

9.2.2. Inferential Analysis

Most researcher wishes to go beyond the simple tabulation of frequency distribution and calculation of averages and / or dispersion. They frequently conduct and seek to determine the relationship between variables and test statistical significance. When the population is consisting of more than one variable it is possible to measure the relationship between them.

If we have data on two variables we said to have a bivariate variable, if the data is more than two variables then the population is known as multivariate population. If for every measure of a variable, X, we have corresponding value of variable, Y, the resulting pairs of value are called a bivariate population

In case of bivariate or multivariate population, we often wish to know the relationship between the two or more variables from the data obtained.

E.g., we may like to know, “Whether the number of hours students devote for study is somehow related to their family income, to age, to sex, or to similar other factors.

There are several methods of determining the relationship between variables.

Two questions should be answered to determine the relationship between variables.

1. Is there exist association or correlation between the two or more variables? If yes, then up to what degree?

This will be answered by the use of correlation technique. Correlation technique can be different

In case of bivariate population correlation can be found using

- Cross tabulation
- Karl Pearson's coefficient of correlation: It is simple correlation and commonly used
- Charles Spearman's coefficient of correlation

In case of multivariate population correlation can be studied through:

- Coefficient of multiple correlation
- Coefficient of partial correlation

2. Is there any cause and effect (causal relationship) between two variables or between one variable on one side and two or more variables on the other side?

This question can be answered by the use of regression analysis. In regression analysis the researcher tries to estimate or predict the average value of one variable on the basis of the value of other variable. For instance a researcher estimates the average value score on statistics knowing a student's score on a mathematics examination.

There are different techniques of regression.

- In case of bivariate population cause and effect relationship can be studied through simple regression.
- In case of multivariate population: Causal relationship can be studied through multiple regression analysis.

Time series Analysis; Successive observations of the given phenomenon over a period of time are analyzed through time series analysis. It measures the relationship between variables and time (trend)

Time series will measure seasonal (seasonal fluctuation), cyclical irregular fluctuation, and Trend. The analysis of time series is done to understand the dynamic condition of achieving the short term and long-term goal of business firm for forecasting purpose

The past trend can be used to evaluate the success or failure of management or any other policy. Based on past trend the future patterns can be predicted and policy may accordingly be formulated.

CHAPTER TEN

Interpretation and Reporting the Research Result

After collecting and analyzing the data, the researcher has to accomplish the task of drawing inferences followed by the report writing. Interpretation has to be done carefully so that misleading conclusion will not be drawn and the whole purpose of doing research will not be vitiated.

It is through interpretation that the researcher can expose relations and processes that underline his findings. If hypotheses are tested and upheld (confirmed), the researcher may arrive at generalization.

But incase the researcher had no hypothesis to start with; he would try to explain his findings on the basis of some theory.

All the analytical information and consequential inferences may well be communicated, preferably through research report, to the consumers of research results who may be either an individuals or groups or some public or private organization.

10.1. Meanings and Technique of interpretation of interpretation

Interpretation refers to the task of drawing inferences from the collected facts after analytical or experimental study.

The task of interpretation has two parts or has two major aspects

- 1) The effort to establish continuity in research through linking the results of a given study with those of others.
- 2) The establishment of explanatory concept.

In one sense, interpretation is concerned with relationships within the collected data, partially overlapping analysis.

Interpretation also extends beyond the data of the study to include the results of other research, theory hypothesis.

Why interpretation?

Interpretation is considered as a basic component of research process because of the following reasons: It is through interpretation that the researcher can well understand the abstract principle that works beneath (beyond) his findings.

It will lead to the establishment of explanatory concepts that can serve as a guide for further research study. It opens new avenues of intellectual adventure and stimulates the quest for more knowledge.

Researcher can only be better appreciated only through interpretation why his findings are what they are and can make others to understand the real significance of his research findings. The interpretation of exploratory research often results into hypothesis for experimental research.

Technique of interpretation

The task of interpretation is not an easy job. Rather it requires a good skill on the part of researcher. Interpretation is an art that one learns through practice and experience. The researcher may, at times, seek the guidance from experts for accomplishing the task of interpretation.

There are no existing rules to guide the researcher about how to interpret the data.

However, the following suggested steps could be helpful.

- 1) Researcher must give reasonable explanation of the relation, which he has found and he must interpret the lines of relationship in terms of the underlying processes and must try to find out the thread of uniformity that lies under the surface layer of his diversified research findings.

- 2) Extraneous information, if collected during the study, must be considered while interpreting the final result of research study, for it may prove to be a key factor in understanding the problem under consideration.
- 3) It is advisable, before embarking upon final interpretation, to consult some one having insight into the study and who is frank and honest and will not hesitate to point out omissions and errors in logical argumentation. Such a consultation will result in correct interpretation and, thus, enhance the utility of research result.
- 4) Researcher must accomplish the task of interpretation only after considering all relevant factors affecting the problem to avoid false generalization.

He must not be in hurry while interpreting results, for quite often the conclusion, which appear to be all right at the beginning, may not at all be accurate.

Precaution in interpretation

Researcher must pay attention to the following points for correct interpretation.

- At the outset, researcher must invariably satisfy himself that: the data are appropriate, trust worthy and adequate for drawing inferences. The data reflect good homogeneity (no extreme) and proper analysis has been done through statistical or any other methods.
- The researcher must remain cautious about the errors that can possibly arise in the process of interpreting results. Error can arise due to
 - False generalization and/or due to wrong interpretation of statistical measures, such as:
 - The application of findings beyond the rang of observation
 - Identification of correlation with causation and the like
- He should be well equipped with and must know the correct use of statistical measures for drawing inferences concerning his study.

- Broad generalization must be avoided, because the coverage restricted to a particular time, a particular area and particular condition. Such restriction, if any, must invariably be specified and the result must be framed within their limit.
- The researcher must remember that there should be constant interaction between initial hypothesis and, empirical observation and theoretical conceptions. It is exactly in this area of interaction between theoretical orientation and empirical observation that opportunity for originality and creativity lies. (V. Young, 1849)

10.2. Reporting the research result

Writing report is the last step in a research study and requires a set of skills somewhat different from those called for in research of the earlier stages of research. This task should be accomplished by the researcher with at most care. He may also seek the assistance and guidance of experts for the purpose. The research task remains incomplete till the report has been presented and/or written.

Even the most brilliant hypothesis, well-designed and conducted research study, and the most striking generalization and findings are of little importance unless they are effectively communicated to others.

The purpose of research is not well served unless the findings are made known to others.

Layout of research report

Layout of the report means as to what the research report should contain and look like. A comprehensive layout of the research report should comprise

- Preliminary pages
- The main text
- The end matter

1) Preliminary pages

In this part the report should carry

- Title
- Acknowledgment (this can be in the form of preface and forward, in larger study)
- Table of content
- List of tables (figures) ¹

2) Main text

The main text provides the complete outline of the research report along with all details. Title of the research is repeated at the top followed by abstract and then follows the other details on pages numbered consecutively beginning with second page. Each main section of the report should begin on a new page.

Main text can have the following sections

- Introduction
 - Background of the study
 - Rationale
- Objectives
- Literature Review
- Material and Methodology
 - Data (or material)
 - Methodology used,
 - Limitation of the study
- Results and discussion (in some cases, Empirical Analysis)
- Summary, Conclusion and Recommendation or
 - Concluding comment or

Since, some of the main sections of the report have been explained in some detail in chapter four section two, here attempts were made to explain only selected parts of the report, which need special attentions.

Introduction: the major subdivisions of this part are generally the ones shown in the proposal: statement of the problem, significance of the study, and the organization of the study. This part of the study should be lucid complete and concise. It has to be written in a lively and stimulating manner in order to arouse the interest of the reader to go through the report.

Literature Review: this is a section for documentation with insight theoretical and empirical investigation that had been carried out as related to the study at hand

Material and Methodology or Data and Methodology: this part includes detailed description of the manner in which decision have been made about the type of data needed for the study, the tools and approaches used for their collection and the method by which they have been collected, justification of the selection of the particular method of data collection. Definition of the population, the sampling techniques used to select sample elements with its full justification, the size of the sample and the rational for the size, statistical tools used to analyze the data the rational for using them will be dealt in detail in this section.

Limitations: No report is perfect, so it is important to indicate its implications. If there were problems with non-response errors, or sampling procedures, they should be discussed.

The discussion of limitation should avoid overemphasizing the weakness, though Its aim should be to provide a realistic basis for assessing the results.

Result and Discussion: A detailed presentation of the findings of the study (the results of the data analysis) with supporting data in the form of tables and charts together with a validation of results. In other words in this section the data is

¹ Preliminary pages are commonly numbered by Roman numbers

presented in tables and figures followed by narrative discussion and justifications. Two things may require special attention while writing this part of the report.

- Tables that are too lengthy may better be placed in the appendix
- Tables and figures should be explained. As tables and figures are expected to be self explanatory, the textual discussion should not be a duplicate of the table. Only important facts that lead to generalization will be discussed.

This section generally comprises the body of the report, extending over several sub-sections.

It should contain statistical summaries and reductions of the data rather than the raw data. All results should be presented in logical sequences and divided into readily identifiable sections. All relevant results must find a place in the report.

Summary and Conclusion: Toward the end of this section, the researcher should again put down the results of his research clearly and precisely. This part begins with a brief restatement of the problem, the hypothesis, description of the problem and discussion of findings and conclusion of the study. Most readers skip other details of the report and may prefer to read only this part in order to get an overview of the study and judge its relevance. Thus, it should be written with maximum diligence, clarity and brevity. Moreover, this section must focus attention to

- Announce the acceptance or the rejection of the stated hypothesis.
- Simply unanswered question that were raised in due course of the study and which required further investigation in there are relevant to this part.

A researcher should also state the implication that flows from the results the study for the general reader is interested in the implication that for understanding the human behavior.

Such implication may have three aspects as stated below:

- A statement the inferences drawn from the present study which may be expected to apply in similar circumstances
- The condition of the present study, which may limit the extent of the legitimate generalization of the inferences drawn from the study.
- The relevant questions that still remain unanswered or new questions rose by the study along with suggestion for the kind of research that would provide answer for them.

Generally, it is considered as a good practice to finish the report with a short conclusion, which summarize and recapitulates the main points of the study. The conclusion drawn from the study should be clearly related to the hypothesis or the problem that are stated in the introductory section.

At the same times, a forecast of the problem future of the subject and indication of the kind of research, which needs to be done in those particular fields, is useful and desirable. Conclusions are opinion based on the results, where as recommendations are suggestions for action.

Recommendation: In accordance with the result of the outcome of the research work a researcher may forward (suggest) possible solution that may alleviate the problem in question. The recommendation to be acceptable it should meet the following requirements;

- Should be clear an unambiguous
- Need to be realistic, plausible and operational
- Should point out the responsible body to translate the suggested solution into practice
- Should be modest than assertive

3) End matter:

Here belong sections like: **References (bibliography):** It should be based on alphabetical listing of names and **Appendix**

CHAPTER ELEVEN

Case Study: An Overview

The case study method is a very popular form of qualitative analysis and involves a careful and complete observation of a social unit, be that unit a person, a family, an institution, a cultural group or even the entire community. It is a method of study in depth rather than breadth

The case study places more emphasis on the full analysis of a limited number of events or conditions and their interrelations.

Case study is essentially an intensive investigation of the particular unit under consideration.

Young (1849) describes case study as *“a comprehensive study of a social unit be it that unit a person, a group, a social institution, a district or a community”*

In short, we can say that case study method is a form of qualitative analysis where in careful and complete observation of an individual or a situation or an institution is done. Here efforts are made to study each and every aspect of the concerning unit in minute detail and then from case data generalization and inference are drawn.

The nature (characteristics) of case study method

1. **Study of a unit:** The researcher can take one single social unit or more of such units for his study purpose. May even take a situation to study comprehensively.
2. **Intensive or depth study:** The quantitative method studies a subject in its particular aspect and not in its entirety. But the case study method, deal with every aspect of the subject and studies its both intensively and extensively, i.e., each element is studied deeply and no element left untouched.

3. **Knowledge of behavioral pattern:** The behavioral factor is studied directly and not by indirect and abstract approach. It tries to describe the complex behavioral pattern of a unit and, having done these tries to discover the factors, which will rationally account for them. It aims at description as well as explanation of the unit it studies. It also explains the place and role of unit in its surrounding social environment.

E.g., under this method we not only study how many crimes a given person has done but also peep in to the factors that forced him to commit crime when we are making a case study a man as a criminal

4. **The study of the whole unit:** It makes complete study of the social unit covering all facts.

5. **Causal study:** An effort is made to know the mutual inter-relationship or causal factors.

Assumptions

Case study method is based on several assumptions of which the most important are:

- **The assumption of the fundamental unity of human nature:** There is uniformity in basic human nature in spite of the fact that human behavior may vary according to situations.

All human beings share a common nature and fundamentally alike in some crucial mater.

- The assumption of comprehensive study of all unit concerned
- The assumption of studying the natural history of the unit concerned.

Utility of case study method

- Formation of valid hypothesis:
- Aid of sampling: The case study helps in classifying the units in a much better and efficient manner. It helps to fix definitely the character of a

particular unit, and this intern helps to classify it under a well determined head

- Aid to form questionnaires: The case study will help to select quires, which will yield a desire response.
- Appreciation of quantitative analysis in actual situation: The researcher who do not come in contact with the actual situation and individuals would not quite appreciate the various statistics about the delinquency, prostitution, larceny, gangstersim, etc. A researcher doing actual case work can appreciate this better

Limitations of case study method

- Case studies are seldom comparable. Since the subject under case study tells history in his own word, logical concepts and units of scientific classification have to read into it or out of it by the investigator
- Real information is often not collected because the subjectivity of the researcher does enter in the collection of information in a case study.
- According to Read Bain the case study data are not significant since they do not provide universal information
- There is a danger of false generalization in view the fact that no set rules are followed in collection of the information and only few units are studied
- It consumes more time and requires a lot of expenditure.
- Case study method is based on several assumptions, which may not be very realistic.
- Case study method can be used only in a limited sphere: it is not possible to use it in case of a big society. Sampling is not possible under a case study method.
- Response of the investigator is an important limitation of the case study method. He often thinks that he has full knowledge of the unit can himself

answer about it. In case the same is not true then the result of the study is in question. In fact this is the fault of the researcher rather than the method.

- Small-unit-based conclusion: However, deep and penetrating a study may be, its conclusion will not be generally valid if the unit chosen for study is very small.
- Highly expensive and time consuming: For deep study of a number of units the cost and time factor is prohibitive. It may take year to study some unit.
- Possibility of error: There are high chances of making errors in the selection of case, observation, noting and interview.

CHAPTER TWELVE

Criteria of Good Research

Whatever may be the type of research works and studies, one thing that is important is that they all meet on the common ground of scientific method employed by them.

One expect the scientific research to satisfy the following criteria-

1. The procedural design of the research should be carefully planned to yield results that are as objective as possible.
2. The purpose of the research should be clearly defined and common concepts be used.
3. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings
4. The analysis of data should be sufficiently adequate to reveal its significance and the methods of analysis used should be appropriate. The validity and reliability of the data should be checked carefully
5. Conclusion should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis.
6. Great confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

Qualities of good research

1. Good research is systematic: Research is structured with specified steps to be taken in specified sequences in accordance with the well-defined rules. (This characteristics will not rule out creative thinking but is certainly does reject the use of guessing, and intuition in arriving at conclusion

2. Good research is logical: The research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out a research.
3. Good research is empirical: It implies the research is related basically to one or more aspects of a real situation and deal with concrete data that provides a basis for external validity to research results
4. Good research is replicable: This character allows the result to be verified by replicating the study and thereby building a sound basis for decision.

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