UNIT – I

INTRODUCTION

Learning Objectives

After reading this lesson, you should be able to understand:

- **Meaning, objectives and types of research**
- **Qualities of researcher**
- **Significance of research**
- **Research process**
- **Research problem**
- **Features, importance, characteristics, concepts and types of Research design**
- **Case study research**
- **Hypothesis and its testing**
- **Sample survey and sampling methods**

1.1 Meaning of Research

Research in simple terms, refers to a search for knowledge. It is also known as a scientific and systematic search for information on particular topic or issue. It is also known as the art of scientific investigation. Several social scientists have defined research in different ways

In the Encyclopedia of Social Sciences, D. Slesinger and M. Stephension (1930) defined research as "the manipulation of things, concept or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in practice of an art".

According to Redman and Mory (1923), defined research is a "systematized effort to gain new knowledge". It is an academic activity and therefore the term should be used in a technical sense. According to Clifford Woody (Kothari 1988) research comprises "defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and

evaluating data; making deductions and reaching conclusions; and finally, carefully testing the conclusions to determine whether they fit the formulating hypothesis".

Thus, research is an original addition to the available knowledge, which contributes to its further advancement. It is an attempt to pursue truth through the methods of study, observation, comparison and experiment. In sum, research is the search for knowledge, using objective and systematic methods to find solution to a problem.

1.1.1 Objectives of research

The objective of research is to discover answers to questions by applying scientific procedures. In the other words, the main aim of research is to find out truth which is hidden and has not yet been discovered. Although every research study has its own specific objectives, research objectives may be broadly grouped as follows:-

1. to gain familiarity with or new insights into a phenomenon (i.e., formulative research studies);
2. to accurately portray the characteristics of a particular individual, group, or a situation (i.e., descriptive research studies);
3. to analyse the frequency with which something occurs (i.e., diagnostic research studies); and
4. to examine a hypothesis of a causal relationship between two variables (i.e., hypothesis-testing research studies).

1.1.2 Research methods versus methodology

Research methods include all those techniques/methods that are adopted for conducting research. Thus, research techniques or methods are the methods the researchers adopt for conducting the research operations.

On the other hand, research methodology is the way of systematically solving the research problem. It is a science of studying how research is conducted scientifically. Under it, the researcher acquaints himself/herself with

the various steps generally adopted to study a research problem, along with the underlying logic behind them. Hence, it is not only important for the researcher to know the research techniques/methods, but also the scientific approach called methodology.

1.1.3 Research approaches

There are two main approaches to research, namely quantitative approach and qualitative approach. The quantitative approach involves the collection of quantitative data, which are put to rigorous quantitative analysis in a formal and rigid manner. This approach further includes experimental, inferential, and simulation approaches to research. Meanwhile, the qualitative approach uses the method of subjective assessment of opinions, behaviour and attitudes. Research in such a situation is a function of the researcher's impressions and insights. The results generated by this type of research is either in non-quantitative form or in the form which can not be put to rigorous quantitative analysis. Usually, this approach uses techniques like depth interviews, focus group interviews, and projective techniques.

1.1.4 Types of research

There are different types of research. The basic ones are as follows:

1) **Descriptive vs. Analytical:**

Descriptive research comprises surveys and fact-finding enquiries of different types. The main objective of descriptive research is describing the state of affairs as it prevails at the time of study. The term ex post facto research is quite often used for descriptive research studies in social sciences and business research. The most distinguishing feature of this method is that the researcher has no control over the variables here. He/she has to only report what is happening or what has happened. Majority of the ex post facto research projects are used for descriptive studies in which the researcher attempts to examine

phenomena, such as the consumers' preferences, frequency of purchases, shopping, etc. Despite the inability of the researchers to control the variables, ex post facto studies may also comprise attempts by them to discover the causes of the selected problem. The methods of research adopted in conducting descriptive research are survey methods of all kinds, including correlational and comparative methods.

Meanwhile in the analytical research, the researcher has to use the already available facts or information, and analyse them to make a critical evaluation of the subject.

2) **Applied vs. Fundamental**

Research can also be applied or fundamental research. An attempt to find a solution to an immediate problem encountered by a firm, an industry, a business organisation, or the society is known as applied research. Researchers engaged in such researches aim at drawing certain conclusions confronting a concrete social or business problem. On the other hand, fundamental research mainly concerns generalizations and formulation of a theory. In other words, "Gathering knowledge for knowledge's sake is termed 'pure' or 'basic' research" (Young in Kothari 1988). Researches relating to pure mathematics or concerning some natural phenomenon are instances of fundamental research. Likewise, studies focusing on human behaviour also fall under the category of fundamental research. Thus, while the principal objective of applied research is to find a solution to some pressing practical problem, the objective of basic research is to find information with a broad base of application and add to the already existing organized body of scientific knowledge.

3) **Quantitative vs. Qualitative**

Quantitative research relates to aspects that can be quantified or can be expressed in terms of quantity. It involves the measurement of quantity or

amount. The various available statistical and econometric methods are adopted for analysis in such research. They include correlation, regressions, time series analysis, etc.

Whereas, qualitative research is concerned with qualitative phenomenon, or more specifically, the aspects relating to or involving quality or kind. For example, an important type of qualitative research is 'Motivation Research', which investigates into the reasons for human behaviour. The main aim of this type of research is discovering the underlying motives and desires of human beings, using in-depth interviews. The other techniques employed in such research are story completion tests, sentence completion tests, word association tests, and other similar projective methods. Qualitative research is particularly significant in the context of behavioural sciences, which aim at discovering the underlying motives of human behaviour. Such research help to analyse the various factors that motivate human beings to behave in a certain manner, besides contributing to an understanding of what makes individuals like or dislike a particular thing. However, it is worth noting that conducting qualitative research in practice is considerably a difficult task. Hence, while undertaking such research, seeking guidance from experienced expert researchers is important.

4) **Conceptual vs. Empirical**

A research related to some abstract idea or theory is known as conceptual research. Generally, philosophers and thinkers use it for developing new concepts or for reinterpreting the existing ones. Empirical research, on the other hand, exclusively relies on observation or experience with hardly any regard for theory and system. Such research is data based. They often come up with conclusions that can be verified through experiment or observation. They are also known as experimental type of research. Under such research, it is

important to first collect facts, their source and actively do certain things to stimulate the production of desired information. In such a research, the researcher must first identify a working hypothesis or make a guess of the probable results. Next, he/she gathers sufficient facts to prove or disprove the stated hypothesis. Then he/she formulates experimental designs, which according to him/her would manipulate the individuals or the materials concerned, so as to obtain the desired information. This type of research is thus characterized by the researcher's control over the variables used to study their effects. Empirical research is most appropriate when an attempt is made to prove that certain variables influence the other variables in some way. Therefore, the results obtained using the experimental or empirical studies are considered as one of the most powerful evidences for a given hypothesis.

5) **Other types of research:** The remaining types of research are variations of one or more of the afore-mentioned methods. They vary in terms of the purpose of research, or the time required to complete it, or based on some other similar factor. On the basis of time, research may either be in the nature of one-time or longitudinal research. While the research is restricted to a single time-period in the former case, it is conducted over several time-periods in the latter case. Depending upon the environment in which the research is to be conducted, it may also be laboratory research or field-setting research, or simulation research, besides being diagnostic or clinical in nature. Under such research, in-depth approaches or case-study methods may be employed to analyse the basic causal relations. These studies usually conduct a detailed in-depth analysis of the causes of things or events of interest, and use very small samples and a sharp data collecting method. The research may also be explanatory in nature. Formalized research studies consist of substantial structure and specific hypotheses to be verified. As regards historical research,

sources like historical documents, remains, etc., are utilized to study past events or ideas. It also includes philosophy of persons and groups of the past or any remote point of time. Research is also categorized as decision-oriented and conclusion-oriented. In the case of decision-oriented research, it is always carried out for the need of a decision maker and hence, the researcher has no freedom to conduct the research as per his/her own desires. Whereas, under conclusion-oriented research, the researcher is free to choose the problem, redesign the enquiry as it progresses and even change conceptualization as he/she wishes to. Further, operations research is a kind of decision- oriented research, because it is a scientific method which provides the executive departments a quantitative basis for decision-making with respect to the activities under their purview.

1.1.5 Importance of knowing how to conduct research

The following are the importance of knowing how to conduct a research:

(i) the knowledge of research methodology provides training to new researchers and enables them to do research properly. It helps them to develop disciplined thinking or a 'bent of mind' to objectively observe the field.

(ii) the knowledge of doing research would inculcate the ability to evaluate and utilise the research findings with confidence;

(iii) the knowledge of research methodology equips the researcher with tools that help him/her to observe things objectively; and

(iv) the knowledge of methodology helps the research consumer to evaluate research and make rational decisions.

1.1.6 Qualities of a researcher

It is important for a researcher to have certain qualities to conduct research. Foremost, the researcher being a scientist should be firmly committed to the

'articles of faith' of the scientific methods of research. This implies that a researcher should be a social science person in the truest sense.

Sir Michael Foster (Wilkinson and Bhandarkar 1979) identified a few distinctive qualities of a scientist. According to him, a true research scientist should possess the following main three qualities.

(1) First of all, the nature of a researcher must be of the temperament that vibrates in unison with the theme which he is searching. Hence, the seeker of knowledge must be truthful with truthfulness of nature, which is much more important, much more exacting than what is sometimes known as truthfulness. The truthfulness relates to the desire for accuracy of observation and precision of statement. Ensuring facts is the principle rule of science, which is not an easy matter. Such difficulty may arise due to untrained eye, which fails to see anything beyond what it has the power of seeing and sometimes even less than that. This may also be due to the lack of discipline in the method of science. An unscientific individual often remains satisfied with expressions like approximately, almost, nearly, etc., which is never what nature, is. It cannot see two things which differ, however minutely, as the same.

(2) A researcher must possess an alert mind. The Nature is constantly changing and revealing itself through various ways. A scientific researcher must be keen and watchful to notice such changes, no matter how small or insignificant they may appear. Such receptivity has to be cultivated slowly and patiently over time by the researcher through practice. No individual who is not alert and receptive, or is ignorant or has no keen eyes or mind to observe the unusual behind the routine, can make a good researcher. Research demands a systematic immersion into the subject matter for the researcher to be able to grasp even the slightest hint that may culminate into significant research problems. In this context, Cohen and Negal (Wilkinson and Bhandarkar 1979)

state that "The ability to perceive in some brute experience the occasion of a problem is not a common talent among men… It is a mark of scientific genius to be sensitive to difficulties where less gifted people pass by untroubled by doubt" (Selltiz, et. al.,1965).

(3) Scientific enquiry is pre-eminently an intellectual effort. It requires the moral quality of courage, which reflects the courage of a steadfast endurance. The science of conducting research is not an easy task. There are occasions when a research scientist might feel defeated or completely lost. This is a stage when the researcher would need immense courage and a sense of conviction. The researcher must learn the art of enduring intellectual hardships. In the words of Darwin, "It's dogged that does it" (Wilkinson and Bhandarkar 1979).

In order to cultivate the afore-mentioned three qualities of a researcher, a fourth one may be added. This is the quality of making statements cautiously. According to Huxley, "The assertion that outstrips the evidence is not only a blunder but a crime" (Thompson 1975). A researcher should cultivate the habit of reserving judgment when the required data are insufficient.

1.1.7 Significance of research

According to a famous Hudson Maxim, "All progress is born of inquiry. Doubt is often better than overconfidence, for it leads to inquiry, and inquiry leads to invention" (Wilkinson and Bhandarkar 1979). It brings out the significance of research, increased amounts of which makes progress possible. Research encourages scientific and inductive thinking, besides promoting the development of logical habits of thinking and organisation.

The role of research in applied economics in the context of an economy or business is greatly increasing in modern times. The increasingly complex nature of government and business has raised the use of research in solving

operational problems. Research assumes significant role in the formulation of economic policy, for both the government and business. It provides the basis for almost all government policies of an economic system. Government budget formulation, for example, depends particularly on the analysis of needs and desires of people, and the availability of revenues, which requires research. Research helps to formulate alternative policies, in addition to examining the consequences of these alternatives. Thus, research also facilitates the decision-making of the policy-makers, although in itself it is not a part of research. In the process, research also helps in the proper allocation of a country's scarce resources. Research is also necessary for collecting information on the social and economic structure of an economy to understand the process of change occurring in the country. Collection of statistical information, though not a routine task, involves various research problems. Therefore, large staff of research technicians or experts is engaged by the government these days to undertake this work. Thus, research as a tool of government economic policy formulation involves three distinct stages of operation, viz., (i) investigation of economic structure through continual compilation of facts; (ii) diagnosis of events that are taking place and the analysis of the forces underlying them; and (iii) the prognosis, i.e., the prediction of future developments (Wilkinson and Bhandarkar 1979).

Research also assumes a significant role in solving various operational and planning problems associated with business and industry. In several ways, operations research, market research, and motivational research are vital and their results assist in taking business decisions. Market research is refers to the investigation of the structure and development of a market for the formulation of efficient policies relating to purchases, production and sales. Operational research relates to the application of logical, mathematical, and analytical

techniques to find solution to business problems such as cost minimization or profit maximization, or the optimization problems. Motivational research helps to determine why people behave in the manner they do with respect to market characteristics. More specifically, it is concerned with the analyzing the motivations underlying consumer behaviour. All these researches are very useful for business and industry, who are responsible for business decision-making.

Research is equally important to social scientists for analyzing social relationships and seeking explanations to various social problems. It gives intellectual satisfaction of knowing things for the sake of knowledge. It also possess practical utility for the social scientist to gain knowledge so as to be able to do something better or in a more efficient manner. This, research in social sciences is concerned with both knowledge for its own sake, and knowledge for what it can contribute to solve practical problems.

1.2 Research process

Research process comprises a series of steps or actions required for effectively conducting research and for the sequencing of these steps. The following are the various steps that provide useful procedural guideline regarding the conduct research.

(1) formulating the research problem;
(2) extensive literature survey;
(3) developing hypothesis;
(4) preparing the research design;
(5) determining sample design;
(6) collecting data;
(7) execution of the project;
(8) analysis of data;
(9) hypothesis testing;
(10) generalization and interpretation, and

(11) preparation of the report or presentation of the results. In other words, it involves the formal write-up of conclusions.

1.3 Research Problem

The first and foremost stage in the research process is to select and properly define the research problem. A researcher should firstly identify a problem and formulate it, so as to make it amenable or susceptible to research.

In general, a research problem refers to some kind of difficulty the researcher might encounter or experience in the context of either a theoretical or practical situation, which he/she would like to resolve and find a solution to. A research problem is generally said to exist if the following conditions emerge (Kothari 1988):

(i) there should be an individual or an organisation, say X, to whom the problem can be attributed. The individual or the organization is situated in an environment Y, which is governed by certain uncontrolled variables Z_i.

(ii) there should be atleast two courses of action to be pursued, say A_1 and A_2. These courses of action are defined by one or more values of the controlled variables. For example, the number of items purchased at a specified time is said to be one course of action.

(iii) there should be atleast two alternative possible outcomes of the said course of actions, say B_1 and B_2. Of them, one alternative should be preferable to the other. That is, atleast one outcome should be what the researcher wants, which becomes an objective.

(iv) the courses of possible action available must offer a chance to the researcher to achieve the objective, but not the equal chance. Therefore, if $P(B_j / X, A, Y)$ represents the probability of the occurrence of an outcome B_j when X selects A_j in Y, then $P(B_1 / X, A_1, Y) \neq P(B_1 / X, A_2, Y)$. Putting it in simple words, it means that the choices must not have equal efficiencies for the desired outcome.

Above all these conditions, the individual or organisation may be said to have arrived at the research problem only if X does not know what course of action to be taken is the best. In other words, X should have a doubt about the solution. Thus, an individual or a group of persons can be said to have a problem if they have more than one desired outcome. They should have two or more alternative courses of action, which have some but not equal efficiency for probing the desired objectives, such that they have doubts about the best course of action to be taken.

Thus, the various components of a research problem may be summarised as:

(i) there should be an individual or a group who have some difficulty or problem.
(ii) there should be some objective(s) to be pursued. A person or an organization who want nothing cannot have a problem.
(iii) there should be alternative ways of pursuing the objective the researcher wants to pursue. This implies that there should be more than one alternative means available to the researcher. This is because if the researcher has no choice of alternative means, he/she would not have a problem.
(iv) there should be some doubt in the mind of the researcher about the choice of alternative means. This implies that research should answer the question relating to the relative efficiency or suitability of the possible alternatives.
(v) there should be a context to which the difficulty relates.

Thus, identification of a research problem is the pre-condition to conducting research. A research problem is said to be the one which requires a researcher to find the best available solution to the given problem. That is, the researcher needs to find out the best course of action through which the research objective may be achieved optimally in the context of a given situation. Several factors may contribute to making the problem complicated. For example, the environment may alter, thus affecting the efficiencies of the alternative course of actions taken or the quality of the outcomes. Or, the number of alternative

course of actions may be very large and the individual not involved in making the decision may be affected by the change in environment, and may react to it favorably or unfavorably. Other similar factors are also likely to cause such changes in the context of research, all of which may be considered from the point of view of a research problem.

1.4 Research Design

The most important problem after defining the research problem is preparing the design of the research project, which is popularly known as the 'research design'. A research design helps to decide upon issues like what, when, where, how much, by what means, etc., with regard to an enquiry or a research study. "A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. In fact, the research design is the conceptual structures within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data" (Selltiz, et.al. 1962)**.** Thus, research design provides an outline of what the researcher is going to do in terms of framing the hypothesis, its operational implications, and the final data analysis. Specifically, the research design highlights decisions which include:

(i) the nature of the study
(ii) the purpose of the study
(iii) the location where the study would be conducted
(iv) the nature of data required
(v) from where the required data can be collected
(vi) what time period the study would cover
(vii) the type of sample design that would be used
(viii) the techniques of data collection that would be used
(ix) the methods of data analysis that would be adopted
(x) the manner in which the report would be prepared

In view of the stated research design decisions, the overall research design may be divided into the following (Kothari 1988)

(a) the sampling design that deals with the method of selecting items to be observed for the selected study;

(b) the observational design that relates to the conditions under which the observations are to be made;

(c) the statistical design that concerns with the question of how many items are to be observed, and how the information and data gathered are to be analysed; and

(d) the operational design that deals with the techniques by which the procedures specified in the sampling, statistical and observational designs can be carried out.

1.4.1 Features of research design

The important features of research design may be outlined as follows:

(i) it constitutes a plan that identifies the types and sources of information required for the research problem;

(ii) it constitutes a strategy that specifies the methods of data collection and analysis which would be adopted; and

(iii) it also specifies the time period of research and monetary budget involved in conducting the study, which comprise the two major constraints of undertaking any research.

1.4.2 Concepts relating to research design

It is also important to be familiar with the important concepts relating to research design. Some of them are discussed here.

1. Dependent and independent variables: A magnitude that varies is known as a variable. The concept may assume different quantitative values, like height, weight, income, etc. Qualitative variables are not quantifiable in the strictest

sense or objectively. However, the qualitative phenomena may also be quantified in terms of the presence or absence of the attribute(s) considered. Phenomena that assumes different values quantitatively even in decimal points are known as 'continuous variables'. But, all variables need not be continuous. Values that can be expressed only in integer values are called 'non-continuous variables'. In statistical term, they are also known as 'discrete variables'. For example, age is a continuous variable, whereas the number of children is a non-continuous variable. When changes in one variable depends upon the changes in one or more other variables, it is known as a dependent or endogenous variable, and the variables that cause the changes in the dependent variable are known as the independent or explanatory or exogenous variables. For example, if demand depends upon price, then demand is a dependent variable, while price is the independent variable. And, if more variables determine demand, like income and prices of substitute commodity, then demand also depends upon them in addition to the own price. Then, demand is a dependent variable which is determined by the independent variables own price, income and price of substitutes.

2 .Extraneous variable: The independent variables which are not directly related to the purpose of the study but affect the dependent variable are known as extraneous variables. For instance, assume that a researcher wants to test the hypothesis that there is a relationship between children's school performance and their self-concepts, in which case the latter is an independent variable and the former the dependent variable. In this context, intelligence may also influence the school performance. However, since it is not directly related to the purpose of the study undertaken by the researcher, it would be known as an extraneous variable. The influence caused by the extraneous variable(s) on the dependent variable is technically called as an 'experimental error'. Therefore, a

research study should always be framed in such a manner that the dependent variable(s) that completely influence the change in the independent variable and any other extraneous variable or variables.

3. Control: One of the most important features of a good research design is to minimize the effect of extraneous variable(s). Technically, the term 'control' is used when a researcher designs the study in such a manner that it minimizes the effects of extraneous independent variables. The term 'control' is used in experimental research to reflect the restrain in experimental conditions.

4. Confounded relationship: The relationship between the dependent and independent variables is said to be confounded by an extraneous variable(s), when the dependent variable is not free from its effects.

5. Research hypothesis: When a prediction or a hypothesized relationship is tested by adopting scientific methods, it is known as research hypothesis. The research hypothesis is a predictive statement which relates to a dependent variable and an independent variable. Generally, a research hypothesis must consist of at least one dependent variable and one independent variable. Whereas, the relationships that are assumed but not to be tested are predictive statements that are not to be objectively verified are not classified as research hypotheses.

6. Experimental and non-experimental hypothesis testing research: When the objective of a research is to test a research hypothesis, it is known as a hypothesis-testing research. Such research may be in the nature of experimental design or non-experimental design. A research in which the independent variable is manipulated is known as 'experimental hypothesis-testing research', whereas a research in which the independent variable is not manipulated is termed as 'non-experimental hypothesis-testing research'. For example, assume that a researcher wants to examine whether family income influences the school

attendance of a group of students, by calculating the coefficient of correlation between the two variables. Such an example is known as a non-experimental hypothesis-testing research, because the independent variable family income is not manipulated here. Again assume that the researcher randomly selects 150 students from a group of students who pay their school fees regularly and then classifies them into two sub-groups by randomly including 75 in Group A, whose parents have regular earning, and 75 in group B, whose parents do not have regular earning. Assume that at the end of the study, the researcher conducts a test on each group in order to examine the effects of regular earnings of the parents on the school attendance of the student. Such a study is an example of experimental hypothesis-testing research, because in this particular study the independent variable regular earnings of the parents has been manipulated.

7. Experimental and control groups: When a group is exposed to usual conditions in an experimental hypothesis-testing research, it is known as 'control group'. On the other hand, when the group is exposed to certain new or special condition, it is known as an 'experimental group'. In the afore-mentioned example, the Group A can be called a control group and the Group B an experimental group. If both the groups A and B are exposed to some special feature, then both the groups may be called as 'experimental groups'. A research design may include only the experimental group or both the experimental and control groups together.

8. Treatments: Treatments are referred to the different conditions to which the experimental and control groups are subject to. In the example considered, the two treatments are the parents with regular earnings and those with no regular earnings. Likewise, if a research study attempts to examine through an experiment the comparative impacts of three different types of fertilizers on the

yield of rice crop, then the three types of fertilizers would be treated as the three treatments.

9. Experiment: An experiment refers to the process of verifying the truth of a statistical hypothesis relating to a given research problem. For instance, experiment may be conducted to examine the yield of a certain new variety of rice crop developed. Further, Experiments may be categorized into two types, namely, absolute experiment and comparative experiment. If a researcher wishes to determine the impact of a chemical fertilizer on the yield of a particular variety of rice crop, then it is known as absolute experiment. Meanwhile, if the researcher wishes to determine the impact of chemical fertilizer as compared to the impact of bio-fertilizer, then the experiment is known as a comparative experiment.

10. Experiment unit(s): Experimental units refer to the pre-determined plots, characteristics or the blocks, to which the different treatments are applied. It is worth mentioning here that such experimental units must be selected with great caution.

1.4.3 Types of research design

There are different types of research designs. They may be broadly categorized as:

(1) exploratory research design;
(2) descriptive and diagnostic research design; and
(3) hypothesis-testing research design.

1. Exploratory research design:

The exploratory research design is known as formulative research design. The main objective of using such a research design is for formulating a research problem for an in-depth or more precise investigation, or for developing a working hypothesis from an operational aspect. The major purpose of such

studies is the discovery of ideas and insights. Therefore, such a research design suitable for such a study should be flexible enough to provide opportunity for considering different dimensions of the problem under study. The in-built flexibility in research design is required as the initial research problem would be transformed into a more precise one in the exploratory study, which in turn may necessitate changes in the research procedure for collecting relevant data. Usually, the following three methods are considered in the context of a research design for such studies. They are (a) a survey of related literature; (b) experience survey; and (c) analysis of 'insight-stimulating' instances.

2. Descriptive and diagnostic research design:

A descriptive research design is concerned with describing the characteristics of a particular individual, or a group. Meanwhile, a diagnostic research design determines the frequency with which a variable occurs or its relationship with another variable. In other words, the study analyzing whether a certain variable is associated with another comprises a diagnostic research study. On the other hand, a study that is concerned with specific predictions or with the narration of facts and characteristics relating to an individual, group or situation, are instances of descriptive research studies. Generally, most of the social research design falls under this category. As a research design, both the descriptive and diagnostic studies share common requirements, and hence they may grouped together. However, the procedure to be used must be planned carefully, and so the research design should also be planned carefully. The research design must also make appropriate provision for protection against bias and thus maximize reliability, with due regard to the completion of the research study in as economical manner as possible. The research design in such studies should be rigid and not flexible. Besides, it must also focus attention on the following:

(a) formulation of the objectives of the study,

(b) proper designing of the methods of data collection ,
(c) sample selection,
(d) data collection,
(e) processing and analysis of the collected data, and
(f) Reporting the findings.

3. Hypothesis-testing research design:

Hypothesis-testing research designs are those in which the researcher tests the hypothesis of causal relationship between two or more variables. These studies require procedures that would not only decrease bias and enhance reliability, but also facilitate deriving inferences about the causality. Generally, experiments satisfy such requirements. Hence, when research design is discussed in such studies, it often refers to the design of experiments.

1.4.4 Importance of research design

The need for a research design arises out of the fact that it facilitates the smooth conduct of the various stages of research. It contributes to making research as efficient as possible, thus yielding the maximum information with minimum effort, time and expenditure. A research design helps to plan in advance of the methods to be employed for collecting the relevant data and the techniques to be adopted for their analysis, so as to pursue the objectives of the research in the best possible manner, given the available staff, time and money. Hence, the research design should be prepared with utmost care, so as to avoid any error that may disturb the entire project. Thus, research design plays a crucial role in attaining the reliability of the results obtained, which forms the strong foundation of the entire process of the research work.

Despite its significance, the purpose of a well-planned design is not realized at times. This is because it is not given the importance that this problem deserves. As a consequence, many researchers are not able to achieve the purpose for which the research designs are formulated, due to which they end up

arriving at misleading conclusions. Therefore, faulty designing of the research project tends to render the research exercise meaningless. This makes it imperative that an efficient and suitable research design must be planned before commencing the process of research. The research design helps the researcher to organize his/her ideas in a proper form, which would facilitate him/her to identify the inadequacies and faults in them. The research design may also be discussed with other experts for their comments and critical evaluation, without which it would be difficult for any critic to provide a comprehensive review and comment on the proposed study.

1.4.5 Characteristics of a good research design

A good research design often possesses the qualities such as being flexible, suitable, efficient, economical, and so on. Generally, a research design which minimizes bias and maximizes the reliability of the data collected and analysed is considered a good design (Kothari 1988).

A research design which involves the smallest experimental error is said to be the best design for investigation. Further, a research design that yields maximum information and provides an opportunity of viewing the various dimensions of a research problem is considered to be the most appropriate and efficient design. Thus, the question of a good design relates to the purpose or objective and nature of the research problem studied. While a research design may be good, it may not be equally suitable to all studies. In other words, it may be lacking in one aspect or the other in the case of some other research problems. Therefore, no single research design can be applied to all types of research problems.

A research design suitable for a specific research problem would usually involve the following considerations:

(i) the methods of gathering the information;

(ii) the skills and availability of the researcher and his/her staff, if any;
(iii) the objectives of the research problem being studied;
(iv) the nature of the research problem being studied; and
(v) the available monetary funds and time duration for the research work.

1.5 Case Study Research

The method of exploring and analyzing the life or functioning of a social or economic unit, such as a person, a family, a community, an institution, a firm or an industry, is called a case study method. The objective of a case study method is to examine the factors that cause the behavioural patterns of a given unit and its relationship with the environment. The data for a study are always gathered with the purpose of tracing the natural history of a social or economic unit, and its relationship with the social or economic factors, besides the forces involved in its environment. Thus, a researcher conducting a study using the case study method attempts to understand the complexity of factors that are operative within a social or economic unit as an integrated totality. Burgess (Kothari 1988) described the special significance of the case study in understanding the complex behaviour and situations in specific detail. In the context of social research, he called these data as a social microscope.

1.5.1 Criteria for evaluating adequacy of case study

John Dollard (Dollard 1935) specified seven criteria for evaluating the adequacy of a case or life history in the context of social research. They are as follows: -

(i) The subject being studied must be viewed as a specimen in a cultural set up. That is, the case selected from its total context for the purpose of study should be considered a member of the particular cultural group or community. The scrutiny of the life history of the individual must be carried out with a view to identify the community values, standards and shared ways of life.

(ii) The organic motors of action should be socially relevant. This is to say that the action of the individual cases should be viewed as a series of

reactions to social stimuli or situations. Putting in simple words, the social meaning of behaviour should be taken into consideration.

(iii) The crucial role of the family-group in transmitting the culture should be recognized. This means that as the individual is a member of a family, the role of the family in shaping his/her behaviour should never be ignored.

(iv) The specific method of conversion of organic material into social behaviour should be clearly demonstrated. For instance, case-histories that discuss in detail how basically a biological organism, that is man, gradually transform into a social person are particularly important.

(v) The constant transformation of character of experience from childhood to adulthood should be emphasised. That is, the life-history should portray the inter-relationship between the individual's various experiences during his/her life span. Such a study provides a comprehensive understanding of an individual's life as a continuum.

(vi) The 'social situation' that contributed to the individual's gradual transformation should carefully and continuously specified as a factor. One of crucial the criteria for life-history is that an individual's life should be depicted as evolving itself in the context of a specific social situations and partially caused by it.

(vii) The life-history details themselves should be organized according to some conceptual framework, which in turn would facilitate their generalizations at higher levels.

These criteria discussed by Dollard emphasise the specific link of co-ordinated, related, continuous and configured experience in a cultural pattern that motivated the social and personal behaviour. Although, the criteria indicated by Dollard are principally perfect, but some of them are difficult to put to practice.

Dollard (1935) attempted to express the diverse events depicted in the life-histories of persons during the course of repeated interviews by utilizing psycho-analytical techniques in a given situational context. His criteria of life-

history originated directly from this experience. While the life-histories possess independent significance as research documents, the interviews recorded by the investigators can afford, as Dollard observed, "rich insights into the nature of the social situations experienced by them".

It is a well-known fact that an individual's life is very complex. Till date there is hardly any technique that can establish in some kind of uniformity, and as a result ensure the cumulative of case-history materials by isolating the complex totality of a human life. Nevertheless, although case history data are difficult to put to rigorous analysis, a skilful handling and interpretation of such data could help in developing insights into cultural conflicts and problems arising out of cultural-change.

Gordon Allport (Kothari 1988) has recommended the following aspects so as to broaden the perspective of case-study data as follows:

(i) if the life-history is written in first person, it should be as comprehensive and coherent as possible.

(ii) Life-histories must be written for knowledgeable persons. That is, if the enquiry of study is sociological in nature, the researcher should write it on the assumption that it would be read largely by sociologists only.

(iii) It would be advisable to supplement case study data by observational, statistical and historical data, as they provide standards for assessing the reliability and consistency of the case study materials. Further, such data offer a basis for generalizations.

(iv) Efforts must be made to verify the reliability of life-history data by examining the internal consistency of the collected material, and by repeating the interviews with the person, besides having personal interviews with the persons of the subject's own group who are well-acquainted with him/her.

(v) A judicious combination of different techniques for data-collection is crucial for collecting data that are culturally meaningful and scientifically significant.

(vi) Life-histories or case-histories may be considered as an adequate basis for generalization to the extent that they are typical or representative of a certain group.

(vii) The researcher engaged in the collection of case study data should never ignore the unique or atypical cases. He/she should include them as exceptional cases.

Case histories are filled with valuable information of a personal or private nature. Such information not only help the researcher to portray the personality of the individual, but also the social background that contributed to it. Besides, it also helps in the formulation of relevant hypotheses. In general, although Blummer (in Wilkinson and Bhandarkar 1979) was critical of documentary materials, he gave due credit to case histories by acknowledging the fact that the personal documents offer an opportunity to the researcher to develop his/her spirit of enquiry. The analysis of a particular subject would be more effective if the researcher acquires close acquaintance with it through personal documents. However, Blummer also acknowledges the limitations of the personal documents. According to him, independently such documents do not entirely fulfill the criteria of adequacy, reliability, and representativeness. Despite these shortcomings, avoiding their use in any scientific study of personal life would be wrong, as these documents become necessary and significant for both theory-building and practice.

In spite of these formidable limitations, case study data are used by anthropologists, sociologists, economists and industrial psychiatrists. Gordon Allport (Kothari 1988) strongly recommends the use of case study data for in-depth analysis of a subject. For, it is one's acquaintance with an individual that

instills desire to know his/her nature and understand them. The first stage involves understanding the individual and all the complexity of his/her nature. Any haste in analyzing and classifying the individual would create the risk of reducing his/her emotional world into artificial bits. As a consequence, the important emotional organizations, anchorages, and natural identifications characterizing the personal life of the individual might not yield adequate representation. Hence, the researcher should understand the life of the subject. Therefore, the totality of life-processes reflected in the well-ordered life-history documents become invaluable source of stimulating insights. Such life-history documents provide the basis for comparisons that contribute to statistical generalizations and help to draw inferences regarding the uniformities in human behaviour, which are of great value. Even if some personal documents do not provide ordered data about personal lives of people, which is the basis of psychological science, they should not be ignored. This is because the final aim of science is to understand, control and make predictions about human life. Once they are satisfied, the theoretical and practical importance of personal documents must be recognized as significant. Thus, a case study may be considered as the beginning and the final destination of abstract knowledge.

1.6 Hypothesis

"Hypothesis may be defined as a proposition or a set of propositions set forth as an explanation for the occurrence of some specified group of phenomenon either asserted merely as a provisional conjecture to guide some investigation or accepted as highly probable in the light of established facts" (Kothari 1988). A research hypothesis is quite often a predictive statement, which is capable of being tested using scientific methods that involve an independent and some dependent variables. For instance, the following statements may be considered:

i) “students who take tuitions perform better than the others who not receive tuitions” or,
ii) “the female students perform as well as the male students”.
These two statements are hypotheses that can be objectively verified and tested. Thus, they indicate that a hypothesis states what one is looking for. Besides, it is a proposition that can be put to test in order to examine its validity.

1.6.1 Characteristics of hypothesis:

A hypothesis should have the following characteristic features:-

(i) a hypothesis must be precise and clear . If it is not precise and clear, then the inferences drawn on its basis would not be reliable.

(ii) a hypothesis must be capable of being put to test. Quite often, the research programmes fail owing to its incapability of being subject to testing for validity. Therefore, some prior study may be conducted by the researcher in order to make a hypothesis testable. A hypothesis “is tested if other deductions can be made from it, which in turn can be confirmed or disproved by observation” (Kothari 1988).

(iii) a hypothesis must state relationship between two variable, in the case of relational hypotheses.

(iv) a hypothesis must be specific and limited in scope. This is because a simpler hypothesis generally would be easier to test for the research. And therefore, he/she must formulate such hypotheses.

(v) as far as possible, a hypothesis must be stated in the most simple language, so as to make it understood by all concerned. However, it should be noted that simplicity of a hypothesis is not related to its significance.

(vi) a hypothesis must be consistent and derived from the most known facts. In other words, it should be consistent with a substantial body of established facts. That is, it must be in the form of a statement which judges accept as being the most likely to occur.

(vii) a hypothesis must be amenable to testing within a stipulated or reasonable period of time. No matter how excellent a hypothesis, a researcher should not use if it cannot be tested within a given period of time, as none can afford to spend a life-time on collecting data to test it.

(viii) a hypothesis should state the facts that gave rise to the necessity of looking for an explanation. This is to say that by using the hypothesis, and other known and accepted generalizations, a researcher must be able to derive the original problem condition. Therefore, a hypothesis should explain what it actually wants to explain, and for this it should also have an empirical reference.

1.6.2 Concepts relating to testing of hypotheses

Testing of hypotheses requires a researcher to be familiar with various concepts concerned with it. They are discussed here.

1) Null hypothesis and alternative hypothesis:

In the context of statistical analysis, hypothesis is of two types, viz., null hypothesis and alternative hypothesis. When two methods A and B are compared on their relative superiority, and it is assumed that both the methods are equally good, then such a statement is called as the null hypothesis. On the other hand, if method A is considered relatively superior to method B, or vice-versa, then such a statement is known as an alternative hypothesis. The null hypothesis is expressed as H_0, while the alternative hypothesis is expressed as H_a. For example, if a researcher wants to test the hypothesis that the population mean (μ) is equal to the hypothesized mean (H_0) = 100, then the null hypothesis should be stated as the population mean is equal to the hypothesized mean 100. Symbolically it may be written as:-

$$H_0: \quad = \quad \mu \; = \mu \; H_0 \; = 100$$

If sample results do not support this null hypothesis, then it should be concluded that something else is true. The conclusion of rejecting the null hypothesis is called as alternative hypothesis. To put it in simple words, the set of alternatives to the null hypothesis is termed as the alternative hypothesis. If H_0 is accepted, then it implies that H_a is being rejected. On the other hand, if H_0 is rejected, it means that H_a is being accepted. For H_0: $\mu \; = \mu \; H_0 \; = 100$, the following three possible alternative hypotheses may be considered (Kothari 1988).

Alternative hypothesis	to be read as follows
H_a: $\mu \neq \mu \; H_0$	the alternative hypothesis is that the population mean is not equal to 100, i.e., it could greater than or less than 100
H_a : $\mu > \mu \; H_0$	the alternative hypothesis is that the population mean is greater than 100
H_a : $\mu < \mu \; H_0$	the alternative hypothesis is that the population mean is less than 100

Before the sample is drawn, the researcher has to state the null hypothesis and the alternative hypothesis. While formulating the null hypothesis, the following aspects need to be considered:

(a) alternative hypothesis is usually the one which a researcher wishes to prove, whereas the null hypothesis is the one which he/she wishes to disprove. Thus, a null hypothesis is usually the one which a researcher tries to reject, while an alternative hypothesis is the one that represents all other possibilities.

(b) the rejection of a hypothesis when it is actually true involves great risk, as it indicates that it is a null hypothesis because then the probability of rejecting it when it is true is α (i.e., the level of significance) which is chosen very small.

(c) Null hypothesis should always be specific hypothesis i.e., it should not state about or approximately a certain value.

(2) The level of significance:

In the context of hypothesis testing, the level of significance is a very important concept. It is a certain percentage that should be chosen with great care, reason and thought. If for instance, the significance level is taken at 5 per cent, then it means that H_0 would be rejected when the sampling result has a less than 0.05 probability of occurrence when H_0 is true. In other words, the five per cent level of significance implies that the researcher is willing to take a risk of five per cent of rejecting the null hypothesis, when (H_0) is actually true. In sum, the significance level reflects the maximum value of the probability of rejecting H_0 when it is actually true, and which is usually determined prior to testing the hypothesis.

(3) Test of hypothesis or decision rule

Suppose that the given hypothesis is H_0 and the alternative hypothesis Ha, then the researcher has to make a rule known as the decision rule. According to the decision rule, the researcher accepts or rejects H_0. For example, if the H_0 is that certain students are good against the H_a that all the students are good, then the researcher should decide the number of items to be tested and the criteria on the basis of which to accept or reject the hypothesis.

(4) Type I and Type II errors

As regards the testing of hypotheses, a research can make basically two types of errors. He/she may reject H_0 when it is true, or accept H_0 when it is not true. The former is called as Type I error and the latter is known as Type II error. In other words, Type I error implies the rejection of a hypothesis when it must have been accepted, while Type II error implies the acceptance of a hypothesis which

must have been rejected. Type I error is denoted by α (alpha) and is known as α error, while Type II error is usually denoted by β (beta) and is known as β error.

(5) One-tailed and two-tailed tests

These two types of tests are very important in the context of hypothesis testing. A two-tailed test rejects the null hypothesis, when the sample mean is significantly greater or lower than the hypothesized value of the mean of the population. Such a test is suitable when the null hypothesis is some specified value, the alternative hypothesis is a value that is not equal to the specified value of the null hypothesis.

1.6.3 Procedure of hypothesis testing

Testing a hypothesis refers to verifying whether the hypothesis is valid or not. Hypothesis testing attempts to check whether to accept or not to accept the null hypothesis. The procedure of hypothesis testing includes all the steps that a researcher undertakes for making a choice between the two alternative actions of rejecting or accepting a null hypothesis. The various steps involved in hypothesis testing are as follows:-

(i) Making a formal statement: This step involves making a formal statement of the null hypothesis (H_0) and the alternative hypothesis (H_a). This implies that the hypotheses should be clearly stated within the purview of the research problem. For example, suppose that a school teacher wants to test the understanding capacity of the students which must be rated more than 90 per cent in terms of marks. In this case, the hypotheses may be stated as follows:-

Null Hypothesis H_0 : = 100

Alternative Hypothesis H_a : > 100

(ii) Selecting a significance level: The hypotheses should be tested on a pre-determined level of significance, which should be specified. Usually, either

5% level or 1% level is considered for the purpose. The factors that determine the levels of significance are: (a) the magnitude of difference between the sample means; (b) the sample size: (c) the variability of measurements within samples; and (d) whether the hypothesis is directional or non-directional (Kothari 1988). In sum, the level of significance should be sufficient in the context of the nature and purpose of enquiry.

(iii) Deciding the distribution to use: After making decision on the level of significance for hypothesis testing, the research has to next determine the appropriate sampling distribution. The choice to be made generally relates to normal distribution and the t-distribution. The rules governing the selection of the correct distribution are similar to the ones already discussed with respect to estimation.

(iv) Selection of a random sample and computing an appropriate value: Another step involved in hypothesis testing is the selection of a random sample and then computing a suitable value from the sample data relating to test statistic by using the appropriate distribution. In other words, it involves drawing a sample for furnishing empirical data.

(v) Calculation of the probability: The next step for the researcher is to calculate the probability that the sample result would diverge as far as it can from expectations, under the situation when the null hypothesis is actually true.

(vi) Comparing the probability: Another step involved consists of making a comparison of the probability calculated with the specified value for α, the significance level. If the calculated probability works out to be equal to or smaller than the α value in case of one-tailed test, then the null hypothesis is to be rejected. On the other hand, if the calculated probability is greater, then the null hypothesis is to be accepted. In case the null hypothesis H_0 is rejected, the researcher runs the risk of committing the Type I error. But, if the null

hypothesis H_0 is accepted, then it involves some risk (which cannot be specified in size as long as H_0 is vague and not specific) of committing the Type II error.

1.7 Sample Survey

A sample design is a definite plan for obtaining a sample from a given population (Kothari 1988). Sample constitutes a certain portion of the population or universe. Sampling design refers to the technique or the procedure the researcher adopts for selecting items for the sample from the population or universe. A sample design helps to decide the number of items to be included in the sample, i.e., the size of the sample. The sample design should be determined prior to data collection. There are different kinds of sample designs which a researcher can choose. Some of them are relatively more precise and easier to adopt than the others. A researcher should prepare or select a sample design, which must be reliable and suitable for the research study proposed to be undertaken.

1.8.1 Steps in sampling design

A researcher should take into consideration the following aspects while developing a sample design:

(i) Type of universe: The first step involved in developing sample design is to clearly define the number of cases, technically known as the Universe, to be studied. A universe may be finite or infinite. In a finite universe the number of items is certain, whereas in the case of an infinite universe the number of items is infinite (i.e., there is no idea about the total number of items). For example, while the population of a city or the number of workers in a factory comprise finite universes, the number of stars in the sky, or throwing of a dice represent infinite universe.

(ii) Sampling unit: Prior to selecting a sample, decision has to be made about the sampling unit. A sampling unit may be a geographical area like a state, district, village, etc., or a social unit like a family, religious community, school, etc., or it may also be an individual. At times, the researcher would have to choose one or more of such units for his/her study.

(iii) Source list: Source list is also known as the 'sampling frame', from which the sample is to be selected. The source list consists of names of all the items of a universe. The researcher has to prepare a source list when it is not available. The source list must be reliable, comprehensive, correct, and appropriate. It is important that the source list should be as representative of the population as possible.

(iv) Size of sample: Size of the sample refers to the number of items to be chosen from the universe to form a sample. For a researcher, this constitutes a major problem. The size of sample must be optimum. An optimum sample may be defined as the one that satisfies the requirements of representativeness, flexibility, efficiency, and reliability. While deciding the size of sample, a researcher should determine the desired precision and the acceptable confidence level for the estimate. The size of the population variance should be considered, because in the case of a larger variance generally a larger sample is larger required. The size of the population should considered, as it also limits the sample size. The parameters of interest in a research study should also be considered, while deciding the sample size. Besides, costs or budgetary constraint also plays a crucial role in deciding the sample size.

(a) Parameters of interest: The specific population parameters of interest should also be considered while determining the sample design. For example, the researcher may want to be estimating the proportion of persons with certain characteristic in the population, or may be interested in knowing some average

regarding the population. The population may also consist of important sub-groups about whom the researcher would like to make estimates. All such factors have strong impact on the sample design the researcher selects.

(b) Budgetary constraint: From the practical point of view, cost considerations exercise a major influence on the decisions relating to not only the sample size, but also on the type of sample selected. Thus, budgetary constraint could also lead to the adoption of a non-probability sample design.

(c) Sampling procedure: Finally, the researcher should decide the type of sample or the technique to be adopted for selecting the items for a sample. This technique or procedure itself may represent the sample design. There are different sample designs from which a researcher should select one for his/her study. It is clear that the researcher should select that design which, for a given sample size and budget constraint, involves a smaller error.

1.7.2 Criteria for selecting a sampling procedure

Basically, two costs are involved in a sampling analysis, which govern the selection of a sampling procedure. They are:-

(i) the cost of data collection, and
(ii) the cost of drawing incorrect inference from the selected data.

There are two causes of incorrect inferences, namely systematic bias and sampling error. Systematic bias arise out of errors in the sampling procedures. They cannot be reduced or eliminated by increasing the sample size. Utmost, the causes of these errors can be identified and corrected. Generally a systematic bias arises out of one or more of the following factors:

a. inappropriate sampling frame,
b. defective measuring device,
c. non-respondents,
d. indeterminacy principle, and
e. natural bias in the reporting of data.

Sampling errors refers to the random variations in the sample estimates around the true population parameters. Because they occur randomly and likely to be equally in either direction, they are of compensatory type, the expected value of which errors tend to be equal to zero. Sampling error tends to decrease with the increase in the size of the sample. It also becomes smaller in magnitude when the population is homogenous.

Sampling error can be computed for a given sample size and design. The measurement of sampling error is known as 'precision of the sampling plan'. When the sample size is increased, the precision can be improved. However, increasing the sample size has its own limitations. The large sized sample not only increases the cost of data collection, but also increases the systematic bias. Thus, an effective way of increasing the precision is generally to choose a better sampling design, which has smaller sampling error for a given sample size at a specified cost. In practice, however, researchers generally prefer a less precise design owing to the ease in adopting the same, in addition to the fact that systematic bias can be controlled better way in such designs.

In sum, while selecting the sample a researcher should ensure that the procedure adopted involves a relatively smaller sampling error and helps to control systematic bias.

1.7.3 Characteristics of a good sample design

The following are the characteristic features of a good sample design:

(a) the sample design should yield a truly representative sample;
(b) the sample design should be such that it results in small sampling error;
(c) the sample design should be viable in the context of budgetary constraints of the research study;
(d) the sample design should be such that the systematic bias can be controlled; and
(e) the sample must be such that the results of the sample study would be applicable, in general, to the universe at a reasonable level of confidence.

1.7.4 Different types of sample designs

Sample designs may be classified into different categories based on two factors, namely, the representation basis and the element selection technique. Under the representation basis, the sample may be classified as:-

I. non-probability sampling
II. probability sampling

While probability sampling is based on random selection, the non-probability sampling is based on 'non-random' sampling.

I. Non-probability sampling:

Non-probability sampling is the sampling procedure that does not afford any basis for estimating the probability that each item in the population would have an equal chance of being included in the sample. Non-probability sampling is also known as deliberate sampling, judgment sampling and purposive sampling. Under this type of sampling, the items for the sample are deliberately chosen by the researcher; and his/her choice concerning the choice of items remains supreme. In other words, under non-probability sampling the researchers select a particular unit of the universe for forming a sample on the basis that the small number that is thus selected out of a huge one would be typical or representative of the whole population. For example, to study the economic conditions of people living in a state, a few towns or village may be purposively selected for an intensive study based on the principle that they are representative of the entire state. In such a case, the judgment of the researcher of the study assumes prime importance in this sampling design.

Quota sampling: Quota sampling is also an example of non-probability sampling. Under this sampling, the researchers simply assume quotas to be

filled from different strata, with certain restrictions imposed on how they should be selected. This type of sampling is very convenient and is relatively less expensive. However, the samples selected using this method certainly do not satisfy the characteristics of random samples. They are essentially judgements samples and inferences drawn based on the would not be amenable to statistical treatment in a formal way.

II. Probability Sampling:

Probability sampling is also known as 'choice sampling' or 'random sampling'. Under this sampling design, every item of the universe has an equal chance of being included in the sample. In a way, it is a lottery method under which individual units are selected from the whole group, not deliberately, but by using some mechanical process. Therefore, only chance determines whether an item or the other would be included in the sample or not. The results obtained from probability or random sampling would be assured in terms of probability. That is, the researcher can measure the errors of estimation or the significance of results obtained from the random sample. This is the superiority of random sampling design over the deliberate sampling design. Random sampling satisfies the law of Statistical Regularity, according to which if on an average the sample chosen is random, then it would have the same composition and characteristics of the universe. This is the reason why the random sampling method is considered the best technique of choosing a representative sample.

The following are the implications of the random sampling:

(i) it provides each element in the population an equal probability chance of being chosen in the sample, with all choices being independent of one another; and

(ii) it offers each possible sample combination an equal probability opportunity of being selected.

1.7.5 Method of selecting a random sample

The process of selecting a random sample involves writing the name of each element of a finite population on a slip of paper and putting them into a box or a bag. Then they have to be thoroughly mixed and then the required number of slips for the sample should be picked one after the other without replacement. While doing this, it has to be ensured that in successive drawings each of the remaining elements of the population has an equal chance of being chosen. This method would result in the same probability for each possible sample.

1.7.6 Complex random sampling designs

Under restricted sampling technique, the probability sampling may result in complex random sampling designs. Such designs are known as mixed sampling designs. Many of such designs may represent a combination of non-probability and probability sampling procedures in choosing a sample. Few of the prominent complex random sampling designs are as follows:

(i) Systematic sampling: In some cases, the best way of sampling is to select every ith item on a list. Sampling of this kind is called as systematic sampling. An element of randomness is introduced in this type of sampling by using random numbers to select the unit with which to start. For example, if a 10 per cent sample is required, the first item would be selected randomly from the first and thereafter every 10^{th} item. In this kind of sampling, only the first unit is selected randomly, while rests of the units of the sample are chosen at fixed intervals.

(ii) Stratified sampling: When a population from which a sample is to be selected does not comprise a homogeneous group, stratified sampling technique is generally employed for obtaining a representative sample. Under stratified sampling, the population is divided into many sub-populations in such a manner that they are individually more homogeneous than rest of the total population.

Then, items are selected from each stratum to form a sample. As each stratum is more homogeneous than the remaining total population, the researcher would be able to obtain a more precise estimate for each stratum and by estimating more accurately each of the component parts, he/she is able to obtain a better estimate of the whole. In some stratified sampling method yields a more reliable and detailed information.

(iii) Cluster sampling: When the total area of research interest is large, a convenient way in which a sample may be selected is to divide the area into a number of smaller non-overlapping areas and then randomly selecting a number of such smaller areas. In the process, the ultimate sample would consist of all the units in these small areas or clusters. Thus in cluster sampling, the total population is sub-divided into numerous relatively smaller subdivisions, which in themselves constitute clusters of still smaller units. And then, some of such clusters would be randomly chosen for inclusion in the overall sample.

(iv) Area sampling: When clusters are in the form of some geographic subdivisions, then cluster sampling is termed as area sampling. That is, when the primary sampling unit represents a cluster of units based on geographic area, the cluster designs are distinguished as area sampling. The merits and demerits of cluster sampling is equally applicable to area sampling.

(iv) Multi-stage sampling: A further development of the principle of cluster sampling is multi-stage sampling. When the researcher desires to investigate the working efficiency of nationalized banks in India and a sample of few banks is required for this purpose, the first stage would be to select large primary sampling unit like the states in the country. Next, certain districts may be selected and all banks interviewed in the chosen districts. This represents a two-stage sampling design, with the ultimate sampling units being clusters of districts.

On the other hand, if instead of taking census of all banks within the selected districts, the researcher chooses certain towns and interviews all banks in it, this would represent three-stage sampling design. Again, if instead of taking a census of all banks within the selected towns, the researcher randomly selects sample banks from each selected town, then it represents a case of using a four-stage sampling plan. Thus, if the researcher selects randomly at all stages, then it is called as multi-stage random sampling design.

(vi) Sampling with probability proportional to size: When the case of cluster sampling units does not have exactly or approximately the same number of elements, it is better for the researcher to adopt a random selection process, where the probability of inclusion of each cluster in the sample tends to be proportional to the size of the cluster. For this, the number of elements in each cluster has to be listed, irrespective of the method used for ordering it. Then the researcher should systematically pick the required number of elements from the cumulative totals. The actual numbers thus chosen would not however reflect the individual elements, but would indicate as to which cluster and how many from them are to be chosen by using simple random sampling or systematic sampling. The outcome of such sampling is equivalent to that of simple random sample. The method is also less cumbersome and is also relatively less expensive.

Thus, a researcher has to pass through various stages of conducting research once the problem of interest has been selected. Research methodology familiarizes a researcher with the complex scientific methods of conducting research, which yields reliable results that are useful to policy-makers, government, industries, etc., in decision-making.

References: