**RESEARCH METHODOLOGY**

Research in common parlance refers to a search for knowledge. One can also define research as a scientific and systematic search for pertinent information on a specific topic. In fact, research is an art of scientific investigation. The Advanced Learner’s Dictionary of Current English lays down the meaning of research as “**a careful investigation or inquiry especially through search for new facts in any branch of knowledge.**”1 Redman and Mory define research as a “systematized effort to gain new knowledge.”2 Some people consider research as a movement, a movement from the known to the unknown. **It is actually a voyage of discovery. We all possess the vital instinct of inquisitiveness for, when the unknown confronts us, we wonder and our inquisitiveness makes us probe and attain full and fuller understanding of the unknown. This inquisitiveness is the mother of all knowledge and the method, which man employs for obtaining the knowledge of whatever the unknown, can be termed as research.**

**Research is an academic activity and a s such the term should be used in a technical sense. According to Clifford Woody research comprises defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organising and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis.** D. Slesinger and M. Stephenson in the Encyclopaedia of Social Sciences define research as “the manipulation of things, concepts or symbols for the purpose of generalising to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art.”3 Research is, thus, an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment. In short, the search for knowledge through objective and systematic method of finding solution to a problem is research. The systematic approach concerning generalisation and the formulation of a theory is also research. As such the term ‘research’ refers to the systematic method consisting of enunciating the problem, formulating a hypothesis, collecting the facts or data, analysing the facts and reaching certain conclusions either in the form of solutions(s) towards the concerned problem or in certain generalisations for some theoretical formulation

**OBJECTIVES OF RESEARCH**

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, we may think of research objectives as falling into a number of following broad groupings:

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formulative research studies);

2. To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies);

3. To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies);

4. To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis-testing research studies).

**MOTIVATION IN RESEARCH**

What makes people to undertake research? This is a question of fundamental importance. The possible motives for doing research may be either one or more of the following:

1. Desire to get a research degree along with its consequential benefits;

2. Desire to face the challenge in solving the unsolved problems, i.e., concern over practical problems initiates research;

3. Desire to get intellectual joy of doing some creative work;

4. Desire to be of service to society;

5. Desire to get respectability.

However, this is not an exhaustive list of factors motivating people to undertake research studies. Many more factors such as directives of government, employment conditions, curiosity about new things, desire to understand causal relationships, social thinking and awakening, and the like may as well motivate (or at times compel) people to perform research operations.

**TYPES OF RESEARCH**

The basic types of research are as follows:

1. **Descriptive vs. Analytical:** Descriptive research includes surveys and fact-finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present. In social science and business research we quite often use the term Ex post facto research for descriptive research studies. **The main characteristic of this method is that the researcher has no control over the variables; he can only report what has happened or what is happening. It does not answer questions why, when and how. It always answer question what.** Most ex post facto research projects are used for descriptive studies in which the researcher seeks to measure such items as, for example, frequency of shopping, preferences of people, or similar data. **Ex post facto studies also include attempts by researchers to discover causes even when they cannot control the variables**. The methods of research utilized in descriptive research are survey methods of all kinds, including comparative and correlational methods. In analytical research, on the other hand, the researcher has to use facts or information already available, and analyze these to make a critical evaluation of the material
2. **Applied vs. Fundamental:** Research can either be applied (or action) research or fundamental (to basic or pure) research. Applied research aims at finding a solution for an immediate problem facing a society or an industrial/business organisation, whereas fundamental research is mainly concerned with generalisations and with the formulation of a theory. “Gathering knowledge for knowledge’s sake is termed ‘pure’ or ‘basic’ research.” **Research concerning some natural phenomenon or relating to pure mathematics are examples of fundamental research.** Similarly, research studies, concerning human behaviour carried on with a view to make generalisations about human behaviour, are also examples of fundamental research, but research aimed at certain conclusions (say, a solution) facing a concrete social or business problem is an example of applied research. Research to identify social, economic or political trends that may affect a particular institution or the copy research (research to find out whether certain communications will be read and understood) or the marketing research or evaluation research are examples of applied research. Thus, the central aim of applied research is to discover a solution for some pressing practical problem, whereas basic research is directed towards finding information that has a broad base of applications and thus, adds to the already existing organized body of scientific knowledge.
3. **Quantitative vs. Qualitative**: Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. Qualitative research, on the other hand, is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind. For instance, when we are interested in investigating the reasons for human behaviour (i.e., why people think or do certain things), we quite often talk of ‘Motivation Research’, an important type of qualitative research. **This type of research aims at discovering the underlying motives and desires, using in depth interviews for the purpose. Other techniques of such research are word association tests, sentence completion tests, story completion tests and similar other projective techniques.** Attitude or opinion research i.e., research designed to find out how people feel or what they think about a particular subject or institution is also qualitative research. Qualitative research is especially important in the behavioural sciences where the aim is to discover the underlying motives of human behaviour. Through such research we can analyse the various factors which motivate people to behave in a particular manner or which make people like or dislike a particular thing. It may be stated, however, that to apply qualitative research in practice is relatively a difficult job and therefore, while doing such research, one should seek guidance from experimental psychologists.
4. **Conceptual vs. Empirical**: Conceptual research is that related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. On the other hand, empirical research relies on experience or observation alone, often without due regard for system and theory. **It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. We can also call it as experimental type of research. In such a research it is necessary to get at facts first-hand, at their source, and actively to go about doing certain things to stimulate the production of desired information. In such a research, the researcher must first provide himself with a working hypothesis or guess as to the probable results.** He then works to get enough facts (data) to prove or disprove his hypothesis. He then sets up experimental designs which he thinks will manipulate the persons or the materials concerned so as to bring forth the desired information. Such research is thus characterised by the experimenter’s control over the variables under study and his deliberate manipulation of one of them to study its effects. **Empirical research is appropriate when proof is sought that certain variables affect other variables in some way.** Evidence gathered through experiments or empirical studies is today considered to be the most powerful support possible for a given hypothesis.
5. **Some Other Types of Research:** All other types of research are variations of one or more of the above stated approaches, based on either the purpose of research, or the time required to accomplish research, on the environment in which research is done, or on the basis of some other similar factor. Form the point of view of time, we can think of research either as one-time research or longitudinal research. In the former case the research is confined to a single time-period, whereas in the latter case the research is carried on over several time-periods. Research can be field-setting research or laboratory research or simulation research, depending upon the environment in which it is to be carried out. Research can as well be understood as clinical or diagnostic research. Such research follow case-study methods or in-depth approaches to reach the basic causal relations. Such studies usually go deep into the causes of things or events that interest us, using very small samples and very deep probing data gathering devices. The research may be exploratory or it may be formalized. The objective of exploratory research is the development of hypotheses rather than their testing, whereas formalized research studies are those with substantial structure and with specific hypotheses to be tested. Historical research is that which utilizes historical sources like documents, remains, etc. to study events or ideas of the past, including the philosophy of persons and groups at any remote point of time. Research can also be classified as conclusion-oriented and decision-oriented. While doing conclusion oriented research, a researcher is free to pick up a problem, redesign the enquiry as he proceeds and is prepared to conceptualize as he wishes. Decision-oriented research is always for the need of a decision maker and the researcher in this case is not free to embark upon research according to his own inclination. Operations research is an example of decision oriented research since it is a scientific method of providing executive departments with a quantitative basis for decisions regarding operations under their control.

**Research Approaches**

The above description of the types of research brings to light the fact that there are two basic approaches to research, viz., quantitative approach and the qualitative approach. The former involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion. This approach can be further sub-classified into inferential, experimental and simulation approaches to research. The purpose of inferential approach to research is to form a data base from which to infer characteristics or relationships of population. This usually means survey research where a sample of population is studied (questioned or observed) to determine its characteristics, and it is then inferred that the population has the same characteristics. Experimental approach is characterised by much greater control over the research environment and in this case some variables are manipulated to observe their effect on other variables. Simulation approach involves the construction of an artificial environment within which relevant information and data can be generated. This permits an observation of the dynamic behaviour of a system (or its sub-system) under controlled conditions. The term ‘simulation’ in the context of business and social sciences applications refers to “the operation of a numerical model that represents the structure of a dynamic process. Given the values of initial conditions, parameters and exogenous variables, a simulation is run to represent the behaviour of the process over time.” Simulation approach can also be useful in building models for understanding future conditions. Qualitative approach to research is concerned with subjective assessment of attitudes, opinions and behaviour. Research in such a situation is a function of researcher’s insights and impressions. Such an approach to research generates results either in non-quantitative form or in the form which are not subjected to rigorous quantitative analysis. Generally, the techniques of focus group interviews, projective techniques and depth interviews are used.

**Significance of Research**

“All progress is born of inquiry. Doubt is often better than overconfidence, for it leads to inquiry, and inquiry leads to invention” is a famous Hudson Maxim in context of which the significance of research can well be understood. Increased amounts of research make progress possible. Research inculcates scientific and inductive thinking and it promotes the development of logical habits of thinking and organisation. The role of research in several fields of applied economics, whether related to business or to the economy as a whole, has greatly increased in modern times. The increasingly complex nature of business and government has focused attention on the use of research in solving operational problems. Research, as an aid to economic policy, has gained added importance, both for government and business. Research provides the basis for nearly all government policies in our economic system. For instance, government’s budgets rest in part on an analysis of the needs and desires of the people and on the availability of revenues to meet these needs. The cost of needs has to be equated to probable revenues and this is a field where research is most needed. Through research we can devise alternative policies and can as well examine the consequences of each of these alternatives.

**LESSON 2**

**QUALITY OF A GOOD RESEARCH TOPIC**

**A researchable research question** is one that can generate a hypothesis that can be tested through a structured and rigorous process of data collection, analysis and testing, either quantitatively or qualitatively or a hybrid of methods.

**A non- researchable question** is therefore one that is not formulated to enable a testable hypothesis to be generated. A non-researchable questions could be too broad or vague, or they could be questions for which answer are readily obtainable

**Qualities of a good research topic**

The first thing that determines the success of your research is your research topic. A good research topic must have the following characteristics:

**Clarity:** The topic should be clear so that others can easily understand the nature of your research. The research topic should have a single interpretation so that people cannot get distracted. It means, your research topic must be void of ambiguity. It also means that the research topic must be directional.

**Simple Language:** The language should be very simple. Use technical terms only when it is necessary. Do not introduce any form of bias into research topic or problem, directly or indirectly, willingly or unwillingly

**The Titling:** The research problem should use the rule of titling. There are various rules of titling. You can either use a sentence case or a title case but the title case is more common and preferred. Capitalise the first and the last word

Capitalise nouns, pronouns, adjectives, verbs, adverbs, and subordinating conjunctions

Lowercase articles (a, an, the), coordinating conjunctions and, and prepositions

**Current Importance:** This should be given consideration while selecting a research topic. An obsolete topic will not benefit anyone, therefore, current importance is very crucial.

**Variables**

A variable is anything that has a quality or quantity that varies.

**The dependent variables**: This is a variable that the researcher is interested in

**Independent variable.** This is a variable believed to affect the dependent variables. It is a variable manipulated to see if it make the dependent variable change. It is a variable over which the researcher has control and is manipulating

**Mediating variable** also known as an intervening variable is a variable through which the independent variables affect dependent variable

**Moderating Variable:** A variable that influences, or moderates, the relation between two other variables and thus produces an interaction effect

**Confounding Variable:** Confounding variable is a variable that the researcher failed to control, or eliminate, damaging the internal validity of an experiment

**RESEARCH PROBLEM**

**A research problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same. Usually we say that a research problem does exist if the following conditions are met with:**

**Situations indicating a researchable problem**

1. A perceived discrepancy between what is and what should be
2. A question why the discrepancy exists (i.e factors responsible)
3. At least two possible and plausible answers to the questions exist

**Non-Research**

A discrepancy exists between desired and observed situation

We know why the discrepancy exists

We know the best solution

**Research**

A discrepancy exists between desired and observed situation

We don’t know why the discrepancy exists

We don’t know the best solution

**Characteristics of a statement of problem**

1. I t should address a gap in knowledge
2. It should be significant enough to contribute to the existing body of research
3. It should lead to further research
4. The problem should render itself to investigation through data collection
5. It should be of interest to the researcher and suit his/her skills, time and resources
6. The approach towards solving the problem should be ethical

Format of a statement of the research problem

Part A. This describes the ideal situation, a desired goal or how things should be

Part B. This describes the reality. It describes the conditions that prevents the goal, state, or value in Part A from being achieved or realised at this time, explain how the current situation fall short of the goal or ideal

Part C. The consequences. It identifies the way you propose to improve the current situations and move it to ideal

**Problems definitions**

Level of incidence or prevalence

Geographic areas affected

Characteristics of the population affected

Findings of other research studies (Plausible reasons for the problem)

Past experiences to address the problem (to understand possible solution

Success of earlier initiatives

Unanswered questions

**Justification of the problem**

Is the problem current and existing?

How wide spread is the problem?

Is the problem of special group?

Does the problem relate to an ongoing programme activities?

Who are concerned with the problem?

Is the problem under study in the control of the researcher?

**LITERATURE REVIEW**

The researcher must at the same time examine all available literature to get himself acquainted with the selected problem. He may review two types of literature:

1. the conceptual literature concerning the concepts and theories, and
2. The empirical literature consisting of studies made earlier which are similar to the one proposed. The empirical review should be limited to recent articles in learned journals. The empirical review must be critiqued and the gaps properly identified.

The basic outcome of this review will be the knowledge as to what data and other materials are available for operational purposes which will enable the researcher to specify his own research problem in a meaningful context**. The researcher must ensure that all the sources of information are properly acknowledged.**

**REFERENCES**

**Why reference?**

When you reference you use the standardised style to acknowledge the source of information used in your assignment.

It is important (morally & legally) to acknowledge someone else’s ideas or words you have used. Academic writing encourages paraphrasing information you have researched and read. Paraphrasing means re-wording something you have read in to your own words. If you use someone else’s words or work and fail to acknowledge them – you may be accused of plagiarism and infringing copyright.

Referencing correctly enables the marker or reader of your assignment to locate the source of the information. They can verify the information or read further on the topic.

Referencing also allows for you to retrace your steps and locate information you have used for assignments and discover further views or ideas discussed by the author.

By referencing clearly and correctly, it demonstrates you have undertaken research on the assignment topic and located relevant information.

**There are two main parts to referencing:**

1. The first indicating within your assignment the sources of the information you have used to write your assignment. This demonstrates support for your ideas, arguments and views. Sometimes this is referred to as: citing in text, in text citations or text citations

2. The second part to referencing is the construction of a reference list. The reference list shows the complete details of everything you cited and appears in an alphabetical list on a separate page, at the end of your assignment.

**Tip**: Everything you have cited in text appears in your reference list and likewise... everything that appears in your reference list will have been cited in text! Check this is the case prior to handing in your assignment. (The exception is when using a personal communication. Personal communications are cited in text but do not appear in the reference list

**Examples of Reference Styles**

American Psychological Association 6th ed

American Political Science Association

American Medical Association

American Sociological Association

Chicago manual of style 16th edition

Cite them right 10th edition –Harvard

**Serial/journal articles**

1. Author/s last name (surname) first, followed by initials.

2. Year of publication in brackets. (2012)

3. Title of article. Capitalise only the first word of the title and the subtitle, if any, and proper names. Use a colon (:) between the title and subtitle.

4. Title of the serial/journal in full in italics. 5. Volume number, in italics. Do not use “Vol.” before the number.

6. Issue number. This is bracketed immediately after the volume number but not italicised. 7. Month, season or other designation of publication if there is no volume or issue number. 8. Include all page numbers. 9. Include any Digital Object Identifiers [DOI].

**Books**

1. Author/s or Editor/s last name (surname) appears first, followed by initials (Bloggs, J.).

2. Year of publication in brackets (2010).

3. Full title of the book. Capitalise only the first word of the title and the subtitle, if any, and proper names. Italicise the title. Use a colon (:) between the title and subtitle.

4. Include the edition number, if applicable, in brackets after the title or subtitle (3rd ed.) or (Rev. ed.).Note: No full stop, after the title, if there is an edition.

5. Place of publication. Always include the city and 2-letter state code when published inside the USA, and the city & country, if published outside the USA (Fort Bragg, CA or Auckland, New Zealand or Benalla, Australia or Weybridge, England). If there are two or more places included in the source, then use the first one listed. 6. Publisher’s name. Provide this as briefly as possible. Do not use terms such as Publishers, Co., or Inc. but include the words Books & Press. When the author and the publisher are the same, use the word Author as the name of the publisher.

**RESEARCH DESIGN**

Preparing the research design: The research problem having been formulated in clear cut terms, the researcher will be required to prepare a research design, i.e., he will have to state the conceptual structure within which research would be conducted. The preparation of such a design facilitates research to be as efficient as possible yielding maximal information. In other words, the function of research design is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money. But how all these can be achieved depends mainly on the research purpose. Research purposes may be grouped into four categories, viz., (i) Exploration

(ii) Description,

(iii) Diagnosis, and

(iv) Experimentation. A flexible research design which provides opportunity for considering many different aspects of a problem is considered appropriate if the purpose of the research study is that of exploration. But when the purpose happens to be an accurate description of a situation or of an association between variables, the suitable design will be one that minimises bias and maximises the reliability of the data collected and analysed.

The preparation of the research design, appropriate for a particular research problem, involves usually the consideration of the following:

1. The means of obtaining the information;
2. The availability and skills of the researcher and his staff (if any);
3. Explanation of the way in which selected means of obtaining information will be organised and the reasoning leading to the selection;
4. The time available for research; and
5. The cost factor relating to research, i.e., the finance available for the purpose

**Types of Research Design**

There are several research designs and the researcher must decide in advance of collection and analysis of data as to which design would prove to be more appropriate for his research project. He must give due weight to various points such as the type of universe and its nature, the objective of his study, the resource list or the sampling frame, desired standard of accuracy and the like when taking a decision in respect of the design for his research project

**Exploratory Research Design:**

**Exploratory research studies are also termed as formulative research studies.** The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the working hypotheses from an operational point of view. The major emphasis in such studies is on the discovery of ideas and insights. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. Inbuilt flexibility in research design is needed because the research problem, broadly defined initially, is transformed into one with more precise meaning in exploratory studies, which fact may necessitate changes in the research procedure for gathering relevant data.

Generally, the following three methods in the context of research design for such studies are talked about:

**(a) The survey of relevant literature:** This happens to be the most simple and fruitful method of formulating precisely the research problem or developing hypothesis. Hypotheses stated by earlier workers may be reviewed and their usefulness be evaluated as a basis for further research. It may also be considered whether the already stated hypotheses suggest new hypothesis. In this way the researcher should review and build upon the work already done by others, but in cases where hypotheses have not yet been formulated, his task is to review the available material for deriving the relevant hypotheses from it. Besides, the bibliographical survey of studies, already made in one’s area of interest may as well as made by the researcher for precisely formulating the problem. He should also make an attempt to apply concepts and theories developed in different research contexts to the area in which he is himself working. Sometimes the works of creative writers also provide a fertile ground for hypothesis formulation and as such may be looked into by the researcher.

(b) **The experience survey:** Experience survey means the survey of people who have had practical experience with the problem to be studied. The object of such a survey is to obtain insight into the relationships between variables and new ideas relating to the research problem. For such a survey people who are competent and can contribute new ideas may be carefully selected as respondents to ensure a representation of different types of experience. The respondents so selected may then be interviewed by the investigator. The researcher must prepare an interview schedule for the systematic questioning of informants. But the interview must ensure flexibility in the sense that the respondents should be allowed to raise issues and questions which the investigator has not previously considered. Generally, the experience collecting interview is likely to be long and may last for few hours. Hence, it is often considered desirable to send a copy of the questions to be discussed to the respondents well in advance. This will also give an opportunity to the respondents for doing some advance thinking over the various issues involved so that, at the time of interview, they may be able to contribute effectively. Thus, an experience survey may enable the researcher to define the problem more concisely and help in the formulation of the research hypothesis. This survey may as well provide information about the practical possibilities for doing different types of research.

(c) **The analysis of ‘insight-stimulating’ examples**. Analysis of ‘insight-stimulating’ examples is also a fruitful method for suggesting hypotheses for research. It is particularly suitable in areas where there is little experience to serve as a guide. This method consists of the intensive study of selected instances of the phenomenon in which one is interested. For this purpose the existing records, if any, may be examined, the unstructured interviewing may take place, or some other approach may be adopted. Attitude of the investigator, the intensity of the study and the ability of the researcher to draw together diverse information into a unified interpretation are the main features which make this method an appropriate procedure for evoking insights.

**Descriptive Research Design:** Research design in case of descriptive and diagnostic research studies: Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group, whereas diagnostic research studies determine the frequency with which something occurs or its association with something else. The studies concerning whether certain variables are associated are examples of diagnostic research studies. As against this, studies concerned with specific predictions, with narration of facts and characteristics concerning individual, group or situation are all examples of descriptive research studies. Most of the social research comes under this category. From the point of view of the research design, the descriptive as well as diagnostic studies share common requirements and as such we may group together these two types of research studies. In descriptive as well as in diagnostic studies, the researcher must be able to define clearly, what he wants to measure and must find adequate methods for measuring it along with a clear cut definition of ‘population’ he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias and must maximise reliability, with due concern for the economical completion of the research study. The design in such studies must be rigid and not flexible

Then comes the question of selecting the methods by which the data are to be obtained. In other words, techniques for collecting the information must be devised. Several methods include:

**Observation**

**Questionnaires**

**Interviewing**

**examination of records, etc.**

While designing data-collection procedure, adequate safeguards against bias and unreliability must be ensured. Whichever method is selected, questions must be well examined and be made unambiguous; interviewers must be instructed not to express their own opinion; observers must be trained so that they uniformly record a given item of behaviour. It is always desirable to pre-test the data collection instruments before they are finally used for the study purposes. In other words, we can say that “structured instruments” are used in such studies.

However, it must ensure the minimisation of bias and maximisation of reliability of the evidence collected. The said design can be appropriately referred to as a survey design since it takes into account all the steps involved in a survey concerning a phenomenon to be studied.

The data collected must be processed and analysed. This includes steps like coding the interview replies, observations, etc.; tabulating the data; and performing several statistical computations

**Experimental Design:** Research design in case of hypothesis-testing research studies: Hypothesis-testing research studies (generally known as experimental studies) are those where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, but will permit drawing inferences about causality. Usually experiments meet this requirement. Hence, when we talk of research design in such studies, we often mean the design of experiments.

**SAMPLING DESIGN**

**THE POPULATION AND SAMPLE**

All items in any field of inquiry constitute a **‘Universe’ or ‘Population**.’ A complete enumeration of all items in the ‘population’ is known as **a census inquiry**. It can be presumed that in such an inquiry, when all items are covered, no element of chance is left and highest accuracy is obtained. But in practice this may not be true. Even the slightest element of bias in such an inquiry will get larger and larger as the number of observation increases. Moreover, there is no way of checking the element of bias or its extent except through a resurvey or use of sample checks. Besides, this type of inquiry involves a great deal of time, money and energy. Therefore, when the field of inquiry is large, this method becomes difficult to adopt because of the resources involved. At times, this method is practically beyond the reach of ordinary researchers. Perhaps, government is the only institution which can get the complete enumeration carried out. Even the government adopts this in very rare cases such as population census conducted once in a decade. Further, many a time it is not possible to examine every item in the population, and sometimes it is possible to obtain sufficiently accurate results by studying only a part of total population. In such cases there is no utility of census surveys. However, it needs to be emphasised that when the universe is a small one, it is no use resorting to a sample survey. When field studies are undertaken in practical life, considerations of time and cost almost invariably lead to a selection of respondents i.e., selection of only a few items. The respondents selected should be as representative of the total population as possible in order to produce a miniature cross-section. The selected respondents constitute what is technically called a ‘sample’ and the selection process is called ‘sampling technique.’ The survey so conducted is known as ‘sample survey’. Algebraically, let the population size be N and if a part of size n (which is < N) of this population is selected according to some rule for studying some characteristic of the population, the group consisting of these n units is known as ‘sample’. Researcher must prepare a sample design for his study i.e., he must plan how a sample should be selected and of what size such a sample would be.

**IMPLICATIONS OF A SAMPLE DESIGN**

A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample. Sample design may as well lay down the number of items to be included in the sample i.e., the size of the sample. Sample design is determined before data are collected. There are many sample designs from which a researcher can choose. Some designs are relatively more precise and easier to apply than others. Researcher must select/prepare a sample design which should be reliable and appropriate for his research study.

**STEPS IN SAMPLE DESIGN**

While developing a sampling design, the researcher must pay attention to the following points:

1. **Type of universe:** The first step in developing any sample design is to clearly define the set of objects, technically called the Universe, to be studied. The universe can be finite or infinite. In finite universe the number of items is certain, but in case of an infinite universe the number of items is infinite, i.e., we cannot have any idea about the total number of items. The population of a city, the number of workers in a factory and the like are examples of finite universes, whereas the number of stars in the sky, listeners of a specific radio programme, throwing of a dice etc. are examples of infinite universes.
2. Sampling unit: A decision has to be taken concerning a sampling unit before selecting sample. Sampling unit may be a geographical one such as state, district, village, etc., or a construction unit such as house, flat, etc., or it may be a social unit such as family, club, school, etc., or it may be an individual. The researcher will have to decide one or more of such units that he has to select for his study.
3. Source list: It is also known as ‘sampling frame’ from which sample is to be drawn. It contains the names of all items of a universe (in case of finite universe only). If source list is not available, researcher has to prepare it. Such a list should be comprehensive, correct, reliable and appropriate. It is extremely important for the source list to be as representative of the population as possible.
4. Size of sample: This refers to the number of items to be selected from the universe to constitute a sample. This a major problem before a researcher. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility. While deciding the size of sample, researcher must determine the desired precision as also an acceptable confidence level for the estimate. The size of population variance needs to be considered as in case of larger variance usually a bigger sample is needed. The size of population must be kept in view for this also limits the sample size. The parameters of interest in a research study must be kept in view, while deciding the size of the sample. Costs too dictate the size of sample that we can draw. As such, budgetary constraint must invariably be taken into consideration when we decide the sample size.
5. (v) Parameters of interest: In determining the sample design, one must consider the question of the specific population parameters which are of interest. For instance, we may be interested in estimating the proportion of persons with some characteristic in the population, or we may be interested in knowing some average or the other measure concerning the population. There may also be important sub-groups in the population about whom we
6. Parameters of interest: In determining the sample design, one must consider the question of the specific population parameters which are of interest. For instance, we may be interested in estimating the proportion of persons with some characteristic in the population, or we may be interested in knowing some average or the other measure concerning the population. There may also be important sub-groups in the population about whom we would like to make estimates. All this has a strong impact upon the sample design we would accept.
7. Budgetary constraint: Cost considerations, from practical point of view, have a major impact upon decisions relating to not only the size of the sample but also to the type of sample. This fact can even lead to the use of a non-probability sample. (vii) Sampling procedure: Finally, the researcher must decide the type of sample he will use i.e., he must decide about the technique to be used in selecting the items for the sample. In fact, this technique or procedure stands for the sample design itself. There are several sample designs (explained in the pages that follow) out of which the researcher must choose one for his study. Obviously, he must select that design which, for a given sample size and for a given cost, has a smaller sampling error.

**CRITERIA OF SELECTING A SAMPLING PROCEDURE**

In this context one must remember that two costs are involved in a sampling analysis viz., the cost of collecting the data and the cost of an incorrect inference resulting from the data. Researcher must keep in view the two causes of incorrect inferences viz., systematic bias and sampling error. A systematic bias results from errors in the sampling procedures, and it cannot be reduced or eliminated by increasing the sample size. At best the causes responsible for these errors can be detected and corrected. Usually a systematic bias is the result of one or more of the following factors:

1. Inappropriate sampling frame: If the sampling frame is inappropriate i.e., a biased representation of the universe, it will result in a systematic bias.
2. Defective measuring device: If the measuring device is constantly in error, it will result in systematic bias. In survey work, systematic bias can result if the questionnaire or the interviewer is biased. Similarly, if the physical measuring device is defective there will be systematic bias in the data collected through such a measuring device.
3. Non-respondents: If we are unable to sample all the individuals initially included in the sample, there may arise a systematic bias. The reason is that in such a situation the likelihood of establishing contact or receiving a response from an individual is often correlated with the measure of what is to be estimated.
4. Indeterminacy principle: Sometimes we find that individuals act differently when kept under observation than what they do when kept in non-observed situations. For instance, if workers are aware that somebody is observing them in course of a work study on the basis of which the average length of time to complete a task will be determined and accordingly the quota will be set for piece work, they generally tend to work slowly in comparison to the speed with which they work if kept unobserved. Thus, the indeterminacy principle may also be a cause of a systematic bias.
5. 5. Natural bias in the reporting of data: Natural bias of respondents in the reporting of data is often the cause of a systematic bias in many inquiries. There is usually a downward bias in the income data collected by government taxation department, whereas we find an upward bias in the income data collected by some social organisation. People in general understate their incomes if asked about it for tax purposes, but they overstate the same if asked for social status or their affluence. Generally in psychological surveys, people tend to give what they think is the ‘correct’ answer rather than revealing their true feelings.
6. Sampling errors are the random variations in the sample estimates around the true population parameters. Since they occur randomly and are equally likely to be in either direction, their nature happens to be of compensatory type and the expected value of such errors happens to be equal to zero. Sampling error decreases with the increase in the size of the sample, and it happens to be of a smaller magnitude in case of homogeneous population. Sampling error can be measured for a given sample design and size. The measurement of sampling error is usually called the ‘precision of the sampling plan’. If we increase the sample size, the precision can be improved. But increasing the size of the sample has its own limitations viz., a large sized sample increases the cost of collecting data and also enhances the systematic bias. Thus the effective way to increase precision is usually to select a better sampling design which has a smaller sampling error for a given sample size at a given cost. In practice, however, people prefer a less precise design because it is easier to adopt the same and also because of the fact that systematic bias can be controlled in a better way in such a design. In brief, while selecting a sampling procedure, researcher must ensure that the procedure causes a relatively small sampling error and helps to control the systematic bias in a better way.

CHARACTERISTICS OF A GOOD SAMPLE DESIGN

From what has been stated above, we can list down the characteristics of a good sample design as under:

1. Sample design must result in a truly representative sample. (b) Sample design must be such which results in a small sampling error. (c) Sample design must be viable in the context of funds available for the research study. (d) Sample design must be such so that systematic bias can be controlled in a better way. (e) Sample should be such that the results of the sample study can be applied, in general, for the universe with a reasonable level of confidence.

**DIFFERENT TYPES OF SAMPLE DESIGNS**

There are different types of sample designs based on two factors viz., the representation basis and the element selection technique. On the representation basis, the sample may be probability sampling or it may be non-probability sampling. Probability sampling is based on the concept of random selection, whereas non-probability sampling is ‘non-random’ sampling. On element selection basis, the sample may be either unrestricted or restricted. When each sample element is drawn individually from the population at large, then the sample so drawn is known as ‘unrestricted sample’, whereas all other forms of sampling are covered under the term ‘restricted sampling’. The following chart exhibits the sample designs as explained above. Thus, sample designs are basically of two types’ viz**., non-probability sampling and probability sampling**. We take up these two designs separately.

**Non-probability sampling:** Non-probability sampling is that sampling procedure which does not afford any basis for estimating the probability that each item in the population has of being included in the sample. **Non-probability sampling is also known by different names such as deliberate sampling, purposive sampling and judgement sampling**. In this type of sampling, items for the sample are selected deliberately by the researcher; his choice concerning the items remains supreme. In other words, under non-probability sampling the organisers of the inquiry purposively choose the particular units of the universe for constituting a sample on the basis that the small mass that they so select out of a huge one will be typical or representative of the whole. For instance, if economic conditions of people living in a state are to be studied, a few towns and villages may be purposively selected for intensive study on the principle that they can be representative of the entire state. Thus, the judgement of the organisers of the study plays an important part in this sampling design. In such a design, personal element has a great chance of entering into the selection of the sample. The investigator may select a sample which shall yield results favourable to his point of view and if that happens, the entire inquiry may get vitiated. Thus, there is always the danger of bias entering into this type of sampling technique. But in the investigators are impartial, work without bias and have the necessary experience so as to take sound judgement, the results obtained from an analysis of deliberately selected sample may be tolerably reliable. However, in such a sampling, there is no assurance that every element has some specifiable chance of being included. Sampling error in this type of sampling cannot be estimated and the element of bias, great or small, is always there. As such this sampling design in rarely adopted in large inquires of importance. However, in small inquiries and researches by individuals, this design may be adopted because of the relative advantage of time and money inherent in this method of sampling.

**Quota sampling is also an example of non-probability sampling**. Under quota sampling the interviewers are simply given quotas to be filled from the different strata, with some restrictions on how they are to be filled. In other words, the actual selection of the items for the sample is left to the interviewer’s discretion. This type of sampling is very convenient and is relatively inexpensive. But the samples so selected certainly do not possess the characteristic of random samples. Quota samples are essentially judgement samples and inferences drawn on their basis are not amenable to statistical treatment in a formal way.

**Probability sampling:** Probability sampling is also known as ‘random sampling’ or ‘chance sampling’. Under this sampling design, every item of the universe has an equal chance of inclusion in the sample. It is, so to say, a lottery method in which individual units are picked up from the whole group not deliberately but by some mechanical process.

**Simple Random Sampling:** Random sampling from a finite population refers to that method of sample selection which gives each possible sample combination an equal probability of being picked up and each item in the entire population to have an equal chance of being included in the sample. This applies to sampling without replacement i.e., once an item is selected for the sample, it cannot appear in the sample again (Sampling with replacement is used less frequently in which procedure the element selected for the sample is returned to the population before the next element is selected. In such a situation the same element could appear twice in the same sample before the second element is chosen). In brief, the implications of random sampling (or simple random sampling) are:

(a) It gives each element in the population an equal probability of getting into the sample; and all choices are independent of one another. (b) It gives each possible sample combination an equal probability of being chosen.

Keeping this in view we can define a simple random sample (or simply a random sample) from a finite population as a sample which is chosen in such a way that each of the NCn possible samples has the same probability, 1/NCn, of being selected. To make it more clear we take a certain finite population consisting of six elements (say a, b, c, d, e, f ) i.e., N = 6. Suppose that we want to take a sample of size n = 3 from it. Then there are 6C3 = 20 possible distinct samples of the required size, and they consist of the elements abc, abd, abe, abf, acd, ace, acf, ade, adf, aef, bcd, bce, bcf, bde, bdf, bef, cde, cdf, cef, and def. If we choose one of these samples in such a way that each has the probability 1/20 of being chosen, we will then call this a random sample.

**COMPLEX RANDOM SAMPLING DESIGNS**

Probability sampling under restricted sampling techniques, as stated above, may result in complex random sampling designs. Such designs may as well be called ‘mixed sampling designs’ for many of such designs may represent a combination of probability and non-probability sampling procedures in selecting a sample. Some of the popular complex random sampling designs are as follows:

1. **Systematic sampling**: In some instances, the most practical way of sampling is to select every ith item on a list. Sampling of this type is known as systematic sampling. An element of randomness is introduced into this kind of sampling by using random numbers to pick up the unit with which to start. For instance, if a 4 per cent sample is desired, the first item would be selected randomly from the first twenty-five and thereafter every 25th item would automatically be included in the sample. Thus, in systematic sampling only the first unit is selected randomly and the remaining units of the sample are selected at fixed intervals. Although a systematic sample is not a random sample in the strict sense of the term, but it is often considered reasonable to treat systematic sample as if it were a random sample. Systematic sampling has certain plus points. It can be taken as an improvement over a simple random sample in as much as the systematic sample is spread more evenly over the entire population. It is an easier and less costlier method of sampling and can be conveniently used even in case of large populations. But there are certain dangers too in using this type of sampling. If there is a hidden periodicity in the population, systematic sampling will prove to be an inefficient method of sampling. For instance, every 25th item produced by a certain production process is defective. If we are to select a 4% sample of the items of this process in a systematic manner, we would either get all defective items or all good items in our sample depending upon the random starting position. If all elements of the universe are ordered in a manner representative of the total population, i.e., the population list is in random order, systematic sampling is considered equivalent to random sampling. But if this is not so, then the results of such sampling may, at times, not be very reliable. In practice, systematic sampling is used when lists of population are available and they are of considerable length.

(**ii) Stratified sampling**: If a population from which a sample is to be drawn does not constitute a homogeneous group, stratified sampling technique is generally applied in order to obtain a representative sample. Under stratified sampling the population is divided into several sub-populations that are individually more homogeneous than the total population (the different sub-populations are called ‘strata’) and then we select items from each stratum to constitute a sample. Since each stratum is more homogeneous than the total population, we are able to get more precise estimates for each stratum and by estimating more accurately each of the component parts, we get a better estimate of the whole. In brief, stratified sampling results in more reliable and detailed information.

(**iii) Cluster sampling:** If the total area of interest happens to be a big one, a convenient way in which a sample can be taken is to divide the area into a number of smaller non-overlapping areas and then to randomly select a number of these smaller areas (usually called clusters), with the ultimate sample consisting of all (or samples of) units in these small areas or clusters. Thus in cluster sampling the total population is divided into a number of relatively small subdivisions which are themselves clusters of still smaller units and then some of these clusters are randomly selected for inclusion in the overall sample. Suppose we want to estimate the proportion of machine parts in an inventory which are defective. Also assume that there are 20000 machine parts in the inventory at a given point of time, stored in 400 cases of 50 each. Now using a cluster sampling, we would consider the 400 cases as clusters and randomly select ‘n’ cases and examine all the machine parts in each randomly selected case. Cluster sampling, no doubt, reduces cost by concentrating surveys in selected clusters. But certainly it is less precise than random sampling. There is also not as much information in ‘n’ observations within a cluster as there happens to be in ‘n’ randomly drawn observations. Cluster sampling is used only because of the economic advantage it possesses; estimates based on cluster samples are usually more reliable per unit cost.

**(iv) Area sampling**: If clusters happen to be some geographic subdivisions, in that case cluster sampling is better known as area sampling. In other words, cluster designs, where the primary sampling unit represents a cluster of units based on geographic area, are distinguished as area sampling. The plus and minus points of cluster sampling are also applicable to area sampling.

**(v) Multi-stage sampling**: Multi-stage sampling is a further development of the principle of cluster sampling. Suppose we want to investigate the working efficiency of nationalised banks in India and we want to take a sample of few banks for this purpose. The first stage is to select large primary sampling unit such as states in a country. Then we may select certain districts and interview all banks in the chosen districts. This would represent a two-stage sampling design with the ultimate sampling units being clusters of districts. If instead of taking a census of all banks within the selected districts, we select certain towns and interview all banks in the chosen towns. This would represent a three-stage sampling design. If instead of taking a census of all banks within the selected towns, we randomly sample banks from each selected town, then it is a case of using a four-stage sampling plan. If we select randomly at all stages, we will have what is known as ‘multi-stage random sampling design’. Ordinarily multi-stage sampling is applied in big inquires extending to a considerable large geographical area, say, the entire country. There are two advantages of this sampling design viz., (a) It is easier to administer than most single stage designs mainly because of the fact that sampling frame under multi-stage sampling is developed in partial units. (b) A large number of units can be sampled for a given cost under multistage sampling because of sequential clustering, whereas this is not possible in most of the simple designs.

(vi) **Sampling with probability proportional to size**: In case the cluster sampling units do not have the same number or approximately the same number of elements, it is considered appropriate to use a random selection process where the probability of each cluster being included in the sample is proportional to the size of the cluster. For this purpose, we have to list the number of elements in each cluster irrespective of the method of ordering the cluster. Then we must sample systematically the appropriate number of elements from the cumulative totals. The actual numbers selected in this way do not refer to individual elements, but indicate which clusters and how many from the cluster are to be selected by simple random sampling or by systematic sampling. The results of this type of sampling are equivalent to those of a simple random sample and the method is less cumbersome and is also relatively less expensive. We can illustrate this with the help of an example.

**SAMPLE SIZE AND ITS DETERMINATION**

In sampling analysis the most ticklish question is: What should be the size of the sample or how large or small should be ‘n’? If the sample size (‘n’) is too small, it may not serve to achieve the objectives and if it is too large, we may incur huge cost and waste resources. As a general rule, one can say that the sample must be of an optimum size i.e., it should neither be excessively large nor too small. Technically, the sample size should be large enough to give a confidence interval of desired width and as such the size of the sample must be chosen by some logical process before sample is taken from the universe. Size of the sample should be determined by a researcher keeping in view the following points:

1. **Nature of universe**: Universe may be either homogenous or heterogeneous in nature. If the items of the universe are homogenous, a small sample can serve the purpose. But if the items are heterogeneous, a large sample would be required. Technically, this can be termed as the dispersion factor.
2. **Number of classes proposed**: If many class-groups (groups and sub-groups) are to be formed, a large sample would be required because a small sample might not be able to give a reasonable number of items in each class-group.
3. **Nature of study:** If items are to be intensively and continuously studied, the sample should be small. For a general survey the size of the sample should be large, but a small sample is considered appropriate in technical surveys.
4. **Type of sampling**: Sampling technique plays an important part in determining the size of the sample. A small random sample is apt to be much superior to a larger but badly selected sample.
5. **Standard of accuracy and acceptable confidence level:** If the standard of accuracy or the level of precision is to be kept high, we shall require relatively larger sample. For doubling the accuracy for a fixed significance level, the sample size has to be increased fourfold.
6. **Availability of finance:** In practice, size of the sample depends upon the amount of money available for the study purposes. This factor should be kept in view while determining the size of sample for large samples result in increasing the cost of sampling estimates.
7. **Other considerations:** Nature of units, size of the population, size of questionnaire, availability of trained investigators, the conditions under which the sample is being conducted, the time available for completion of the study are a few other considerations to which a researcher must pay attention while selecting the size of the sample

**Determination of Sample Size if the population is finite**

n = z2. p. q. N …………………………eq. .1

e2(N-1) + z2.p.q

where

*N* = size of population

*n* = size of sample

*e* = acceptable error (the precision) at 95% confidence interval

p = standard deviation of population at 95% confidence interval or sample proportion which is assumed to be 0.5

q= 1-p

**But if the population happens to be infinite, then our sample size will be as under:**

n = z2. p. q. …………………………eq. 2

e2

**Illustration:**  What should be the size of the sample if a simple random sample from a population of 4000 items is to be drawn to estimate the per cent defective within 2 per cent of the true value with 95.5 per cent probability? What would be the size of the sample if the population is assumed to be infinite in the given case?

**Solution:** In the given question we have the following: N = 4000; e = .02 (since the estimate should be within 2% of true value); z = 2.005 (as per table of area under normal curve for the given confidence level of 95.5%). As we have not been given the p value being the proportion of defectives in the universe, let us assume it to be p = .02 (This may be on the basis of our experience or on the basis of past data or may be the result of a pilot study). Now we can determine the size of the sample using all this information for the given question as follows:

n = z2. p. q. N …………………………eq. 3.

e2(N-1) + z2.p.q

where

*N* = size of population

*n* = size of sample

*e* = acceptable error (the precision) at 95% confidence interval

p = standard deviation of population at 95% confidence interval or sample proportion

q= 1-p

*z* = standard variate at a given confidence level.

n = 2.0052. 02. (1-,02). 4000 …………………………eq. 4

0.022(4000-1) + 2.0052. 02(1-0.02)

315.2

1.678

n = 188

**The sample size for infinite population**

n = z2. p. q. …………………………eq. 5

e2

n = 2.0052. ,02. (1-.02) …………………………eq. 6

0.022

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When the researcher does not have the idea of standard deviation of the population , then what value we should assign to it? One method may be to take the value of p = 0.5 in which case ‘n’ will be the maximum and the sample will yield at least the desired precision. This will be the most conservative sample size. The other method may be to take an initial estimate of p which may either be based on personal judgment or may be the result of a pilot study.

**Illustration:** Assume your population is 514 and your confidence interval is 95%, what should be sample size.

**Solution**

n = z2. p. q. N …………………………eq. 3.

e2(N-1) + z2.p.q

where

*N* = size of population

*n* = size of sample

*e* = acceptable error (the precision) at 95% confidence interval

p = standard deviation of population at 95% confidence interval or sample proportion which is assumed to be 0.5

q= 1-p

*z* = standard variate at a given confidence level.

n = 1.962 x 0.5x 0.5x 514

0.052(514-1) + 1.962x0.5x0.5

n = 534

1.3875+0.9604

n =494 = 220

2.2429