

Research Methodology: An Introduction

Meaning Of Research

Research may be very broadly defined as systematic gathering of data and information and its analysis for advancement of knowledge in any subject. Research attempts to find answer intellectual and practical questions through application of systematic methods. Webster's Collegiate Dictionary defines research as "studious inquiry or examination; esp: investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws". 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 as 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, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis. D. Steiner and M. Stephenson in the Encyclopedia of Social Sciences define research as "the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art."

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 generalization 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, analyzing the facts and reaching certain conclusions either in the form of solutions(s) towards the concerned problem or in certain generalizations 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).

Types of research

Types of research can be classified in many different ways. some major ways of classifying research include the following.

- Descriptive versus Analytical Research
- Applied versus Fundamental Research
- Qualitative versus Quantitative Research
- Conceptual versus Empirical Research

Descriptive research concentrates on finding facts to ascertain the nature of something as it exists. In contrast **analytical research** is concerned with determining validity of hypothesis based on analysis of facts collected.

Applied research is carried out to find answers to practical problems to be solved and as an aid in decision making in different areas including product design, process design and policy making. **Fundamental research** is carried out as more to satisfy intellectual curiosity, than with the intention of using the research findings for any immediate practical application.

Quantitative research studies such aspects of the research subject which are not quantifiable, and hence not subject to measurement and quantitative analysis. In contrast **quantitative research** makes substantial use of measurements and quantitative analysis techniques.

Conceptual research is involves investigation of thoughts and ideas and developing new ideas or interpreting the old ones based on logical reasoning. In contrast **empirical research** is based on firm verifiable data collected by either observation of facts under natural condition or obtained through experimentation.

(v) 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, 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 characterized 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 behavior 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 dynamic process. Given the values of initial conditions, parameters and exogenous variables, simulation is run to represent the behavior of the process over time."⁵ Simulation approach can also be useful in building models for understanding future conditions.

Qualitative approach to research is concerned with subjective assessment of attitudes, opinion and behavior. 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.

Research Methods versus Methodology

It seems appropriate at this juncture to explain the difference between research methods and research methodology. Research methods may be understood as all those methods/ techniques that are used for conduction of research. Research methods or techniques*, thus, refer to the methods the researchers use in performing research operations. In other words, all those methods which are used by the researcher during the course of studying his research problem are termed as research methods. Since the object of research, particularly the applied research, is to arrive at a solution for a given problem, the available data and the unknown aspects of the problem have to be related to each other to make a solution possible. Keeping this in view, research methods can be put into the following three groups:

1. In the first group we include those methods which are concerned with the collection of data. These methods will be used where the data already available are not sufficient to arrive at the required solution;
2. The second group consists of those statistical techniques which are used for establishing relationships between the data and the unknowns;
3. The third group consists of those methods which are used to evaluate the accuracy of the results obtained.

Research methods falling in the above stated last two groups are generally taken as the analytical tools of research. Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them.

It is necessary for the researcher to know not only the research methods/techniques but also the methodology. Researchers not only need to know how to develop certain indices or tests, how to calculate the mean, the mode, the median or the standard deviation or chi-square, how to apply particular research techniques, but they also need to know which of these methods or techniques, are relevant and which are not, and what would they mean and indicate and why.

Researchers also need to understand the assumptions underlying various techniques and they need to know the criteria by which they can decide that certain techniques and procedures will be applicable to certain problems and others will not. All this means that it is necessary for the researcher to design his methodology for his problem as the same may differ from problem to problem. For example, an architect, who designs a building, has to consciously evaluate the basis of his decisions, i.e., he has to evaluate why and on what basis he selects particular size, number and location of doors, windows and ventilators, uses particular materials and not others and the like.

Similarly, in research the scientist has to expose the research decisions to evaluation before they are implemented. He has to specify very clearly and precisely what decisions he selects and why he selects them so that they can be evaluated by others also. From what has been stated above, we can say that research methodology has many dimension and research methods do constitute a part of the research methodology.

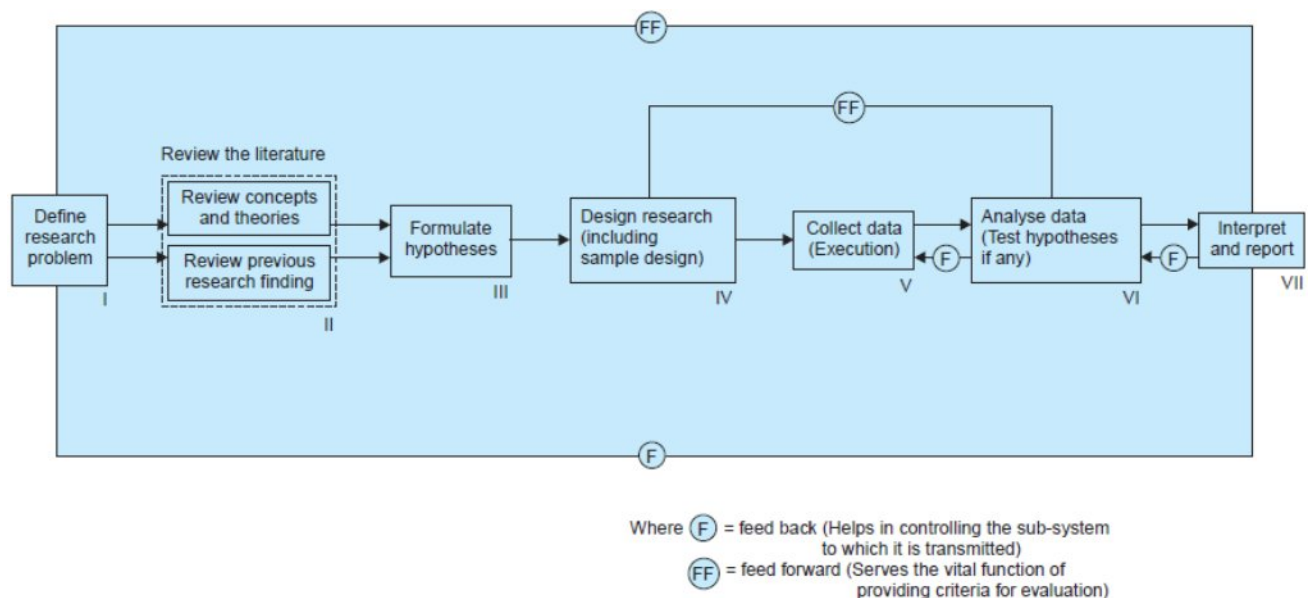
The scope of research methodology is wider than that of research methods. Thus, when we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or technique and

why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others.

Why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data have been collected and what particular method has been adopted, why particular technique of analyzing data has been used and a host of similar other questions are usually answered when we talk of research methodology concerning a research problem or study.

Research Process:

Before embarking on the details of research methodology and techniques, it seems appropriate to present a brief overview of the research process. Research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps. The chart shown in Figure well illustrates a research process. The chart indicates that the research process consists of a number of closely related activities, as shown through I to VII. But such activities overlap continuously rather than following a strictly prescribed sequence.



At times, the first step determines the nature of the last step to be undertaken. If subsequent procedures have not been taken into account in the early stages, serious difficulties may arise which may even prevent the completion of the study. One

should remember that the various steps involved in a research process are not mutually exclusive; nor are they separate and distinct.

They do not necessarily follow each other in any specific order and the researcher has to be constantly anticipating at each step in the research process the requirements of the subsequent steps. However, the following order concerning various steps provides a useful procedural guideline regarding the research process:

1. formulating the research problem;
2. extensive literature survey;
3. developing the hypothesis;
4. preparing the research design;
5. determining sample design;
6. collecting the data;
7. execution of the project;
8. analysis of data;
9. hypothesis testing;
10. generalizations and interpretation, and
11. preparation of the report or presentation of the results, i.e., formal write-up of conclusions reached.

A brief description of the above stated steps will be helpful.

1. Formulating the research problem: There are two types of research problems, viz., those which relate to states of nature and those which relate to relationships between variables. At the very outset the researcher must single out the problem he wants to study, i.e., he must decide the general area of interest or aspect of a subject-matter that he would like to inquire into. Initially the problem may be stated in a broad general way and then the ambiguities, if any, relating to the problem be resolved. Then, the feasibility of a particular solution has to be

considered before a working formulation of the problem can be set up. The formulation of a general topic into a specific research problem, thus, constitutes the first step in a scientific enquiry. Essentially two steps are involved in formulating the research problem, vi., understanding the problem thoroughly, and rephrasing the same into meaningful terms from an analytical point of view.

The best way of understanding the problem is to discuss it with one's own colleagues or with those having some expertise in the matter. In an academic institution the researcher can seek the help from a guide who is usually an experienced man and has several research problems in mind. often, the guide puts forth the problem in general terms and it is up to the researcher to narrow it down and phrase the problem in operational terms. In private business units or in governmental, the problem is usually earmarked by the administrative agencies with whom the researcher can discuss as to how the problem originally came about and what considerations are involved in its possible solutions.

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—the conceptual literature concerning the concepts and theories, and the empirical literature consisting of studies made earlier which are similar to the one proposed. 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. After this the researcher rephrases the problem into analytical or operational terms i.e., to put the problem in as specific terms as possible.

This task of formulating, or defining, a research problem is a step of greatest importance in the entire research process. The problem to be investigated must be defined unambiguously for that will help discriminating relevant data from irrelevant ones. Care must, however, be taken to verify the objectivity and validity of the background facts concerning the problem. Professor W. A. Mismanage correctly states that the statement of the objective is of basic importance because it determines the data which are to be collected, the characteristics of the data which

are relevant, relations which are to be explored, the choice of techniques to be used in these explorations and the form of the final report. If there are certain pertinent terms, the same should be clearly defined along with the task of formulating the problem.

In fact, formulation of the problem often follows a sequential pattern where a number of formulations are set up, each formulation more specific than the preceding one, each one phrased in more analytical terms, and each more realistic in terms of the available data and resources.

2.Extensive literature survey: Once the problem is formulated, a brief summary of it should be written down. It is compulsory for a research worker writing a thesis for a Ph.D. degree to write synopsis of the topic and submit it to the necessary Committee or the Research Board for approval. At this juncture the researcher should undertake extensive literature survey connected with the problem.

For this purpose, the abstracting and indexing journals and published or unpublished bibliographies are the first place to go to. Academic journals, conference proceedings, government reports, books etc., must be tapped depending on the nature of the problem. In this process, it should be remembered that one source will lead to another. The earlier studies, if any, which are similar to the study in and should be carefully studied. A good library will be a great help to the researcher at this stage.

3.Development of working hypotheses: After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses. Working hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. As such the manner in which research hypotheses are developed is particularly important since they provide the focal point for research.

They also affect the manner in which tests must be conducted in the analysis of data and indirectly the quality of data which is required for the analysis. In most types of research, the development of working hypothesis plays an important role.

Hypothesis should be very specific and limited to the piece of research in hand because it has to be tested. The role of the hypothesis is to guide the researcher by delimiting the area of research and to keep him on the right track. It sharpens his thinking and focuses attention on the more important facets of the problem. It also indicates the type of data required and the type of methods of data analysis to be used.

How does one go about developing working hypotheses? The answer is by using the following approach:

- a. Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution;
- b. Examination of data and records, if available, concerning the problem for possible trends, peculiarities and other clues;
- c. Review of similar studies in the area or of the studies on similar problems; and
- d. Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals with a view to secure greater insight into the practical aspects of the problem.

Thus, working hypotheses arise as a result of a-priori thinking about the subject, examination of the available data and material including related studies and the counsel of experts and interested parties. Working hypotheses are more useful when stated in precise and clearly defined terms. It may as well be remembered that occasionally we may encounter a problem where we do not need working hypotheses, especially in the case of exploratory or formulative researches which do not aim at testing the hypothesis. But as a general rule, specification of working hypotheses is another basic step of the research process in most research problems.

4.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,

- 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 minimizes bias and maximizes the reliability of the data collected and analyses.

There are several research designs, such as, experimental and non-experimental hypothesis testing. Experimental designs can be either informal designs (such as before-and-after without control, after-only with control, before-and-after with control) or formal designs (such as completely randomized design, randomized block design, Latin square design, simple and complex factorial designs), out of which the researcher must select one for his own project.

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

- i. the means of obtaining the information;
- ii. the availability and skills of the researcher and his staff (if any);
- iii. explanation of the way in which selected means of obtaining information will be organized and the reasoning leading to the selection;
- iv. the time available for research; and
- v. the cost factor relating to research, i.e., the finance available for the purpose.

5.Determining sample design: All the items under consideration in any field of inquiry constitute 'universe' or 'population'. A complete enumeration of all the items in the 'population' is known as a census inquiry. It can be presumed that in such an inquiry when all the 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 observations increases. Moreover, there is no way of checking the element of bias or its extent except through a survey or use of sample checks. Besides, this type of inquiry involves a great deal of time, money and energy. Not only this, census inquiry is not possible in practice under many circumstances. For instance, blood testing is done only on sample basis. Hence, quite often we select only a few items from the universe for our study purposes. The items so selected constitute what is technically called sample.

The researcher must decide the way of selecting a sample or what is popularly known as the sample design. In other words, a sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given population. Thus, the plan to select 12 of a city's 200 drugstores in a certain way constitutes a sample design. Samples can be either probability samples or non-probability samples.

With probability samples each element has a known probability of being included in the sample but the non-probability samples do not allow the researcher to determine this probability. Probability samples are those based on simple random sampling, systematic sampling, stratified sampling, cluster/area sampling whereas non-probability samples are those based on convenience sampling, judgment sampling and quota sampling techniques. A brief mention of the important sample designs is as follows:

a.Deliberate sampling: Deliberate sampling is also known as purposive or non-probability sampling. This sampling method involves purposive or deliberate selection of particular units of the universe for constituting a sample which represents the universe. When population elements are selected for inclusion in the sample based on the ease of access, it can be called convenience sampling. If a researcher wishes to secure data from, say, gasoline buyers, he may select a fixed number of petrol stations and may conduct interviews at these stations. This would

be an example of convenience sample of gasoline buyers. At times such a procedure may give very biased results particularly when the population is not homogeneous. On the other hand, in judgment sampling the researcher's judgment is used for selecting items which he considers as representative of the population. For example, a judgment sample of college students might be taken to secure reactions to a new method of teaching. Judgment sampling is used quite frequently in qualitative research where the desire happens to be to develop hypotheses rather than to generalize to larger populations.

b.Simple random sampling: This type of sampling is also known as chance sampling or probability sampling where each and every item in the population has an equal chance of inclusion in the sample and each one of the possible samples, in case of finite universe, has the same probability of being selected. For example, if we have to select a sample of 300 items from a universe of 15,000 items, then we can put the names or numbers of all the 15,000 items on slips of paper and conduct a lottery. Using the random number tables is another method of random sampling. To select the sample, each item is assigned a number from 1 to 15,000. Then, 300 five digits random numbers are selected from the table. To do this we select some random starting point and then a systematic pattern is used in proceeding through the table. We might start in the 4th row, second column and proceed down the column to the bottom of the table and then move to the top of the next column to the right. When a number exceeds the limit of the numbers in the frame, in our case over 15,000, it is simply passed over and the next number selected that does fall within the relevant range. Since the numbers were placed in the table in a completely random fashion, the resulting sample is random. This procedure gives each item an equal probability of being selected. In case of infinite population, the selection of each item in a random sample is controlled by the same probability and that successive selections are independent of one another.

c.Systematic sampling: In some instances the most practical way of sampling is to select every 15th name on a list, every 10th house on one side of a street and so on. Sampling of this type is known as systematic sampling. An element of randomness is usually introduced into this kind of sampling by using random numbers to pick up the unit with which to start. This procedure is useful when sampling frame is available in the form of a list. In such design the selection process starts by picking

some random point in the list and then every n th element is selected until the desired number is secured.

d.Stratified sampling: If the population from which a sample is to be drawn does not constitute homogeneous group, then stratified sampling technique is applied so as to obtain representative sample. In this technique, the population is stratified into a number of non-overlapping subpopulations or strata and sample items are selected from each stratum. If the items selected from each stratum is based on simple random sampling the entire procedure, first stratification and then simple random sampling, is known as stratified random sampling.

e.Quota sampling: In stratified sampling the cost of taking random samples from individual strata is often so expensive that interviewers are simply given quota to be filled from different strata, the actual selection of items for sample being left to the interviewer judgment. This is called quota sampling. The size of the quota for each stratum is generally proportionate to the size of that stratum in the population. Quota sampling is thus an important form of non-probability sampling. Quota samples generally happen to be judgment samples rather than random samples.

f. Cluster sampling and area sampling: Cluster sampling involves grouping the population and then selecting the groups or the clusters rather than individual elements for inclusion in the sample. Suppose some departmental store wishes to sample its credit card holders. It has issued its cards to 15,000 customers. The sample size is to be kept say 450. For cluster sampling this list of 15,000 card holders could be formed into 100 clusters of 150 cardholders each. Three clusters might then be selected for the sample randomly. The sample size must often be larger than the simple random sample to ensure the same level of accuracy because is cluster sampling procedural potential for order bias and other sources of error is usually accentuated. The clustering approach can, however, make the sampling procedure relatively easier and increase the efficiency of field work, specially in the case of personal interviews. Area sampling is quite close to cluster sampling and is often talked about when the total geographical area of interest happens to be big one. Under area sampling we first divide the total area into a number of smaller non-overlapping areas, generally called geographical clusters, then a number of these smaller areas are randomly selected, and all units in these small areas are included in the sample. Area sampling is specially helpful where we do not have

the list of the population concerned. It also makes the field interviewing more efficient since interviewer can do many interviews at each location.

g. Multi-stage sampling: This is a further development of the idea of cluster sampling. This technique is meant for big inquiries extending to a considerably large geographical area like an entire country. Under multi-stage sampling the first stage may be to select large primary sampling units such as states, then districts, then towns and finally certain families within towns. If the technique of random-sampling is applied at all stages, the sampling procedures described as multi-stage random sampling.

h. Sequential sampling: This is somewhat a complex sample design where the ultimate size of the sample is not fixed in advance but is determined according to mathematical decisions on the basis of information yielded as survey progresses. This design is usually adopted under acceptance sampling plan in the context of statistical quality control.

In practice, several of the methods of sampling described above may well be used in the same study in which case it can be called mixed sampling. It may be pointed out here that normally one should resort to random sampling so that bias can be eliminated and sampling error can be estimated. But purposive sampling is considered desirable when the universe happens to be small and a known characteristic of it is to be studied intensively. Also, there are conditions under which sample designs other than random sampling may be considered better for reasons like convenience and low costs. The sample design to be used must be decided by the researcher taking into consideration the nature of the inquiry and other related factors.

6. Collecting the data: In dealing with any real life problem it is often found that data at hand are inadequate, and hence, it becomes necessary to collect data that are appropriate. There are several ways of collecting the appropriate data which differ considerably in context of money costs, time and other resources at the disposal of the researcher. Primary data can be collected either through experiment or through survey. If the researcher conducts an experiment, he observes some quantitative measurements, or the data, with the help of which he examines the truth contained

in his hypothesis. But in the case of a survey, data can be collected by any one or more of the following ways:

i. By observation: This method implies the collection of information by way of investigator's own observation, without interviewing the respondents. The information obtained relates to what is currently happening and is not complicated by either the past behavior or future intentions or attitudes of respondents. This method is no doubt an expensive method and the information provided by this method is also very limited. As such this method is not suitable in inquiries where large samples are concerned.

ii. Through personal interview: The investigator follows a rigid procedure and seeks answers to a set of pre-conceived questions through personal interviews. This method of collecting data is usually carried out in a structured way where output depends upon the ability of the interviewer to a large extent.

iii. Through telephone interviews: This method of collecting information involves contacting the respondents on telephone itself. This is not a very widely used method but it plays an important role in industrial surveys in developed regions, particularly, when the survey has to be accomplished in a very limited time.

iv. By mailing of questionnaires: The researcher and the respondents do come in contact with each other if this method of survey is adopted. Questionnaires are mailed to the respondents with a request to return after completing the same. It is the most extensively used method in various economic and business surveys. Before applying this method, usually Pilot Study for testing the questionnaire is conducted which reveals the weaknesses, if any, of the questionnaire. Questionnaire to be used must be prepared very carefully so that it may prove to be effective in collecting the relevant information.

v. Through schedules: Under this method the enumerators are appointed and given training. They are provided with schedules containing relevant questions. These enumerators go to respondents with these schedules. Data are collected by filling up the schedules by enumerators on the basis of replies given by respondents. Much depends upon the capability of enumerators so far as this method is concerned. Some occasional field checks on the work of the enumerators may ensure sincere work.

The researcher should select one of these methods of collecting the data taking into consideration the nature of investigation, objective and scope of the inquiry, financial resources, available time and the desired degree of accuracy. Though he should pay attention to all these factors but much depends upon the ability and experience of the researcher. In this context Dr ALGOL very aptly remarks that in collection of statistical data common sense is the chief requisite and experience is the chief teacher.

7. Execution of the project: Execution of the project is a very important step in the research process. If the execution of the project proceeds on correct lines, the data to be collected would be adequate and dependable. The researcher should see that the project is executed in a systematic manner and in time. If the survey is to be conducted by means of structured questionnaires, data can be readily machine-processed. In such a situation, questions as well as the possible answers may be coded. If the data are to be collected through interviewers, arrangements should be made for proper selection and training of the interviewers.

The training may be given with the help of instruction manuals which explain clearly the job of the interviewers at each step. Occasional field checks should be made to ensure that the interviewers are doing their assigned job sincerely and efficiently. A careful watch should be kept for unanticipated factors in order to keep the survey as much realistic as possible. This, in other words, means that steps should be taken to ensure that the survey is under statistical control so that the collected information is in accordance with the pre-defined standard of accuracy.

If some of the respondents do not cooperate, some suitable methods should be designed to tackle this problem. One method of dealing with the non-response problem is to make a list of the non-respondents and take a small sub-sample of them, and then with the help of experts vigorous efforts can be made for securing response.

8. Analysis of data: After the data have been collected, the researcher turns to the task of analyzing them. The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories

to raw data through coding, tabulation and then drawing statistical inferences. The unwieldy data should necessarily be condensed into a few manageable groups and tables for further analysis. Thus, researcher should classify the raw data into some purposeful and usable categories. Coding operation is usually done at this stage through which the categories of data are transformed into symbols that may be tabulated and counted. Editing is the procedure that improves the quality of the data for coding. With coding the stage is ready for tabulation. Tabulation is a part of the technical procedure wherein the classified data are put in the form of tables. The mechanical devices can be made use of at this juncture. A great deal of data, especially in large inquiries, is tabulated by computers. Computers not only save time but also make it possible to study large number of variables affecting a problem simultaneously.

Analysis work after tabulation is generally based on the computation of various percentages, coefficients, etc., by applying various well defined statistical formulae. In the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to tests of significance to determine with what validity data can be said to indicate any conclusion(s). For instance, if there are two samples of weekly wages, each sample being drawn from factories indifferent parts of the same city, giving two different mean values, then our problem may be whether the two mean values are significantly different or the difference is just a matter of chance.

Through the use of statistical tests we can establish whether such a difference is a real one or is the result of random fluctuations. If the difference happens to be real, the inference will be that the two samples Research come from different universes and if the difference is due to chance, the conclusion would be that the two samples belong to the same universe. Similarly, the technique of analysis of variance can help us in analyzing whether three or more varieties of seeds grown on certain fields yield significantly different results or not. In brief, the researcher can analyze the collected data with the help of various statistical measures.

9. Hypothesis-testing: After analyzing the data as stated above, the researcher is in a position to test the hypotheses, if any, he had formulated earlier. Do the facts support the hypotheses or they happen to be contrary? This is the usual question which should be answered while testing hypotheses. Various tests, such as Chi

square test, t-test, F-test, have been developed by statisticians for the purpose. The hypotheses may be tested through the use of one or more of such tests, depending upon the nature and object of research inquiry. Hypothesis -testing will result in either accepting the hypothesis or in rejecting it. If the researcher had no hypotheses to start with, generalizations established on the basis of data may be stated as hypotheses to be tested by subsequent researches in times to come.

10. Generalizations and interpretation: If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalization, i.e., to build a theory. As a matter of fact, the real value of research lies in its ability to arrive at certain generalizations. If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as interpretation. The process of interpretation may quite often trigger off new questions which in turn may lead to further researches.

11. Preparation of the report or the thesis: Finally, the researcher has to prepare the report of what has been done by him. Writing of report must be done with great care keeping in view the following: The layout of the report should be as follows:

- i. the preliminary pages;
- ii. the main text, and
- iii. the end matter.

In its preliminary pages the report should carry title and date followed by acknowledgement and foreword. Then there should be a table of contents followed by a list of tables and list of graphs and charts, if any, given in the report.

The main text of the report should have the following parts:

Introduction: It should contain a clear statement of the objective of the research and an explanation of the methodology adopted in accomplishing the research. The scope of the study along with various limitations should as well be stated in this part.

Summary of findings: After introduction there would appear a statement of finding and recommendations in non-technical language. If the findings are extensive, they should be summarized.

Main report: The main body of the report should be presented in logical sequence and broken-down into readily identifiable sections.

Conclusion: Towards the end of the main text, researcher should again put down the results of his research clearly and precisely. In fact, it is the final summing up.

At the end of the report, appendices should be enlisted in respect of all technical data. Bibliography, i.e., list of books, journals, reports, etc., consulted, should also be given in the end. Index should also be given specially in a published research report.

Report should be written in a concise and objective style in simple language avoiding vague expressions such as 'it seems,' 'there may be', and the like.

Charts and illustrations in the main report should be used only if they present the information more clearly and forcibly.

Calculated 'confidence limits' must be mentioned and the various constraints experienced in conducting research operations may as well be stated.

Criteria of Good Research:

Whatever may be the types of research and studies; one thing that is important is that they all meet on the common ground of scientific method employed by them. One expects scientific research to satisfy the following criteria:

1. The purpose of the research should be clearly defined and common concepts bemused.
2. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping the continuity of what has already been attained.
3. The procedural design of the research should be carefully planned to yield results that areas objective as possible.
4. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.

5. The analysis of data should be sufficiently adequate to reveal its significance and the methods of analysis used should be appropriate. The validity and reliability of the data should be checked carefully.
6. Conclusions should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis.
7. Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

In other words, we can state the qualities of a good research as under:

1. Good research is systematic: It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules. Systematic characteristic of the research does not rule out creative thinking but it certainly does reject the use of guessing and intuition in arriving at conclusions.
2. Good research is logical: This implies that research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research. Induction is the process of reasoning from a part to the whole whereas deduction is the process of reasoning from some premise to a conclusion which follows from that very premise. In fact, logical reasoning makes research more meaningful in the context of decision making.
3. Good research is empirical: It implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results.
4. Good research is replicable: This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

WHAT IS A RESEARCH PROBLEM?

A research problem is the situation that causes the researcher to feel apprehensive, confused and ill at ease. It is the demarcation of a problem area

within a certain context involving the WHO or WHAT, the WHERE, the WHEN and the WHY of the problem situation. There are many problem situations that may give rise to research. Three sources usually contribute to problem identification. Own experience or the experience of others may be a source of problem supply. A second source could be scientific literature. You may read about certain findings and notice that a certain field was not covered. This could lead to a research problem. Theories could be a third source. Shortcomings in theories could be researched. Research can thus be aimed at clarifying or substantiating an existing theory, at clarifying contradictory findings, at correcting a faulty methodology, at correcting the inadequate or unsuitable use of statistical techniques, at reconciling conflicting opinions, or at solving existing practical problems.

Techniques Involved in Defining a Problem

As a researcher, you must have often read that defining a problem is the first step in a research process. But, have you ever wondered what is meant by defining a problem. Well, it simply means that the researcher has to lay down certain boundaries within which he/she has to study the problem with a pre-defined objective in mind.

Defining a problem is a herculean task, and this must be done intelligently to avoid confusions that arise in the research operation. Try to follow the below steps systematically to best define a problem:

i. State the problem in a general way:

First state the problem in general terms with respect to some practical, scientific or intellectual interest. For this, the researcher may himself read the concerned subject matter thoroughly or take the help of the subject expert. Often, the guide

states the problem in general terms; it depends on the researcher if he/she wants to narrow it down to operational terms. The problem stated should also be checked for ambiguity and feasibility.

ii. Understand the nature of the problem:

The next step is to understand the nature and origin of the problem. The researcher needs to discuss the problem with those related to the subject matter in order to clearly understand the origin of the problem, its nature, objectives, and the environment in which the problem is to be studied.

iii. Survey the available literature:

All available literature including relevant theories, reports, records, and other relevant literature on the problem needs to be reviewed and examined. This would help the researcher to identify the data available, the techniques that might be used, types of difficulties that may be encountered during the study, possible analytical shortcomings, and even new methods of approach to the present problem.

iv. Go for discussions for developing ideas:

The researcher may discuss the problem with his/her colleagues and others related to the concerned subject. This helps the researcher to generate new ideas, identify different aspects on the problem, gain suggestions and advices from others, and sharpen his focus on certain aspects within the field. However, discussions should not be limited to the problem only, but should also be related to the general approach to the problem, techniques that might be used, possible solutions, etc.

v. Rephrase the research problem into a working proposition:

Finally, the researcher must rephrase the problem into a working proposition. Rephrasing the problem means putting the problem in specific terms that is feasible and may help in the development of working hypotheses. Once the researcher has gone through the above steps systematically, it is easy to rephrase the problem into analytical and operational terms.