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UNIT: I
BA 5202 - BUSINESS RESEARCH METHODS

BUSINESS RESEARCH - INTRODUCTION

MEANING OF BUSINESS RESEARCH

An increasing amount of attention is being devoted to the making process of business managers, customers and employees. Many of the advances in business management in recent years are the result of adopting research findings in the behavioral sciences to business situations. Business research is both basic and applied. Basic research carried on for the purpose of extending the frontiers of knowledge. Applied research is problem oriented in that the research in carried on for the making a decision among alternative investment opportunities or among alternative funds. One of the important characteristics of business research is that the results are to be decision oriented. A wide range of subjects areas come with preferences of research in business areas.

DEFINITION OF BUSINESS RESEARCH:

According to McDaniel and Gates: "Business research is the planning, collecting and analysis of data relevant to business decision making and communication of the results of this analysis to management". It is symmetrical and Objective process of gathering, recording and analyzing data for aid in making decisions.

According to Zikmund, "Business research is a management tool that the companies use to reduce Uncertainty. It is a manger's source of information about organizational and environmental conditions, and covers topics ranging from long-range planning to the most ephemeral tactical decisions".

SIGNIFICANCE OF BUSINESS RESEARCH

- ❖ Testing of new product
- ❖ Ensuring adequate distribution
- ❖ Studying the competition
- ❖ Measuring adverting effectiveness

Testing new products:

Business research test the potential success of new products companies must known what types products and services customers want before they market them. For example. A restaurant chain may initially interview focus groups to test half dozen types of finish meals. The focus groups will likely consists of small groups of customers. The objective of the focus group may be to determine which fish meal customers like the best.

Ensuring adequate distribution:

Companies may also use business research to ensure the adequate distribution of their products. For example, a telephone directory publisher may conduct a distribution follow up study to make sure phone directories have been delivered to all residential customers. Publishers of telephone directories base their adverting rates on distribution. Therefore, ensuring that all residences receive phone books is crucial to the success of the publisher's business clients.

Measuring adverting effectiveness:

Companies use business research to determine the success of their advertising. For example, a milk manufacture may want to known what percentage of the population saw its most recent television commercial. The milk company may find that more people become aware of its advertising the longer the television and runs the milk company may need to run its television advertisements at different times if few people have seen the commercials. Companies also use business research to see if consumers recall the message or slogan of their commercials.

Studying the competition: Companies often use business research to study key competitors in their markets companies will often start with secondary research information or information that is already available for

example, the researchers can then study the purchasing trends, in the industry, striving to increase their company's share of the market companies will often need to increase market share in an industry to increase sales and profits.

RESEARCH PROCESS:
Defining research question/ problem and research objectives:
The first step in research is defining research problem. It is most important stage in applied research, as poorly defined problems will not yield useful results. It is rightly said that, "A problem well defined is half-solved". Poorly defined problems cause confusion and do not allow the researcher to develop a good research design. After a problem has been chosen, the next task is to formulate it precisely. This is too needs a good deal of care on the part of marketing researchers. Essentially two steps are involved in formulating the research problem, viz. understanding the problem and rephrasing the same into meaningful terms from an analytical point of view.

Extensive literature survey:
Once the problem is formulated, the next step is to write down a brief summary. For this the researcher should undertake extensive literature survey connected with the problem for this purpose , the abstracting and indexing journals and published and unpublished bibliographies are the first place to go to academic journals, conference proceedings, government reports, books ,etc., must be taped depending on the nature of the problem.

Formation of hypothesis:
Now the researcher should state in clear terms the working hypothesis or hypothesis .working hypothesis is tentative assumption made in order to draw out and test its, logical or empirical consequence. as such the manner in which research hypothesis are developed is particularly important since they provide the focal point for research. Hypothesis should be very specific and limited to the piece of research in hand because it has to be tested tie role of the hypothesis is to guide the research by delimiting the area of research and to keep him on the right track.

Preparing the research design:
Research designs are the conceptual structure within which research should be conducted. a research design specifies the methods and procedures for conducting a particular study the researcher should specific the approach he intends to use with respect to the proposed study . The function of research design is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money. Research designs can be grouped into three categories

❖ **Exploratory research**: An exploratory research focuses on the discovery of ideas and is generally based on secondary data. It is preliminary investigation, which does not have a rigid design.

❖ **Descriptive research**; A descriptive study is undertaken when the researcher wants to know the characteristics of certain groups such as age, sex, educational level, income, occupation, etc. in contrast to exploratory studies, descriptive studies are well structured.

❖ **Causal research:** A Causal research is undertaken when the researcher is interested in knowing the cause and effect relationship between two or more variables such studies are based on reasoning along well-tested lines.

Determining sample design:
The researcher must decide the ways of selecting a "sample" or the sample design. A sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given population. Sample can be either probability sample or non probability samples with probability sample s each element has a known probability of being included in the sample but the non-probability samples do not the researcher to determine this probability.

Collecting the data:
The next step is to determine the sources of data to be used. The researcher has to decide whether he has to collect primary data or depend exclusively on secondary data. Sometimes, the research study is based on both secondary and primary data. Any statistical data can be classified under two categories depending upon the scours utilized. These categories are

❖   Primary data
❖   Secondary data

       The primary data are those, which are collected a fresh and for the first time , and thus happen to be original in character .the secondary data, on the other hand, are those which have already been collected by someone else and which have already been passed through the statistical process.

Execution of the project:
       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, question as well as the possible answers may be coded. If the data are to be collected through interviewers, arrangements should be made 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.

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 into some purposeful and usable categories to raw data through.

Coding: operation is usually done at this stage through which the categories of data are transformed into symbol 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 producer where in the classified data are put in the form of tables.

In order to derive meaningful results from the statistical tables,

Analysis work after tabulation is generally based on the computation of various percentages, coefficients, etc., by applying various well-defined statistical for statistical formulae.

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

Generalization 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. 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 may quite often trigger off new questions, which in turn may lead to further researches.

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 as follows:

The preliminary page

The main text and

The end matter

In its preliminary pages the report should clearly title and date followed by acknowledgements and foreword by a list 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 object 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:
After introduction there would appear a statement of findings 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 sequences and broken –down into readily identifiable sections.

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

At the end of the report:
Appendices should be enlisted d in respect of all technical data. Bibliographies, list of books, journals, reports, etc., consulted should be also being given in the end. Index should also be given specially in a published research report.

Report should write in a concise and objective style in simple language avoiding vague. Expression such as 'it seems' 'there may be'. And the like, Charts and illustration 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 as stated.

TYPES OF RESEARCH:
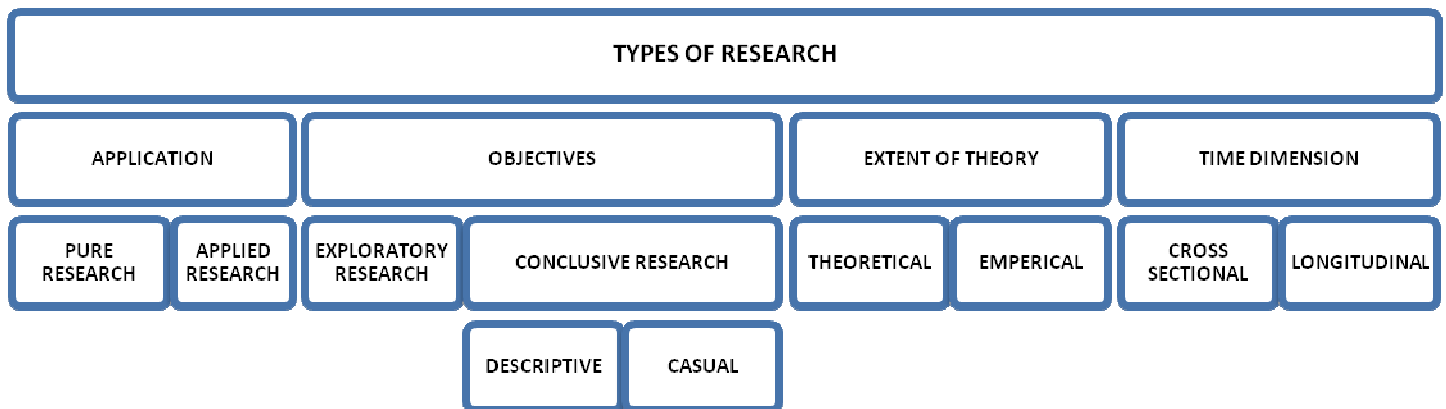
Research may be very broadly defined as systematic gathering of data and information and its analysis for advancement of knowledge in any subject. Research attempts to find answer intellectual and partial question through application of systematic methods. Research comprises a systematic method of exploring actual person and groups, focused primarily on their experience within their socials worlds, inclusive of social attitudes and value the mode of analyses of these experiences permits stating proposition in the specific form. *In short search for knowledge through objective and systematic method of finding solution to a problem is research on the basis of application research is of two types;*

❖ Pure research
❖ Applied research:

Pure Research:
Pure research also called basic research, is concerned with quest for knowledge and to know more about the phenomenon without concern for its practical use and also with developing and testing hypothesis and theories .pure research take place to explore a particular concept, or issue, without regards for a specific problem and may be carried out to simply gain a better understanding of the overall concept. It is said, there

is nothing so practical as a good theory, for example, the development of a model of a coaching behavior such research in itself has on immediate value beyond contributing to an area of intellectual inquiry.

Advantage of pure research:
- ❖ It results in general knowledge and an understanding of nature and its laws
- ❖ Provides the means of answering a large number of important practical problems
- ❖ Pure research lays down the foundation for the applied science that follows.
- ❖ This research also leads to innovation in every aspect of human life and knowledge application..

Disadvantage of pure research:
- ❖ It may not give a complete specific answer to practical problems.
- ❖ There is no obvious commercial value to the discoveries that result from pure research
- ❖ It is time consuming costly.
- ❖ It is based on theoretical aspects, but with on practical idea.

APPLIED RESEARCH:

This research is concerned with research for way of using scientific knowledge to solve practical problems. It focuses on analyzing and solving social and real life problems. The finding becomes basis of framing programme and policies, based on principles of pure research. According to Horton and Hunt, this research is an investigation for way of using scientific knowledge to solve practical problems. Because this research is generally conducted on large –scale basis, it is expensive. As such, it is often conducted with the support of some financing agency like government, public corporation, World Bank, UNICEF, UCG, ICSSR etc. many of time; this type of research is conducted on interdisciplinary basis also.

An example of this may be a sports organization that wishes to explore a potential market. They could commission research to determine demand for sports related services or products, or carry out research to explain why individual dropout from a particular fitness programme after a short period of time.

A sociologist who seeks to find out why crime is committed or how a person becomes a criminal is working for pure research. If this sociologists then tries to find out how criminal can be rehabilitated and his deviant behavior can be controlled, is doing applied research.

Advantages of Applied research:
- ❖ Social benefits to society.
- ❖ Economic gains.
- ❖ Applied research might also provide basic researchers with knowledge about novel research techniques and methodologies.
- ❖ Has the potential to solve real problems and can create innovation.

Disadvantage of Applied research:
- ❖ Needs to be carried out quickly in order to solve problems.
- ❖ Assumes that all problems can be solved
- ❖ As it deals real people, methods may have to be adopted, impacting the robustness of the study.
- ❖ Initial solution may be very limited and not generalisable and that appropriate solutions for accomplishing the desired outcome may not be produced at all.

EXPLORATORY RESEARCH:

When the objective of research is to gain familiarity with a phenomenon or acquire new insight into a in order to formulate a more precise problem or develop hypothesis, the exploratory studies is very helpful. If the theory happens to be too general or too specific, a hypothesis cannot be formulated. Therefore a need for an exploratory research is felt to gain experience that will be helpful in formulating relevant hypothesis for more definite investigation. Exploratory research is characterized by flexibility and versatility with respect to the methods because formal research protocol and produce are not employed. It rarely involves structured questionnaires, large sample, and probability sampling Plans. Rather researchers are altering to new ideas is pursued until its possibilities are exhausted or another direction is found. For the reason, the focus of the investigation may shift constantly as new insights are discovered thus the creating and ingenuity of the research plays a major role in exploratory research.

For example: A researcher in the field of psychology is interested in studying the influence of social environment on mental health. The researcher is restrained from formulating any precise hypothesis for investigation based on the writing on the topic. In such a case the exploratory study is usually most suitable. The following are the three approaches to the exploratory study:

Survey of literature: A review of the literature helps to identify the hypothesis which may serve as a guide for further investigation.

Experience survey: A small portion of existing knowledge and experience is put into written form. Everyday experiences provide opportunity to obtain information required to formulate hypothesis.

Case study: the focus may be on individuals or situations or groups or communities. The method of study may stress on the examination of the existing records. It may be instructed interviewing or participant observation or some other approach.

It is important to bear in mind that exploratory study merely leads to insights for formulating hypothesis. Their approaches do not consider it important to test or demonstrate them.

CASUAL OR EXPERIMENTAL RESEARCH:

Casual research used to obtain evidence of cause and effect (causal) relationships. In a casual studies it is typical to have an expectation of the relationship to be explained, such as predication about the Influence of price, packaging, adverting and like on sale. Thus, research must be knowledgeable about the research subject managers continually make decision based on assumed causal relationship. These assumptions may not be justifiable, and the validity of the causal relationship   should be examined via formal research. For example, the common assumption that a decrease in price will lead to increased sales and market share dose not hold in certain competitive environments causal research is appropriate for the following purpose:

- To understand which variables are the causes (independent variable) and which the variable are effects (dependent variable) of a phenomenon.
- To determine the nature of the relationship between the causal variables and the effect to be predicated.

Like descriptive research, casual research requires a planned and structured design. Although descriptive research can determine the degree of association between variables, it is not appropriate for examining casual relationship .such as examination requires a causal design in which the causal or independent variables are manipulated in a relatively controlled environment is one in which the

Other variables that may effect the dependant variable are controlled or checked as much as possible. The effect of this manipulation on one or more dependent is then measured to infer causality. The main method of causal research is experimentation.

THEORETICAL RESEARCH: Theoretical research generally uses the findings from existing works to develop new idea through analyzing existing theory and explanations. These new ideas are not tested through collecting evidence in the form of primary data. Theoretical research is held to be a classical way of adding something of value to the body of knowledge. In the business and management studies world theoretical research is not always well received. In fact some academic researchers would argue that the process described as theoretical research should not be regarded as "proper" academic research. The basis of such a claim is that miss types of theoretical research do not have a test component. One of the primary role of theoretical research is to rework already established ideas in order to improve insights into the subject matter. Such improvements could well-constitute adding some thing of value to the body of the knowledge

Evaluating theoretical research: Theoretical research dose not rely on data or evidence collection, analysis arid synthesis it is sometimes often said to be more difficult theoretical research relies heavily on creativity and imagination. Although those attributes are still required for empirical research they are often required to a greater Extent in theoretical research.

Advantages of theoretical research:
- ❖ Theoretical research advances the fundamental limits of understanding, which has led to important advances in the past and will continue to lead to important advances in future.
- ❖ It provides common body of understanding that practitioners automatically employ in attacking Technical tasks.
- ❖ This research is valuable as without the theory there would be nothing to be apply.

Disadvantages of theoretical research

❖ This research is often purely theoretical with the goal of increasing human understanding of certain phenomena or human behavior but does not try to solve or treat this problems

❖ The new ideas developed from this research are not tested through collecting evidence in form of collected primary data.

❖ This research is based on existing work or literature, therefore reliability of such sources affects the conclusions of theoretical research.

EMPIRICAL RESEARCH

Empirical research based upon observation or measurement rather than theoretical reasoning. It supports the development of new ideas through the collection of data. Thus a researcher who develops the theory of sports fan violence through visiting library and developing their own explanation through reading existing work will be undertaking theoretical research. For example, Computer simulations generate scores from random number routine, case and measures are not involved. Analytical researchers use mathematical operations to work from initial assumptions to conclusions. Empirical research involves three activities, which are as follows:

Measurement: It involves activities associated with measuring the factors that form expected relationship. In other situations, a researcher may begin with measures already developed and asses their suitability for a study at hand.

Research design: It establishes procedures to obtain cases for study and to determine how scores will be obtain from these cases.

Analysis: Empirical research also involves analyses of scores. Analyses are performed to describe scores on single measures and especially. To identify relationships that may exist between scores across different measure.

Benefits of empirical research (advantages)

Some of the benefits of empirical research which academics may perceive to possess are as follows:

❖ Understand and respond to dynamics of situations (context)

❖ Respect contextual differences, Build upon what is already known to work

❖ Meet accepted professional standards of research. Integrate professional knowledge with empirical data to inform instructional development decisions

❖ Establish relationship between intervention and behavioral response.

Limitation or disadvantages of empirical research:

Some of this advantage which academics, may, correctly, or incorrectly, perceive, empirical research to possess is as follows;

Time: Since empirical research requires soliciting predication and "data gathering" from various off campus business firms, the time required for at least these phase of the research studies are only party under the control of the researchers. Thus , the researcher may feel that the less control they have over the time required for each phase of the research, the longer the expected completion time, the greater the variation in the time required to complete the work and thus the greater the risk associated with the projects completion.

Cost : Field research requiring on-site visits by the researchers may requires cash outlays for travel, lodging, and other expenses not required in conceptual research, which can usually be accomplished in the local academic setting.

Access to firms: They cannot gain access to the types of firms necessary-for their studies.

Access to data: Even if they gain access to business firms, such firms may be reluctant to release any or all the data necessary for the studies,

Skills: They do not possess the requisite skills necessary to design such empirically based studies, to gather and analyzes the often times voluminous data efficiently, or to interpret the result in a manner meaningful to and rewarded by both the business and academic worlds. The time and effort required to learn or upgrade these necessary skills is indeed an extra burden to academy

CROSS-SECTIONAL RESEARCH

In cross-sectional research, researchers observe at one point in time.

It is usually the simplest and least cost alternative.

A cross-sectional design provides a snapshot of the variables included in the study, at one particular point in time.

Cross-sectional designs generally use survey techniques to gather data.

For example, the Population Census. Cross-sectional research can be exploratory, descriptive, or explanatory but it is most consistent with a descriptive approach to research.

Advantages and Disadvantages of Cross-Sectional Designs

Advantages	Disadvantages
Data on many variables	Increased chances of error
Data from a large number of subjects	Increased cost with more subjects
Data from dispersed subjects	Increased cost with each location
Answers questions on who, what, when, where	Cannot measure change
Good for exploratory research	Cannot establish cause and effect
Generates hypotheses for future research	No control of independent variable
Data useful to many different researchers	Difficult to rule out rival hypotheses
Data on attitudes and behaviors	Static, time bound

TIME SERIES RESEARCH:

A Time Series Design collects data on the same variable at regular intervals (weeks, months, years, etc.) in the form of aggregate measures of a population. Measurements are taken on each variable over two or more distinct time periods. This allows the researcher to measure change in variables over time. For example, the Consumer Price Index (CPI), the FBI Uniform Crime Rate, unemployment rates, poverty rates, etc.

Time series designs are useful for:
- ❖ Establishing a baseline measure
- ❖ Forecasting future (short term) trends
- ❖ Describing changes over time
- ❖ Keeping track of trends

Advantages and Disadvantages of Longitudinal Designs

Advantages	Disadvantages
Data easy to collect	Data collection method may change over time
Easy to present in graphs	Difficult to show more than one variable at a time
Easy to interpret	Needs qualitative research to explain fluctuations
Can forecast short term trends	Assumes present trends will continue unchanged

Panel study:

It is a powerful type of longitudinal research. It is more difficult to conduct than time –series research. In a panel study, the research observes exactly the same people, group, or organization across time periods. Participants, who are examined over repeated time point, may affected by having previously completed the measure being used. (This is known as sensitization .)Therefore it is sometime necessary to include a control group matched on age and gender with which to compare the panel group at each time interval Panel research is formidable to conduct and very costly. Tracking people over time is often difficult because some people die or cannot be located .Nevertheless, the result of a well –designed panel study are very valuable. Even short –term panel studies can clearly show the impact of a particular life event.

Cohort study:

It is similar to the panel study, but rather than observing the exact same people, a category of people who share a similar life experience examine in a specified time period is studied. Cohort analysis is "explicitly

macro analytic " which means researchers examine the category as a whole of important feature .In cohort study , the individuals examined over time may not be same but they should be representative of a particular group (or cohort) of individuals who have shared a common experience . When cohort analysis design is used, a table is constructed to display the result with column for the time interval of Data collection (the cohort interval), for example age group such as 15- 20 years, 21-25 years etc…

RESEARCH QUESTION OR PROBLEMS
Needs of defining a problem
- ❖ The definition of a problem serve the following purpose :
- ❖ The definition of a problem sets the direction of the study.
- ❖ The definition reveals the methodology or procedure of the study.
- ❖ The definition helps the researcher to control subjectivity or biases of the researcher.
- ❖ The definition of the problem suggests and specifies the variables to be taken-up into the investigation through a problem involved into so many variables.
- ❖ The definition makes the research work practicable.

Components of a research problem
- ❖ There must be an individual or a group, which has some difficulty of the problem.
- ❖ There must be some objective to be attained at. If one wants nothing, one cannot have a problem.
- ❖ There must be alternative means (or die course of action) for obtaining the objectives) one wishes to attain This means that there must be least two means available to a researcher for if he has no choice of means, he cannot have a problem.
- ❖ There must remain some doubt in the mind of as researcher with regard to the selection of alternative. This means that research must answer the question concerning the relative efficiency of the possible alternatives to which the difficulty pertains.
- ❖ Thus, a research problem is one, which required a researcher to find out the best solution for the given problem, i.e., to find out by which course of action the objective can be attained optimally in the context of a given environment.

Selection the problem:
 The research problem understands for study must be carefully selected. The task is a difficult one, although it may not appear to be so. A problem must spring from the researcher's mind like a plan springing from its own seed. The following points may be observed by a researcher in selecting a research problem or a subject for research.
- ❖ Subject which is overdone should not be normally chosen, for it will be a difficult task to throw any new light in such a case.
- ❖ Controversial subject should not become the choice of an average researcher.
- ❖ Too narrow or too vague problem should be avoided.
- ❖ The importance of the subject , the qualification and the training of a researcher, the costs involved , the time factor are few other criteria that must also be considered in selecting a problem .In other words, before the final selection of a problem is done , a researcher must ask himself the following question:
- ❖ Whether he is well equipped in term of his background to carry out the research?
- ❖ Whether the necessary cooperation can be obtained from those who must participate in research as subjects?
- ❖ If the answers to the entire question are in the affirmative, one may become sure so far as the practicability of the study is concerned.

In the selection of problem a researcher should take the following precautions:
- ❖ Researchers 's interest
- ❖ Topic of significance
- ❖ Availability of data
- ❖ Novelty of the idea
- ❖ Benefits of the research
- ❖ Feasibility of the study

Process of research problem: It is properly and clearly is a crucial part of a research study and must in no case be accomplished hurriedly. However, in practice this frequently overlooked which causes a lot of problem later on. Hence, the research problem should be defined in a systematic manner, giving due weight age to all relating points. The technique for the purpose involves the undertaking of the following steps generally one after the other.

- ❖ Statement of the problem in a general way.
- ❖ Understanding the nature of the problem
- ❖ Surveying the available literature
- ❖ Developing the idea through discussions and
- ❖ Rephrasing the research problem into a working proposition.

Statement of the problem in a general way:

The research problem must address either a specific practical operational issues or some scientific discovery. It can also be pertaining to satisfaction or broadening of a particular intellectual curiosity. Whatever the area of research, the problems definition should generally be at a logical level.

Understanding the nature of:

The next step in defining the problem is to stand its origin and nature clearly .The best way of understanding the problem is to discuss it nth those who first raised it in order to find out how the problem originally came about and with what objective in view . If the researcher has stated the problem himself, he should consider once again all points that induced him to make a general statement concerning the problem.

Surveying the available literature:

It is important to review and survey all the possible literature that is available on the research area prior to defining the research problem. It assists researcher to look into newer dimensions in that particular area and leads to enhancement of knowledge. All available literature concerning the problem at hand must necessarily be surveyed and examined before a definition of the research problem is given.

Developing the idea through discussions:

Discussion concerning a problem often produces useful information. Various new ideas can be development through such an exercise. Hence, a researcher must discuss his problem with his colleagues and other who have enough experience in the same area or in working on similar problem .This is quite often known as an experience survey..

Rephrasing the research problem:

Finally, the researcher must sit to rephrase the research problem into a working proposition .Once the nature of the problem has been clearly understood, the environment (Within which the problem has got to be studied) has been defined, discussions over the problem have taken place and the available literature has been surveying and examined, rephrasing the problem into analytical or operational terms is not a difficult task.

Research problem:

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

OBJECTIVES OF RESEARCH:
- ❖ **Research extends knowledge**:
  Research extends knowledge of human beings, social life environment. Scientists and researchers build up the wealth of knowledge through their research findings. They search answer for various type of question; "What, where, when, How, and Why of various phenomena, and enlighten us . The bodies of knowledge have been developed by research in general and pure of fundamental research in particular.

❖ **Research unravels the mysteries of Nature:** It brings to light hidden information that might never be discovered fully during the ordinary course of life.

❖ **Research Establishes Generalizations and General Laws**:

Research establishes generalization and general law and contributes to theory building various fields of knowledge. The knowledge of isolated event is connected together to draw generalization and general law laws of gravitation , law of demand and principals of organization such as unity command and scalar principal ,the theory of consumer behavior and motivation theories are some example for such generalization, laws and theories.

❖ **Research verifies and tests:**

Research verifies and tests existing fact and theory and these help improvising knowledge and ability to handle situations and events .empirical research goes far beyond the passive role of verifying and testing theory .research plays an active role: it performs at least four major functions, initiates, formulate, deflects and clarifies theory.

❖ **General laws and developed through researches:**

General laws and developed through research may enable us to make reliable predication of events yet to happen. Researcher analyze inter-relationship: Researcher aim analyze inter-relationship between variables and drive causal explanations and thus enables to have better understanding of the world in which live. Applied research aim at finding solution: Applied research aim at finding solution to problems socio-economic problem (eg. Social unrest, unemployment, and poverty) health problem, human relation problems in organization and so on. Thanks to the fruits' of research, having better quality of life, longer life span and better control over events.

It aims to develop tools, concepts: research also aims at developing new tools, and theories for a better study of unknown phenomena.

Types of research objectives:
- Market attractiveness evaluation
- Communications planning
- Concepts testing
- Pricing
- Adverts testing
- Product testing
- Competitive forces
- List building
- Customer satisfactions
- Customer insight

HYPOTHESIS RESEARCH:

Meaning and definition

A statistical hypothesis is an assumption about a population parameter .this assumption is may or may not be true. A hypothesis statement about the population parameter. hypothesis testing\significance testing in procedure that helps us to decide whether the hypothesized population parameter value is to be accepted or rejected by making use of the information about obtained by sample.

According to Prof. Mories Hamburg. "A hypothesis is simply a quantitative statement about a population".

According to Palmer O Johnson, "A hypothesis is island in the uncharted seas of thought to be used as bases for consolidation and recuperation as we advance into the unknown".

Types of hypothesis:

1. **Research hypothesis:**

Substantive hypotheses, sometime called research hypotheses are tentative statements about the expected outcomes for the variables of the research study. An example of a substantive or research hypothesis is," As corrective, displinary methods are increased in an elementary hool, student achievement will decrease". In research in science education, hypothesis might be –"Laboratory instruction enhances the student's

understanding of scientific processes over an instructional approach limited to lecture, discussion. and theoretical problem solution". Notice that the research hypotheses are a directional hypothesis, i.e., it indicates the expected direction of the results. The direction is implied by theory or previous research.

2. **Statistical hypothesis:**

It is given in statistical terms. Technically, in the context of infertinal statistical, it is a statement about one or more parameters that are measures of the populations under study. Statistical hypothesis often are given in quantitative terms, e.g.," the mean reading achievement of the population of third grade students taught by method A equals the mean reading achievement of the population taught by method B".

3.   **Null hypothesis:**

 A statistical hypotheses which is stated for the purpose of possible acceptance is called null hypothesis. It is usually denoted by the symbol H_0.for example, the null hypothesis may be expressed symbolically as:$H_0:\mu = 162$ cms

The following may be borne in mind in setting the null hypothesis: If we want to test the significance of the difference between a statistic and the parameter or between two sample statistics then we set up a null hypothesis that's difference is not significant. This means that the difference is not significant. This means that the difference is just due to fluctuations of sampling: $H_0:\mu = \bar{X}$

If we want to test any statement about the population we set up the null hypotheses that it is true.$H_0:\mu = \mu_0$

4. **Alternative hypothesis**: Any hypotheses which is complementary to the null hypothesis is called an alternative hypothesis and is denoted byH_1or H_α.

Then the alternative hypothesis could be:

$H_1:\mu \neq \mu_0$ $H_1:\mu > \mu_0$ $H_1:\mu < \mu_0$

5. **Directional and non directional hypothesis:** Directional hypothesis indicates the type of direction of relationship between variables. It uses the words such as increase or decrease, more than or less than.

Non directional hypothesis postulate relationship but does not offer indication of direction.ss

Procedure for hypothesis testing: Test a hypothesis means to tell whether or not the hypothesis seems to be valid. In hypothesis testing the main question is: whether to accept the null hypothesis or not to accept the null hypothesis? Procedure for hypothesis testing refers to all those steps that we undertake for making a choice between the two actions i.e., rejection and acceptance of a null hypothesis. The various steps involved in hypothesis testing are stated below:

Making a formal statement:

The step consists in making a formal statement of the null hypothesis (H_0) and also of the alternative hypothesis (H_a). This means that hypotheses should be clearly stated, considering the nature of the research problem..The formulation of hypotheses is an important step which must be accomplished with due care in accordance with the object and nature of the problem under consideration. It also indicates whether we should use a one-tailed test or a two-tailed test. If Ha is of the type greater than , we use a one-tailed test, but when Ha is of the type "whether greater or smaller" then we use a two-tailed test.

Selecting a significance level:

The hypotheses are tested on a pre-determined level of significance and as such the same should be specified. Generally, in practice, either 5% level or 1% level is adopted for the purpose. The factors that affect the level of significance are:

a)   The magnitude of the difference between sample means,

b)   The size of the samples,

c)   The variability of measurements within samples

d)   Whether the hypothesis is directional or non-directional. In brief, the level of significance must be adequate in the context of the purpose and nature of enquiry**.**

Deciding the distribution to use: After deciding the level of significance, the next step in hypothesis testing is to determine the appropriate sampling distribution. The choice generally remains between normal distribution and the t-distribution..

Selecting a random sample and computing an appropriate value: Another step is to select a random sample(s) and compute an appropriate value from the sample data concerning the test statistic utilizing the relevant distribution. In other words, draw a sample to furnish empirical data.

Calculation of the probability: One has then to calculate the probability that the sample result would diverge as widely as it has from expectations, if the null hypothesis were in fact true.

Comparing the probability:

Yet another step consists in comparing the probability thus calculated with the specified value for a , the significance level. If the calculated probability is equal to or smaller than the a value in case of one-tailed test then reject the null hypothesis but if the calculated probability is greater, then accept the null hypothesis. In case we reject H0, we run a risk of omitting an error of Type I, but if we accept H0, then we run some risk of committing an error of Type II.

CHARACTERISTICS OF HYPOTHESIS:

1. **Clear and precise**: hypothesis should be clear and precise. If the hypothesis is not clear and precise, the inference drawn on its basis cannot be taken as reliable.
2. **Capable:** Hypothesis should be capable of being tested. In a swap of un-testable hypothesis , many a time the research programmer are blogged down .some prior study may be researcher in order to make hypothesis a testable one.
3. **State relationship between variables**: Hypothesis state relationship between variables, if it happens to be relational hypothesis.
4. **Limited in scope**: hypothesis should be limited in scope and must be specific, A researcher must remember that narrower hypothesis are generally more testable and researcher should develop such hypothesis.
5. **Simple**: hypothesis should be stated as far as possible in most simple terms so that the same is easily understandable by all concerned .but one must remember that simplicity of hypothesis has nothing to do with its significance.
6. **Consistent**: Hypothesis should be consistent with must most known fact i.e., it must consistent with substantial body of the establish facts. In other words , it should be one which   judges accepts as being the most likely.

DEFINITIONS OF SOME IMPORTANCE TERMS ARE

Statistical hypothesis: A statement about the parameters describing a population (not a sample).

Statistic: A value calculated from a sample, often to summarize the sample for comparison purposes.

Simple hypothesis: Any hypothesis which specifies the population distribution completely.

Composite hypothesis: Any hypothesis which does *not* specify the population distribution completely.

Null hypothesis (H_0): A hypothesis associated with a contradiction to a theory one would like to prove.

Alternative hypothesis (H_1): A hypothesis (often composite) associated with a theory one would like to prove.

Statistical test : A procedure whose inputs are samples and whose result is a hypothesis.

Region of acceptance: The set of values of the test statistic for which we fail to reject the null hypothesis.

Region of Critical region: The set of values of the test statistic for which the null hypothesis is rejected.

Critical value: The threshold value delimiting the regions of acceptance and rejection for the test statistic.

Power of a test ($1 - \beta$): The test's probability of correctly rejecting the null hypothesis. The complement of the false negative rate, β. Power is termed sensitivity in biostatistics. See sensitivity and specificity and Type I and type II errors for exhaustive definitions.

Size:

For simple hypotheses, this is the test's probability of incorrectly rejecting the null hypothesis. The false positive rate. For composite hypotheses this is the supermom of the probability of rejecting the null hypothesis over all cases covered by the null hypothesis. The complement of the false positive rate is termed specificity in biostatistics. See sensitivity and specificity and Type I and type II errors for exhaustive definitions.

Significance level of a test (α):

 It is the upper bound imposed on the size of a test. Its value is chosen by the statistician prior to looking at the data or choosing any particular test to be used. It is the maximum exposure to erroneously rejecting

H_0 he/she is ready to accept. Testing H_0 at significance level α means testing H_0 with a test whose size does not exceed α. In most cases, one uses tests whose size is equal to the significance level.

P-value: The probability, assuming the null hypothesis is true, of observing a result at least as extreme as the test statistic.

Statistical significance test:

A predecessor to the statistical hypothesis test (see the Origins section). An experimental result was said to be statistically significant if a sample was sufficiently inconsistent with the (null) hypothesis. This was variously considered common sense, a pragmatic heuristic for identifying meaningful experimental results, a convention establishing a threshold of statistical evidence or a method for drawing conclusions from data.

Research in an evolutionary perspective:

It has taken, a long time of determined how the world should be investigated. The earliest way focused on the Greek philosophers such as Aristotle, who maintained the men and women have different numbers of teeth. He did not check this, and merely provided lengthy arguments as to why this should be so. However, arguments cannot determine whether a statement is correct. Proof is required. Since then, the world has learnt to carry-out experiment and perform observation. This approach means that results are universal and may be reproduced. Thus, the scientific methods was born, which was subsequently followed by research in the behavioral science.

The empirical and social sciences borrowed from probability theory and statistics, decision theory, game theory, utility theory and operation research. Philosophers of science have addressed general methodological problems such as the nature of scientific explanation and the justification of induction.

According to Hawking: Any physical theory is always provisional in the sense that it is only a hypothesis-you can never it. Thus, no matter how many times the result of subsequent experiments agree with the theory, you cannot predict whether the next time the result may not contradict the theory. However to disprove a theory you only have to find a single observation that contradict it .thus, a new theory generally is an extension of pervious theory. in practice, a new theory may be devised following upon add-ons to the pervious theory , through modifications or even abandonment.

Type I error:

It is the error of rejecting the null hypothesis H_0 , when it is true. The probability of making a type I error is denoted by α, the level of significance.

Type II error:

It is the error of accepting the null hypothesis H_0 , when it is false. The probability of making a type II error is denoted by β.

Theory research:

Meaning of theory

A theory is a set of symmetrically interrelated concepts, definition, and proposition that are advanced to explain and predict phenomena (fact). In this sense, we have many theories and use them continually to explain or predict what goes on around as. To the degree that our theories are sound and fit situation, we are successful in our explanation and predictions.

ROLE OF THEORY IN RESEARCH:

A theory can develop scientific knowledge in research by these criteria;

Prediction of behavior:

The theory enables to predict the behavior or characteristics of one phenomenon from the knowledge of another phenomenon. Accomplishing the first goal allows the theorist to predict the behavior or may theories that older investors tend to be more interested in investment income than yield on the basis of younger investor. This theory once verified, should allow researchers to predict the importance of expected dividend yield on the basis of investor age.

Understanding relationship:

To gain understanding of the relationship among various phenomena. A theory is a coherent set of general propositions, used as principles of explanation of the apparent relationship of certain observed phenomena.

A key element in our definition is the term proportion. Before one can see what a proportion is. However, he must discuss the theoretical concepts.

Other roles:
- Suggests a problem for study
- Gives a hypothesis to be tested
- Provide simple explanation about the observed relationship regarding their relation to phenomena
- Helps in being consistent with already founded body of the knowledge and the observed relationship
- Provides a devices verification and revision, fourth problem, stimulate further research in areas needing investigation
- Provides a conceptual model for delimiting

COMPONENTS OF THEORY:

Concepts:
To understand and communicate information about objects and events there must be a common ground on which to do it concepts to serve the purpose A concepts is a generally collection of meaning or chacteristics associated with certain events, objects, condition, situations, and behavior.

Constructs:
A constructs is a theoretical dimension that has been or potentially could be operationalised by one or more variables. the terms 'concepts' and 'constructs' are often used in place of one another, but some authors make certain distinctions between the two. Concepts are usually regarded as the more general of the terms.

Definition:
Confusion about the meaning of concepts can destroy a research study's value without the researcher or client even knowing it. If words have different meanings to the parties involved, then the parties involved, then the parties are not communicating well.

Variables:
In practice, the term variable is used as a synonym for construct or the property being studied. In this variable of the symbol of an event, act, characteristics, trait, or attribute that can be measured, and to which assign to categorical values

Proposition and hypothesis:
A proposition is a statement about observer able phenomena (concept) that may be judged as true or false. Hypothesis is a formal statement explaining some outcome, in its simplest form, a hypothesis is a guess.

Theory generation: A theory may be developed with deductive reasoning by going form a general statement to specific assertion. Deductive reasoning is logical process of deriving a conclusion about a specific instance based on a known general promise or something known to be true. Inductive reasoning is the logical process of establishing a general proposition on the basis of observation of particular facts.

Deductive theory: Deduction is the process by which we arrive at the reasoned conclusion by logical generalization of known fact. For example: we known that all high performs are highly proficient in their jobs. If john is a high performance, we than conclude that highly proficient in job.

Inductive theory: Induction is a process where we observe certain phenomena, and on this basis arrive at conclusion. in otherworld, in induction we logically establish a general proposition based pn observed facts. For example: we see that production processes are the prime features of factories or manufacturing plants.

UNIT -II
RESEARCH DESIGN AND MEASUREMENT

MEANING OF RESEARCH DESIGN

A research design is a framework or blueprint for conducting the marketing research project. It details the procedures necessary for obtaining the information needed to structure or solve marketing research problems. In simple words it is the general plan of how you will go about your research.

Definitions of Research Design

According to Kerlinger-"Research design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance".

According to Green and Tull -"A research is the specification of methods and procedures for acquiring the information needed. It is the overall operational pattern or framework of the project that stipulates what information is to be collected from which sources by what procedures.

Feature of good research design:

1. Objectivity:

It refers to the findings related to the method of data collection and scoring of the responses. The research design should permit the measuring instrument which is fairly objective in which every observer or judge scoring the performance must precisely give the same report.

2. Reliability:

Reliability refers to consistency throughout a series of measurements. For eg: if a respondent gives out a response to a particular item, he is expected to give the same response to that item even if he is asked repeatedly. If he is changing his response to the same item, the consistency will be lost. So the researcher should frame the items in a questionnaire in such a way that it provides consistency or reliability.

3. Validity:

Any measuring device or instrument is said to be valid when it measures what it is expected to measure. For eg: an intelligence test conducted for measuring the I.Q should measure only the intelligence and nothing else, and the questionnaire shall be framed accordingly.

4. Generalization:

It means how best the data collected from the samples can be utilized for drawing certain generalizations applicable to a large group from which sample is drawn. Thus a research design helps an investigator to generalize his findings provided he has taken due care in defining the population, selecting the sample, deriving appropriate statistical analysis etc. while preparing the research design. Thus a good research design is one which is methodologically prepared and should ensure that.

5. **Adequate information:**

The most important requirement of good research design.
- ❖ Identifying the exact research problem to be studied
- ❖ The objective of the research
- ❖ The process of obtaining information
- ❖ The availability of adequate and skilled manpower and
- ❖ The availability of adequate financial resources for carrying-out research.

6. Other Features:

Some other important feature of good research design is flexibility, adaptability, efficiency, being economic and so on. A good research design should minimize bias and maximize accuracy of the data obtained and should have as few errors as possible.

NEED OF RESEARCH DESIGN:
- ➢ Accurate result
- ➢ Control variance
- ➢ Provide blue print
- ➢ Facilities systematic investigation
- ➢ Visualizes and forecasts potential problems

Accurate result:

All the research activities have the purpose of answering research questions. However, the manner of the seeking answer to the research question differs from situation to situation according to the nature of the problem. In any project the research problems are further stated in from of specific hypothesis so that they can be tested against empirical evidence achieved. The hypothesis states the relationship between variables and may vary from being most general to most specific ones.

Control variance:

Second basis need of research design is the control of variance. Research design help in manipulation of experimental variables. I.e., in seeking and establishing the relationship between the assumed the cause or the experimental variables and effect, i.e., the dependent variable. To establish such a relationship it is essential that the effect of other variables, besides the experimental one, should be controlled.

Provides blue print:

A researcher may face many problems like that sample is to be taken. What is to be asked, what method of data collection is to be used and so forth. Research design minimizes all these problems of the researchers because all decisions are taken beforehand.

Facilities systematic investigation:

This refers to determining whether only one cause out of many causes to be examined, only one (or a few selected) hypothesis is to be tested: only attitudes of students of one educational institution are to be studied and so on. Since the objectives are clear and the structure is also provided, systematic investigation is possible.

Visualizes and forecasts potential problems:

The researcher studies available literature and learn about new alternative approaches, for example, he gets an estimate of personnel required as investigator , cost, possible, measurement of problems and so forth.

REQUIREMENTS OF GOOD RESEARCH DESIGN:

Well defined problems: Nature and scope of the problem to be studied must be stated clearly, or say must be well defined and formulated.
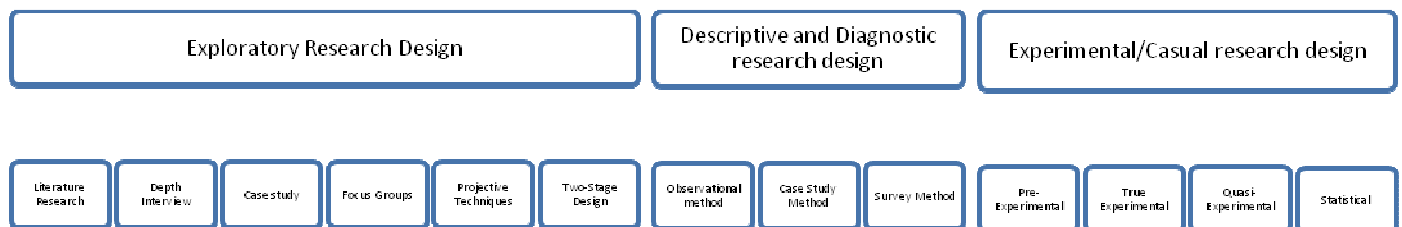
Clarity information: if any hypothesis is to be tested it must be clearly formulated.

Testable: the research design must adequately answer the research questions and test the hypothesis.

Identifying variables: relevant variables must be clearly identified and operationalised. Adequate methods of collecting the information methods of logically deriving the conclusion must be developed. Only then control of variance possible.

Sever the validity need: the research design must be structured in a manner that it fulfills the need of internal and external validity.

TYPES OF RESEARCH DESIGN

Exploratory Research Design	Descriptive and Diagnostic research design	Experimental/Casual research design

Literature Research	Depth Interview	Case study	Focus Groups	Projective Techniques	Two-Stage Design	Observational method	Case Study Method	Survey Method	Pre-Experimental	True Experimental	Quasi Experimental	Statistical

EXPLORATORY RESEARCH DESIGN

Meaning:

Exploratory means to explore the hidden things, which are not clearly visible. Exploratory research is a type of Research conducted for a problem that has not been clearly defined. Exploratory Research Studies are also termed as formulate Research studies. Exploratory research helps determine the best research design, data collection method and selection of subjects.

For Example: It is one thing to describe the crime rate in a country, to examine trends over time or to compare the rates in different countries, it is quite different thing to develop explanations about why the crime rate is as high as it is why some types of crime are increasing or why the rate is higher in some countries than in others.

Exploratory Research provides insights into and comprehension of an issue or situation. It draws definitive conclusions only with extreme caution. Exploratory research is a type of research conducted because a problem has not been clearly defined. Exploratory research often relies on secondary research such as reviewing available literature an/or Data , or qualitative approaches such as informal discussions with consumers, employees, management or competitors and more formal approaches through in – depth

interviews, focus groups, projective Methods, case studies or pilot studies. The internet allows for Research methods that are more interactive in nature.

Important of research design:

New discoveries can be made:

Exploratory research discovers new ideas to understand the problem at hand . the focus of the experiment is always shifted towards discovering the new insight of the study. Researchers are always alter new idea as they may redirect the exploration of researchers into a new direction.

Increasing Understanding

The principal use of exploratory research is to increase a researcher's understanding of a subject. It should not be used to draw definite conclusions, due to its lack of statistical strength, but it can help a researcher begin to determine why and how things happen.
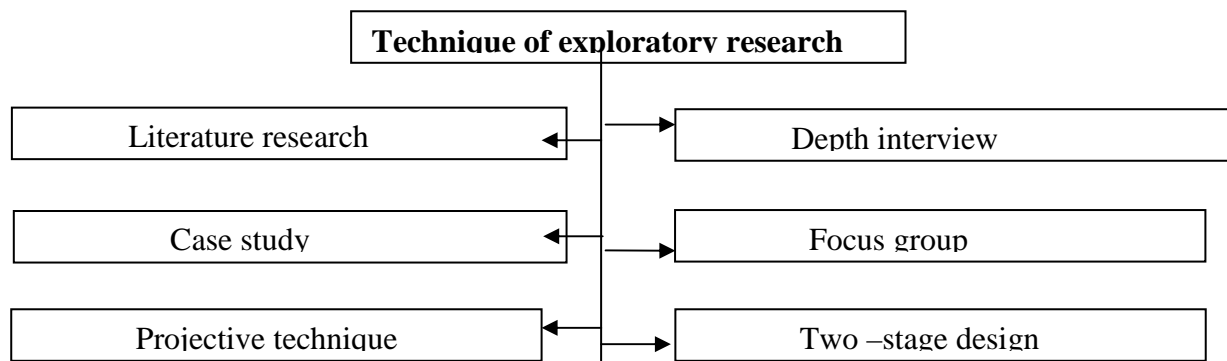
Flexibility of Sources:

Secondary sources, such as published literature or data, are commonly used in exploratory research. Other sources of information used in exploratory studies include informal discussions, formal structured interviews, pilot studies or case studies. These might involve customers, colleagues, patients or clients. Care should be taken to select a range of unbiased sources to give a broad and well-rounded understanding of the subject.

Better Conclusions: Exploratory research can be very advantageous in directing subsequent research approaches. A greater understanding of a subject helps hone subsequent research questions and can greatly increase the usefulness of a study's conclusions. This research is also very useful in determining the best approach to achieve a researcher's objectives

Strategic Planning: Exploratory research in some cases can save a great deal of time and money by flagging dead ends early. For example, in drug development, exploratory Phase II clinical trials give the e If the treatment effect is too small or the safety profile is unacceptable --- giving a low benefit-to-risk ratio --- drug development can be shelved early, saving the company millions (if not billions) of dollar

Technique of exploratory research design:

Following are the techniques of exploratory research design:

Technique of exploratory research	
Literature research	Depth interview
Case study	Focus group
Projective technique	Two –stage design

Literature research\ study secondary data: the quickest and most economical way is to find possible hypothesis from the available literature. The past researchers may be suitable sources of information to develop new hypothesis. The finding of marketing research is generally published in trade and professional journals, which can be fruitful sources of information. Such research findings are available company and public libraries. Various forms of literature such as conceptual Literature, trade Literature, published statistics and soico-psychological Literature are available in these libraries. The researcher can search them for his research purpose.

Depth interview \survey of knowledgeable persons or experience survey: experience survey means the survey of people who had practical experience with the problem to be studied. These individuals can be top executives, sales managers' executives, wholesalers and retailers possessing valuable knowledge and information about the problem environment. Various techniques have been developed to aid in collecting exploratory data from individuals – they make up what is usually called qualities research. When applied to consumers, such research is generally aimed at finding the thoughts feeling and attitudes that influence consumer's behavior.

Case study: the third technique of exploratory research is the case study method. This research methods has long been considered "soft "or non –scientific, but with the modern surge in qualitative research the case method has received more attention. Indeed, the case method might be considered one variation of the survey of individuals with ideas it involves the comprehensive study of one, or a few, specific situation and lends itself particularly to the study of complex situations in which the interrelations of several individuals are important

Focus group: Focus groups originate from sociology studies .they have been extensively used in marketing research. Focus group studies generally conduced to evaluate the potential of a new product idea or concept. A focus group comprises several persons, who are led by a trained moderator. The moderator's task is to lead the team generating and exchanging ideas on a particular issue. The process starts by issuing a topic for discussion among participants by the moderator.

Projective techniques: A projective techniques is an unstructured, indirect form of questioning that encourages respondents to project their underlying motivations, belief, attitudes or feeling regarding the issues of concern. In projective techniques, respondents are asked to interpret the behavior of others rather than describe their own behavior, in interpreting the behavior of others, respondents indirectly project their own motivation, belief, attitudes or feeling into the situation. As in psychology, these techniques are classified as association, completion, construction and expression.

Two –stage design: A two-stage design is a beneficial approach for designing research. in this method, the exploration is conducted in two stage. The first stage consists of clearly defining the research problem, while the second stage comprises developing the research design. A two stage design is beneficial, when the problem is vaguely defined and the researcher is no clear about the particular topic that has to be studied

Significance of research design:
Increasing Understanding
The principal use of exploratory research is to increase a researcher's understanding of a subject. It should not be used to draw definite conclusions, due to its lack of statistical strength, but it can help a researcher begin to determine why and how things happen.

Flexibility of Sources: Secondary sources, such as published literature or data, are commonly used in exploratory research. Other sources of information used in exploratory studies include informal discussions, formal structured interviews, pilot studies or case studies. These might involve customers, colleagues, patients or clients. Care should be taken to select a range of unbiased sources to give a broad and well-rounded understanding of the subject.

Better Conclusions: Exploratory research can be very advantageous in directing subsequent research approaches. A greater understanding of a subject helps hone subsequent research questions and can greatly increase the usefulness of a study's conclusions. This research is also very useful in determining the best approach to achieve a researcher's objectives

Strategic Planning: Exploratory research in some cases can save a great deal of time and money by flagging dead ends early. For example, in drug development, exploratory Phase II clinical trials give the expected treatment effect and adverse reaction profile of a drug in small groups of patients before moving into larger scale trials. If the treatment effect is too small or the safety profile is unacceptable --- giving a low benefit-to-risk ratio --- drug development can be shelved early, saving the company millions (if not billions) of dollars.

DESCRIPTIVE RESEARCH

Meaning:
Descriptive research design is concerned with the research studies with a focus on the portrayal of the characteristics of a group or individual or a situation. The main objective of such studies is to acquire knowledge. For example to identify the use of a product to various groups a research study may be undertaken to question whether the use varies with income, age, sex, or any other characteristics of population. Similarly such studies are used to examine the characteristics of the corporate sector or consumer behavior etc. Descriptive research is a marked by the prior formulation of specific research question. The

investigator already knows a substantial amount about the research problem, perhaps as a result of an exploratory study before the project is initiate

Observational Method: With the observational method (sometimes referred to as field observation) animal and human behavior is closely observed. There are two main categories of the observational method — naturalistic observation and laboratory observation. The biggest advantage of the naturalistic method of research is that researchers view participants in their natural environments. This leads to greater ecological validity than laboratory observation, proponents say. Laboratory observations are usually less time-consuming and cheaper than naturalistic observations. Of course, both naturalistic and laboratory observation are important in regard to the advancement of scientific knowledge.

Case Study Method:

Case study research involves an in-depth study of an individual or group of individuals. Case studies often lead to testable hypotheses and allow us to study rare phenomena. Case studies should not be used to determine cause and effect, and they have limited use for making accurate predictions.

There are two serious problems with case studies — expectancy effects and a typical individuals. Expectancy effects include the experimenter's underlying biases that might affect the actions take: while conducting research. These biases can lead to misrepresenting participants' descriptions. Describing a typical individuals may lead to poor generalizations and detract from external validity.

Survey Method:

In survey method research, participants answer questions administered through interviews or questionnaires. After participants answer the questions, researchers describe the responses given. In order for the survey to be both reliable and valid it is important that the questions are constructed properly. Questions should be written so they are clear and easy to comprehend.

LIMITATIONS OF DESCRIPTIVE RESEARCH

Confidentiality: Confidentiality is a big limitation of descriptive Research subjects that researchers question may not always be truthful and instead will give Answers that they feel that researcher wants to hear. In interviews, participants may also refuse to answer any questions that they feel are too personal or difficult.

**Carries observer`s paradox:** Descriptive Research also carries with it an observer`s paradox, if participants know that someone is observing them, they may change the way that they act. Subjectivity and error also play a disadvantageous role in descriptive research.

Errors: Questions presented by a Researcher are predetermined and prescriptive, while studies can contain errors. A researcher may choose what information to use and ignore data that does not conform to their hypothesis.

Requires More Skills: Descriptive Research Requires more skills and the response rate of this research is very low.

Unreliable: In Descriptive Research, there are no variables manipulated, there is no way to statistically analyze the result. Many scientists regard this type of study as very unreliable and 'unscientific'. In addition, the results of observational studies are not repeatable, and so there can be no replication of the experiment and reviewing of the Results.

EXPERIMENTAL RESEARCH DESIGN

Experiment is a study in which the investigator manipulates or varies one or more variables and measures other variables. In other words It is a process of manipulating one variable in a controlled environment while holding all other variables constant in order to establish a casual relationship.

All experiment involve three basic component.
1. Variable manipulated in a experiment are referred to as the independent variable or test units.
2. The actual alteration is called the treatment.
3. The actual variable chosen to measure the subject response are known as dependent variables.

The result of the treatment is measured on dependent variable and these results of the treatment are given a variety of names ie outcome , observation change ,effect etc.

Basic Principles of Experimental Designs

The basic principles of experimental designs are randomization, replication and local control. These principles make a valid test of significance possible. Each of them is described briefly in the following subsections.

(1) Randomization. The first principle of an experimental design is randomization, which is a random process of assigning treatments to the experimental units. The random process implies that every possible allotment of treatments has the same probability. An experimental unit is the smallest division of the experimental material, and a treatment means an experimental condition whose effect is to be measured and compared. The purpose of randomization is to remove bias and other sources of extraneous variation which are not controllable. Another advantage of randomization (accompanied by replication) is that it forms the basis of any valid statistical test. Randomization is usually done by drawing numbered cards from a well-shuffled pack of cards, by drawing numbered balls from a well-shaken container or by using tables of random numbers.

(2) Replication. The second principle of an experimental design is replication, which is a repetition of the basic experiment. In other words, it is a complete run for all the treatments to be tested in the experiment. In all experiments, some kind of variation is introduced because of the fact that the experimental units such as individuals or plots of land in agricultural experiments cannot be physically identical. This type of variation can be removed by using a number of experimental units. We therefore perform the experiment more than once, i.e., we repeat the basic experiment. An individual repetition is called a replicate. The number, the shape and the size of replicates depend upon the nature of the experimental material. A replication is used to: Secure a more accurate estimate of the experimental error, a term which represents the differences that would be observed if the same treatments were applied several times to the same experimental units;

(ii) Decrease the experimental error and thereby increase precision, which is a measure of the variability of the experimental error; an

(iii) Obtain a more precise estimate of the mean effect of a treatment, since $\sigma 2y = \sigma 2n$, where nn denotes the number of replications.

(3) Local Control. It has been observed that all extraneous sources of variation are not removed by randomization and replication. This necessitates a refinement of the experimental technique. In other words, we need to choose a design in such a manner that all extraneous sources of variation are brought under control. For this purpose, we make use of local control, a term referring to the amount of balancing, blocking and grouping of the experimental units. Balancing means that the treatments should he assigned to the experimental units in such a way that the result is a balanced arrangement of the treatments. Blocking means that like experimental units should be collected together to form a relatively homogeneous group. A block is also a replicate. The main purpose of the principle of local control is to increase the efficiency of an experimental design by decreasing the experimental error. The point to remember here is that the term local control should not be confused with the word control.

Types of Experimental Research Designs

Experimental research designs can be classified into the following typology:
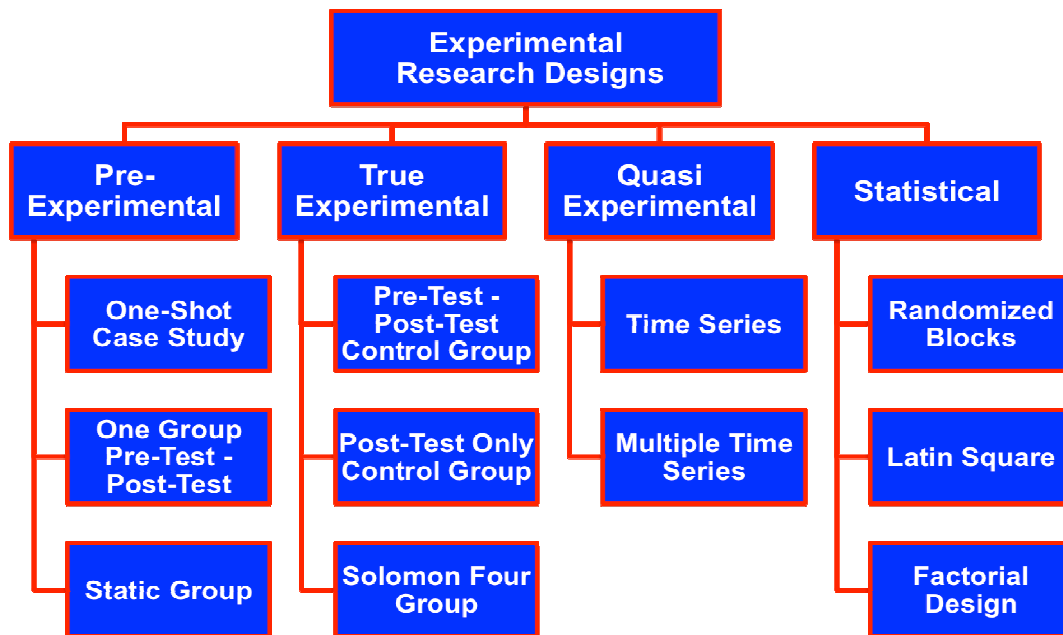
Pre-Experimental Designs: Pre-Experimental Designs are the simplest form of experimental research designs. Pre-experimental designs have little or no control over extraneous variables. And, these designs do not randomly assign subjects to different treatments. As a consequence, the results of a test using a pre-experimental design are difficult to interpret. These designs are often used in testing television commercials because they are simple and relatively inexpensive. There are three types of pre-experimental designs: One-Shot Case Studies, One Group Pre-Test - Post-Test, and Static Group tests

A. One-Shot Case Studies: With a one-shot case study, test units—people, test markets, etc.—are exposed to a treatment. The standard notion for a treatment is the symbol "X." A single measurement of the dependent variable is taken (O_1). There is no random assignment of test subjects as there is only one treatment, and there is no control. Here is the standard notation for a One-Shot Case Study:

This research design has two significant flaws: 1) there is no pre-test and 2) there is no control group. A control group would, in this case, be a group that did not receive the treatment. Without these restraints, this research design cannot establish internal or external validity.

Despite these limitations, market researchers often use this design for testing new-to-the-market products.

B. One Group Pre-Test - Post-Test: With this research design the test unit is measured twice, one before the test and once after the test. There is still no control group; which is to say, a group not receiving the treatment. Here is the standard notation for a one-group pre-test - post-test study:

Marketing researchers often use this design to test changes in the marketing plan for established products. Compared to One-Shot Case Studies, this design has the advantage of taking two measurements: one before and the other after exposure to the treatment. This allows the researcher to estimate the treatment effect by subtracting the pre-test measure from the post-test measure. But, given the lack of a control, the validity of the conclusions are questionable. Extraneous variables like history can affect the results because the observed changes in the dependent variable might be due to factors outside the research design. And, maturation can also be a problem as the observed changes to the dependent variable might be due to changes in the test subjects that are not related to the treatment.

C. Static Group Design: With the Static Group design there is a Control Group (CG) in addition to the Experimental Group (EG). The experimental group is exposed to the treatment while the control group is not. Test units, however, are not randomly assigned to the control or experimental groups. Here is the standard notation for a Static Group study:

$$\text{Static Group Design}$$
$$\text{EG:} \quad X \quad O_1$$
$$\text{CG:} \quad \quad O_2$$

Measurements for both groups are made after the treatment is administered to the experimental group. The treatment effect is measured as $O_1 - O_2$.

Weaknesses of this research design stem from the fact that test units are not randomly assigned to the experimental or control groups and there are no pre-test measurements taken.

True Experimental Designs

True Experimental Designs are where the market researchers assign test units to treatments at random. There are three basic types of True Experimental Designs: Post-Test Only Control Group Design, Pre-Test Post-Test Control Group Design, and Solomon Four Group Design.

A. Post-Test Only Control Group Design:

With this research design, test units are randomly assigned to the experimental and control groups. The experimental group is exposed to the treatment and then both the experimental and control groups are measured. But, there is only one measurement is taken.

Here is the standard notation for a Post-Test Only study:

<div align="center">

Post-Test Only
Control Group Design
EG: R   X O_1
CG: R O_2
R = Random Assignment

</div>

The effect of the treatment is calculated as $O_1 - O_2$.

The advantage of this research design is that the random assignment of the test units should produce roughly equal control and experimental groups before the treatment is administered. And, the mortality for the control and experimental groups should be similar.

B. Pre-Test - Post-Test Control Group Design:

With this research design, test units are randomly assigned to experimental and control groups. A pre-test measure is taken from both groups.

Here is the standard notation for a Pre-Test - Post-Test Control Group study:

<div align="center">

Pre-Test - Post-Test
Control Group Design
EG: R O_1 X O_2
CG: R O_3 O_4
R = Random Assignment

</div>

Selection bias is controlled by the randomized assignments of test units. Mortality can be a problem if it is not relatively equal between the experimental and control groups. History can also be an issue if these factors effect the experimental and control groups unequally.

The treatment effect or TE is measured by $(O_2 O_1) - (O_4 O_3)$.

C. Solomon Four Group Design:

The Solomon Four Group Design is a research design that assesses the impact of pretesting on subsequent measures.[i] It is used when the researcher suspects that earlier tests influence the results of later tests. With this research design, test units are randomly allocated to two experimental groups and two control groups. One of the experimental groups and one of the control groups is measured. Both experimental groups are then exposed to a treatment. Afterwards, both experimental and control groups are measured. A total of six measurements are taken. The design aims to account for pre-testing bias and pre-test manipulation interaction bias.

Here is the standard notation for a Solomon Four Group study:

**Solomon Four
Group Design**

$$EG_1 \quad R_1 \quad O_1 \quad X \quad O_3$$
$$CG_1 \quad R_2 \quad O_2 \qquad O_4$$
$$EG_2 \quad R_3 \qquad X \quad O_5$$
$$CG_2 \quad R_4 \qquad\qquad O_6$$

Quasi-Experimental Designs

Quasi-Experimental Designs are used when the researcher creates an artificial environment to control for extraneous variables. With quasi-experimental designs, the research lacks control over when the treatment is administered or assigns test units to the experimental and control groups in a non-random fashion. There are two basic types of quasi-experimental designs: Time Series and Multiple Time Series.

A. Time Series: There is no randomization of the test units to the treatments. The timing of the treatment presentation as well as which test unites are exposed to the treatment may not be within the researcher's control. Consumer Attitude & Usage panels are an example of quasi-experimental designs using Time Series. Here is the standard notation for a Time Series study:

Time Series Design

$$O_1 \quad O_2 \quad O_3 \quad O_4 \quad O_5 \quad X \quad O_1 \quad O_2 \quad O_3 \quad O_4 \quad O_{10}$$

The advantages of Time Series are that it is easier to interpret the results than a One Group Pre-Test - Post-Test design because of the many measures it takes. The multiple measures help determine underlying trends. But, the Time Series design has two weaknesses. First, researchers cannot control history. Second, given the repeated measures there is a testing effect on the subjects. Subjects may become more aware of their shopping habits, which could influence the results of the study.

B. Multiple Time Series: With the Multiple Time Series, the researchers add a control group to the research design. The addition of a control group enhances the researchers' ability to separate the treatment effect. Here is the standard notation for a Multiple Time Series study:

Multiple Time Series Design

$$EG \quad O_1 \quad O_2 \quad O_3 \quad O_4 \quad O_5 \quad X \quad O_1 \quad O_2 \quad O_3 \quad O_4 \quad O_{10}$$
$$CG \quad O_1 \quad O_2 \quad O_3 \quad O_4 \quad O_5 \quad X \quad O_1 \quad O_2 \quad O_3 \quad O_4 \quad O_{10}$$

4. Statistical design:

Randomized Block design

It is an improvement over the completely randomized design. In this local control can be applied along with other principles of experimental design. The subjects are divided groups known as blocks. , within each group the subjects are relatively homogeneous in respect to some selected variable. The number of subjects in a given block would be equal to the number of treatments and one subject in each block would be randomly assigned to each treatment. In general blocks are the level at which we hold the extraneous factor fixed. So that its contribution to the total variability of data can be measured. The main feature of the R.B. design is that in this each treatment appears the same number of times in each block.

Latin square design: Latin Square Designs are probably not used as much as they should be - they are very efficient designs. Latin square designs allow for two blocking factors. In other words, these designs are used to simultaneously control (or eliminate) two sources of nuisance variability. For instance, if you had a plot of land the fertility of this land might change in both directions, North -- South and East -- West due to soil or moisture gradients. So, both rows and columns can be used as blocking factors. However, you can use Latin squares in lots of other settings. As we shall see, Latin squares can be used as much as the RCBD in industrial experimentation as well as other experiments.

Whenever, you have more than one blocking factor a Latin square design will allow you to remove the variation for these two sources from the error variation. So, consider we had a plot of land, we might have blocked it in columns and rows, i.e. each row is a level of the row factor, and each column is a level of the column factor. We can remove the variation from our measured response in both directions if we consider both rows and columns as factors in our design.

Factorial design: In statistics, a full factorial experiment is an experiment whose design consists of two or more factors, each with discrete possible values or "levels", and whose experimental units take on all

possible combinations of these levels across all such factors. A full factorial design may also be called a fully crossed design. Such an experiment allows the investigator to study the effect of each factor on the response variable, as well as the effects of interactions between factors on the response variable.

Validity refers to the extent to which the conclusions drawn from the are true experiment
I- Internal validity:
Refers to the extent to which the research design accurately identifies casual relationship.
History: When extraneous factors that enter the experiment process between the first and later manipulation affect measure of the dependent variable.
b) Maturation: Changes in the dependent variable based on the natural function of time and not attributed to any specific event.
c) Testing When learned understanding gained from the first treatment and measure of the dependent variable distort future treatment and measurement activities
Instrumentation: Contamination from changes in measurement processes observation technique and measuring instruments
e) Selection Bias: Contamination created by inappropriate selection or assignment process of test subject to experimental treatment groups
f) Statistical Regression: Contamination created when experiment group are selected on the basis of their extreme response or scores
g) Mortality: Contamination due to changing the composition of the test subjects in the experiment.
h) External validity is the validity of generalized (causal) inferences in scientific research, usually based on experiments as experimental validity. In other words, it is the extent to which the results of a study can be generalized to other situations and to other people. Mathematical analysis of external validity concerns a determination

Factors affecting external validity

- **Reactive or interaction effect of testing**--a pretest might increase or decrease a subject's sensitivity or responsiveness to the experimental variable. Indeed, the effect of pretest to subsequent tests has been empirically substantiated

Interaction effects of selection biases and the experimental variable
Reactive effects of experimental arrangements--it is difficult to generalize to non-experimental settings if the effect was attributable to the experimental arrangement of the research.
Multiple treatment interference--as multiple treatments are given to the same subjects, it is difficult to control for the effects of prior treatments.

Significance of experimental research:
Cause and Effect: The primary advantage of the Experimental Research is that the research can determine the cause of something. None of the other research methods allows knowing something about the cause of behavior. If an experiment is done properly, using random assignment and participant blind to their condition, then it can be know that any difference in their behavior was because of the difference manipulated by the experimenter.
Reliable Results: The other benefit of experimental design is that the utilization of quantitative measurement levels, allocation procedures, controlled environment and random selection promote high reliability of the outcomes as well as better genera of the result. Further the results can also be replicated, with similar results being established because of the reliability of the experiment. A researcher can be assured that the outcomes obtained are essentially true representation of the actual events. An extra experiment results can be useful in other populations or settings.

Limitation of experimental research:
Provides helpful insight: Experimental Research offers beneficial insight that can be until for providing results to immediate concern. For example, through experimenting on various methods of teacher can use

results got from different teaching techniques and establish the most suitable option to use, thus benefiting the students.

Control over Variables: Despite inconsistencies in experimental research, the researcher has control over the variables, increasing the possibility of more precisely determining individual effects of each variable. Also determining interaction between variables is more possible.

Dependent and independent variable: The variable that depends on other factors that are measured. These variables are expected to change as a result of an experimental manipulation of the independent variable or variables. The variable that is stable and unaffected by the other variables you are trying to measure. It refers to the condition of an experiment that is systematically manipulated by the investigator. It is the presumed cause.

Qualitative and quantities variables: Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomenon that can be expressed in terms of quantity. Qualitative research is concerned with qualitative phenomenon. Qualitative research is especially important in the behavioral sciences where the aim is to discover the underlying motives, interest, personality and attitudes of human beings

Experimental and measured variables: The experimental variables spell out the details of the investigators manipulation while the measured variables refer to measurement. Measured variables will be called assigned variables. In other words, any variable that is manipulated is an active variable and a variable that cannot be manipulated is an assigned variables.

Categorical and numerical variables: The categorical variables (eg. Occupation, religion, caste, gender, education, income) are made up of sets of categorical which must follows two rules firstly the categorical must be distinct from one another ,i.e., they must be mutually exclusive and secondly the categories must be exhaustive i.e., they should over the potential range of variation in a variable. Numerical variables are broken down into units in which the number used carry mathematical meaning. The number may be either discrete (1,2,3,ect).

Measurement and scale

Measurement can be defined as a standardized process of assigning numbers or other symbols to certain characteristics of the objects of interest, according to some pre- specified rules.

The definition implies that measurement is a three part process

1) Selecting observable events

2) Using numbers or symbols to represent aspects of the events.

3) Applying a mapping rule to connect the observation to the symbol.

Data Type

Data classifications employ the real numbers system. The most accepted basis for scaling has three characteristics.

1) Numbers are ordered

2) Differences between numbers are ordered.

3) Number series origin

Combination of these characteristics of order , distance and origin provide the following widely used classification of measurement scales.

1) Nominal Data: Nominal scale is simply a system of assigning number symbols to events in order to label them. It provides convenient ways of keeping track of people object and events. The counting of members in each group is the only possible arithmetic operation when a nominal scale is employed. Chi-square test is the most common test of statistical significance that can be utilized and for the measure of correlation, the contingency co-efficient can be worked out .

2) Ordinal Scale: It places events in order, but there is no attempt to make the intervals of the scale equal in terms of some rule. A rank order represents ordinal scales and is frequently used in research relating to qualitative phenomenon. It has no absolute values and the real differences between adjacent ranks may not be equal. Can be said that one person is higher or lower on the scale than another but more precise comparisons cannot be made.

3) Internal Scale: It has the power of nominal and ordinal data plus one additional strength. It incorporates the concept of equality of interval. The intervals are adjusted in terms of some rule that has been established as a basis for making the units equal. Interval units are equal only in so far as one accepts the assumptions on which the rule is based .eg Centigrade and Fahrenheit temperature scales Mean, standard of deviation is appropriate measures. The generally used test for statistical significance are the "T" test "F" test & other parametric test are the statistical procedures of choice.

Ratio Scale: Ratio scale has an absolute or true zero of measurement. The term "absolute zero" is not as precise. We can conceive of an absolute zero length and also absolute zero of time. It represents the actual amount of variables. Geometric & harmonic mean can be used as measures of central tendency & coefficient of variation may also be calculated.

CHARACTERISTICS OF SOUND MEASUREMENT

1) Validity: It is the extent to which difference found with a measuring tool reflects true differences among respondents being tested. The difficulty in meeting this test is that usually one does not know what the true difference

a) Content Validity: Degree to which extent content of the item adequately represents the universe of all relevant items under study

i) **Concurrent Validity: Description** of the present criterion data is available at same time as predictor Scores**.**

ii) **Predictive Validity:** Prediction of the future criterion is measured after the passage of time.

c) Construct Validity: It tries to answer the question what accounts for the variance in the measure. Attempt to identify the underlying construct being measured and determine how well the test represents them.

2) Reliability: It is concerned with estimates of the degree to which a measurement is free of random or unstable error. A measure is reliable to the degree that it supplies consistent results.

a) Stability: A measure is said to be stable if you can secure consistent results with repeated measurement of the same person with the same instrument.

b) Equivalence: Degree to which alternative forms of the same measure produce same or similar results.

c) Internal consistency: Degree to which instrument items are homogenous and reflect the same underlying construct.

3) Practicality: It is concerned with how far it economical , convenience and interpretability

a) Economy: There should be a trade off between ideal research project and the budget.

b) Convenience test: Degree to which the measuring instrument is easy to administer.

c) Interpretability: Degree to which the person other researcher is able to interpret the results

SCALING

It is a procedure for the assignment of numbers to a property of objects in order to impart some of the characteristics of numbers to the properties in question.

Scaling Techniques:

I - Rating scale: It involves qualitative description of a limited number of aspects of a thing or of traits of a person. Here we judge an object in absolute terms against some specified criteria There is no rules with points of scales. In practice 3 to 7 points scales are generally used.

There are various types of rating scale;

a) Simple category scale : It has two responses eg YES, NO. This scale is particularly useful for demographic question or where dichotomous response is adequate.

b) Multiple Choice – Single When there are multiple options for the respondent and only one answer is sought this scale is preferred.

c) Multiple Choice – Multiple response scale: It allows the respondent to select one or more alternatives from multiple choices.

e) Likert Scale – It is a mostly used summated rating scale. It consists of statements that express either a favorable or unfavorable attitude toward the object of interest. The respondent is asked to agree or disagree

with each statement. Each response is given a numerical score to reflect its degree of attitude favorableness and the scores may be totaled to measure the respondent's attitude. This data provides interval data.

f) Semantic differential: It helps to measure the psychological attitude. It is used in marketing problems, political issues, and personalities. This method consists of bipolar rating scales, usually with seven points by which one or more respondents rate one or more concepts on each scale item. It produces interval data. The total set of response provides a comprehensive picture about the respondent rating and object which is measured.

g) Numerical Scale: It has equal intervals that separate their numeric scale points. The verbal statement serves as the labels for the extreme points. It is often five point scale . The scale provides absolute & relative measure of the subject.

h) Multiple rating scale: It is similar to numerical scale, but differs in two ways 1) It accepts a circled response from the rater 2) The layout allows visualization of the results. The advantage is that a mental map of the respondent evaluation is evident to both the rater and the researcher. This scale produces interval data.

i) Fixed sum scale : In this scale two categories are presented that must sum to 100. up to 10 categories can be used. The advantage is it's compatibility. It provides continuous data. The scale is used to record to attitudes , behaviour and behavioural intent.

j) Graphic rating scale: It was created to enable researcher to discern fine differences. It uses pictures , icons or other visuals to communicate with the respondents.

ii- Ranking Scales :In this the subject directly compares two or more objects and makes choices among them. The respondents were asked to select one as best or most preferred.

a) Paired –comparison :In this respondent can express attitudes clearly by choosing between two objects.

b) Forced Ranking Scale: :The list of objects are ranked relative to each other .This method is faster than paired comparisons and is usually easier and more motivating to the respondent.

c) Comparative Scales: Another version of the preceding scale would label the categories "excellent" ,"very good" , "Good", "fair" and "poor". Thereby eliminating the implicit comparison. The problem with comparative scale is that the reference point is unclear and different reference points or standards.

SCALE CONSTRUCTION TECHNIQUES

In research while measuring attitudes of the people we generally follow the technique of preparing the opinonnaire (attitude scale) in such a way that the score of the individual responses assigns him a place on a scale. In this respondent express his opinion on various statements. While developing such statement the researcher must note the following points;

1) That the statement must elicit responses which are psychologically related to the attitude being measured.

2) That the statements need be such that they discriminate not merely between extremes of attitude but also among individual who differ slightly.

1. Arbitrary Scale; It is developed on ad hoc basis and are designed largely through the researcher's own subjective selection of items. The researcher select few statement or item which he believes are appropriate to a given topic and it is include in measuring instrument.. Then people are asked to check in a list for their opinion.

Merits:

1. It is easy to develop quickly with less expense.

2. It can be designed highly specific and adequate

Demerits ;

1. It is not reliable

2. It rely on researcher's insight and competence.

2. Differential scale (Thus tone –type scale): It is associated with differential scale which have been developed using consensus scale approach. In this selection is made by panel of judges

The procedure is

1. The researcher gathers a large number of statements

2. The statements are submitted to panel of judges.

3. Each judge is request to arrange in position according to opinion.

4. Each judge is request to place the statement in first, second groups etc according to his favorableness.

5. In case of disagreement between the judges in assigning a position to an item that item is discarded.

6. A final selection of statements is then made .

7. The position of statements on the scale is determined by judges.

Merits

1. It appropriate when we measure single attitude.

2. It is very reliable method

Demerits

1. It is costly method

2. Judge own attitude may reflect in arrangement

3. Summated Scale (Likert Scale) : It developed by utilizing the item analysis approach wherein in a particular item is evaluated on the basis of how well it discriminates between those persons whose total score is high and those whose score is low. Those items or statements that best meet this sort of discrimination test are included in the final instrument.

Procedure:

1. Researcher collect a number of statements relevant to the attitude being studied.

2. A trial test should be made with small group of people

3. The response to various statements are scored in such a way that a response of most favorable attitude is given the highest score of 5, and the most unfavorable attitude is given the lowest score of 1.

4. Then the total score of each respondent is obtained by adding his scores for separate statements.

evaluates the conclusion of the previous studies in the light of the data he has collected. He questions these conclusions and tries to develop the alternative, possible better conclusions.

2. Differential scale (Thus tone –type scale): It is associated with differential scale which have been developed using consensus scale approach. In this selection is made by panel of judges

The procedure is

1. The researcher gathers a large number of statements

2. The statements are submitted to panel of judges.

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7. The position of statements on the scale is determined by judges.

Merits

1. It appropriate when we measure single attitude.

2. It is very reliable method

Demerits

1. It is costly method

2. Judge own attitude may reflect in arrangement

4. Cumulative scale or scalogram: It consists of a series of statements to which a respondent expresses his agreement or disagreement. The special feature of this scale is that statements in it form a cumulative series. The individual score is worked out by counting the number of points concerning number of statement he answered favorably. The major scale of this type of cumulative scales is the Gutt man's scalogram. The scalogram refers to the procedure for determining whether a set of items form a one-dimensional scale. A scale is said to be one-dimensional if response fall into a pattern in extreme and also less extreme points.

Procedure;

1. The layout in clear terms the issue we want to deal in our study.

2. Develop a number of items relating the issue and to eliminate by inspection the items that are irrelevant or those that happen to be extreme items.

3. Pre-test the items whether the issue at hand is scalable. The respondents are asked to record their opinion on all items ranging from 'strongly agree to strongly disagree. The score like 5 -1 was assigned. If there is 5 items in all , total, score can be from 75- 15.

4. Respondent opinionnaires are then arrayed according to total score for analysis and evaluation. If the responses of an item form a cumulative scale, its response category scores should decrease in an orderly fashion. After analyzing the preset results, a few items may be chosen.

5. Then total scores for the various opininnoires and to rearray them to reflect any shift in order resulting from reducing the items.

Merits;

1. It assures that only a single dimension of attitude is measured.

2. Researcher's subjective judgment is not allowed to creep in the development of scale since the scale is determined by the replies of respondent.

3. It can be appropriately be used for personal, telephone or mail surveys.

Demerits:

1. It is very tedious & complex in preparation.

2. Conceptually is more difficult in comparison to other scaling methods.

3. It very a reliable source for assessing attitudes of persons towards complex objects.

5. Factor Scales: It is developed on the basis of inter correlations of items which indicate the degree of interdependence. It includes a variety of technique that has been developed for two problems.

1) How to deal with the universe of content that is multidimensional.

2) How to uncover underlying dimension that have not been identified.

An important factor scale is semantic differential and multidimensional scaling.

a) Semantic differential scale: It is an attempt to measure the psychological meanings of an object to an individual.

b) Multidimensional scaling It is characterized as a set of procedures for portraying perceptual or affective dimension of substantive interest. It is used when all the variables are to be analyzed are happened to be independent. Through MDS techniques one can represent geometrically the locations and interrelationship among a set of points.

Merits:

1. It is used in psychological survey.

2. It is used to measure the perceptual structure of a set of stimuli and cognitive processes underlying the development of this structure.

3. It is an important measurement tool for attitude.

Demerits:

1. It is complicated in calculation.

It is laborious in collection of data & analysis.

GENERAL GUIDELINES FOR DEVELOPING A MULTIPLE ITEM SCALE

• **Determine clearly what it is that you want to measure:** The scale should be well grounded in theory. The construct to be measured and the scale itself should be specific. The construct should be clearly distinguishable from other construct.

• **Generate as many items as possible:** Items essentially are statements that are relevant of the construct. The greater the number of initial items generated. The better the final scale will be. The items that are developed should not be too long nor should they pose any reading difficulty to the respondent.

• **Ask expert to evaluate the initial pool of items:** Experts are people who have worked one are currently working on the phenomenon that is being studied. They can give inputs on the relevancy clarity and conciseness of the items. Based on the experts' evaluation the initial pool of items is modified.

. **Determine the type of attitudinal scale to be used** The various scales such as the likert scale, semantic differential scale, Thurston and associative scale has already been discussed should be selected. The type of attitudinal scale to be used has to be decided quite early, because the wording of the items varies with each scale format.

• **Include validation item in the scale:** Certain items are added to the scale in order to improve the scales validity and also to detect certain flaw in it.

• **Administer the item to an initial sample:** Once it has been determined which construct related items are to be included in the scale; the next step is to administer the scale to an initial sample. This is done to check the validity of the items.

• **Evaluate and refine the item of the scale:** The ultimate quality that is sought in an item is high connotation with the true score of the latent variable that is being measured. The properties that the items of a scale should possess are high interconnotation, high item scale connotation high item variance, a mean close to the center of ht range of possible scores, and a high coefficient alpha.

• **Optimize scale length:** The larger the scale, the greater the reliability but shorter scales are easier he respondent to answer. Hence balance has to be struck between briefly and reliability and the optimal scale length have to be determined.

*************End of Unit II***********

UNIT III

DATA COLLECTION

Data refers to information or facts. Often researcher understands by data only numerical figure. It also includes descriptive facts, non-numerical information (smell of a cookie), qualitative and quantitative information.

Data could be broadly classified as:

Primary Data:

It is known as the data collected for the first time through field survey. Such data are collected with specific set of objectives to assess the current status of any variable studied. Primary data are generally information gathered or generated by the researcher for the purpose of the project immediately at hand. When the data are collected for the first time, the responsibility for their processing also rests with the original investigator.

Secondary data

It refers to the information or facts already collected. Such data are collected with the objective of understanding the past status of any variable.

Secondary data can be obtained internally i.e. within the firm or external from one or more outside agencies.

Sources

I. **Internal Sources**

A. **Accounting Record**
- Sales Invoice
- Sales record
- Cost detail
- Level of profit
- Advertising expenditure
- Budget etc.

B. **Sales force Report**
- Marketing information
- Customers opinion
- Competitor information
- Area Wise Sales

C. **Internal Expert:** Experts working in the company like product manager, marketing research Managers, public relation personnel and advertising personnel etc.

.**Miscellaneous**
- Company history
- Company background
- Market share
- Pamplet
- Prospectus
- Annual General Body Meeting Report.
- Organization manual, chart.

- Organization report.

External Sources
i) Publication of (Government)

     a. Reserve Bank of India Bulleting
     b. Census Report
     c. Registrar general of India
     d. Central Statistical organization
     e. Director general of commercial intelligence
     f. Ministry of commerce & industry
     g. Economic Advisor Office
     h. Ministry of Agriculture
     i. Labor Bureau.

ii) Non-government Publication

     a. Private agencies
     b. Stock –exchange directories
     c. Chamber of commerce
     d. Federation of Indian Chamber of Commerce
     e. Associate Chamber of commerce & Industry Of India
     f. Indo- American Chamber of Commerce etc
     g. Promotion
     h. Market Research & Statistical Bureau

iii) Syndicated Services these are provided by certain organization which collect and tabulate marketing information on a continuing basis. Report based on the marketing information collected by such organization is sent periodically to clients who are subscribers. Apart from syndicated services a number of research agencies, offer and customized research services to their clients.

iv) Technical and trade journals

v) Books, magazines & newspapers

vi) Reports prepared by research scholars' universities economists etc in diff fields

vii) Public records and statistics, historical documents and other sources of published information

viii) Various publications of foreign government or of international bodies and their subsidiary organizations.

CHARACTERISTCS OF SECONDARY DATA
1. **Reliability of Data:**
The reliability can be treated by finding out such things about the said data

     a. Who collected the data?
     b. What were the sources of data?
     c. Were they collected by using proper methods?
     d. At what time were they collected?
     e. Was there any bias of the compiler?
     f. What level of accuracy was desired?

2. **Suitability of Data**
The data that are suitable for one enquiry may not necessarily be found suitable for one enquiry may not necessarily be found suitable in another enquiry. Hence if the available data are found to be unsuitable. The researcher should not use them.

3. **Adequacy of Data:**
If the level of accuracy achieved in data is found inadequate for the purpose of the present enquiry they will be considered as inadequate and should not used by the researcher. The data will also be considered adequate.

4. **Continuity of Data**
This is another problem in using secondary data. For e.g., the format used for providing some date may not be consistently followed by the source. Depending upon the page constraints or availability of material the

data presentation in a format is decided. So frequent change in the format would only add to confusion to the people using the data from such sources.

SPECIAL SOURCES
Computer Search & Internet Applications
Generally most databases allow the researcher to undertake precise searches using combination of key words in the website.

1. Scanning & Browsing
New publications such as journals are unlikely to be indexed immediately in tertiary literature so you will need to browse through these publications to gain an idea of their content. In contrast scanning involves going through individual items such as journal articles to pick out points that are related to your own research.

2. Searching the Internet
The Internet is a worldwide network of computers that provides access to a vast range of literature and other resources stored on computer around the world. Searching these will uncover further material with which you can compare and contrast your ideas. The places where these resources are stored are known as websites.

3. Home Page
Access to a website is through its home page. The home page, which has links to other pages in the site, is similar to a title or contents page. Although they often contain publicity for a company or institution they are an excellent way of navigating the site.

4. Search Tools:
It often referred to as search engines, are probably the most important way of searching the internet for reviewing the literature on your research subject as they enable you to locate the most current and up to date items.

5. Book marking
Once you have found a useful internet site, you will need to note its address. This process termed bookmarking uses the internet browser to note the address so that you will be able to access it again directly.

Sources of Primary Data
Advantages:-
1. It provides a firsthand account of the situation. We can observe the phenomenon as it takes place.
2. The information is more reliable as the investigator collects the data himself, he can take all precautions to ensure their reliability
3. These are the logical starting point for research in several disciplines.
4. Primary data are the only way of finding out opinions, personal qualities, attitudes etc.

Disadvantages:-
1. Collecting primary data is expensive in terms of both time & money.
2. There is greater scope for researcher bias creeping in unless the research investigator is fair to the respondent and methods of data collection the result of the study will not be reliable.
3. Sample selection is yet another problem.

METHODS OF COLLECTING PRIMARY DATA
1. Questionnaire:-
In this method to pre-printed list of questions arranged in sequence is used to elicit response from the informant.

2. Interview:
This is a method in which the investigator and the respondent meet and questions raised are answered and recorded. This method is adopted when personal opinion or view point are to be gathered as a part of data.

3. Observation:
A method which requires familiarity and experience, in this method the observer applies his sense organs to note down whatever that he could observe in the field and relate these data to explain some phenomena.

4. **Feedback:** In the case of some of the consumer goods, the supplier or the manufacturer send the product along with a pre-paid reply cover in which questions on the product and its usage are raised and the customer is required to fill it up and send.

5. **Sales force opinion:** The sales representatives visit the distributor or the retailers shop to note down the detail of stock movement, availability of items etc which give valuable information.

6. **Schedule:** This method of data collection is very much like the questionnaire with little difference which lies in the fact that schedules are being filled in by the enumerators who are specially appointed for the purpose.

7. **Warranty Card:** Warranty Card is usually postal sized card which are used by dealers of consumer durables to collect information regarding their products. The information sought is printed in the form of question on the warranty cards which is placed inside the package along with the product with a request to the consumer to fill in the card and post it back to the dealer.

8. **Distributor or store Audit:** Distributors get the retail stores audited through salesman and use such information to estimate market size, market share, seasonal purchasing pattern & so on.

9. **Pantry Audit:** Pantry audit technique is used to estimate consumption of the baker of goods at the consumer level. The investigators stay at the consuming point and observe the purchasing behavior or the people like price response, quality consciousness, response to price & incentive schemes, who take buying decision, credit facility required.

10. **Consumer Panel:** It refers to an arrangement with select consumers to maintain details of their consumption behavior in their diaries based on these recorded information, useful first hand information is collected about the product & behavior of the consuming public.

11. **Collection through mechanical devices:** The use of mechanical devices has been widely made to collect information by way of indirect means. Eye camera, pupil metric camera, psychgalvanameter, motion picture camera and audiometer etc are principal devices, commonly used for the purpose for collecting the required information.

12. **Projective technique:** This technique is adopted to study the consumers through various methods like recalling advertisement theme, story completion tests, quizzes, thematic appreciation tests etc. Through this technique it is possible to compile information to be used as the basis for projecting the demand for the product at different points of time.

i. **Word association test:** In this the respondent asked to mention the first word that comes to mind, without thinking as the interviewer reads out each word from a list.

j. **Sentence Completion test:** In this informant may asked to complete a sentence analysis of replies from the same informant reveals his attitude toward that subject and the combination of these attitudes of all the sample members is then taken to reflect the views of the population.

k. **Story Completion Test:** It is a step further, where in the researcher may contrive stories instead of sentences and ask the informant to complete them.

l. **Verbal Projection Test:** These are the test where in the respondent is asked to comment on or explain what other people do.

m. **Pictorial Technique * Thematic Apperception Test:** It consists of a set of pictures that are shown to respondents who are asked to describe what they think the pictures represent.

• **Rosenzweig Test:** This test uses a cartoon format wherein we have a series of cartoons with words inserted in balloons above. The respondent is asked to put his own words in an empty balloon space provided for the purpose in the picture.

• **Rorschach Test** It consists of ten cards having prints of ink blots. The respondents are asked to describe what they perceive in such inkblot, and responses are interpreted on the basis of pre-determined psychological framework.

• **Holtzman Inkblot Test** It consists of 48 inkblot cards, which are based on color movement, shading and other facts involved in inkblot perception.

• **Tomkins- Horn Picture Arrangement Test** It consist of twenty five plates each containing three sketches that may be arranged in different ways to portray a sequence of events. The respondent is asked to arrange them in a sequence.

• **Play Technique** In this the respondents are asked to act out a situation in which they have been assigned various roles. The researcher may observe such traits as hostility, dominance, sympathy prejudice or the absence of traits.

• **Quizzes, tests & examination** This is also a technique of extracting information regarding specific ability of candidates indirectly. Through this, the memorizing and analytical ability of candidates.

• **Sociometry** It is a technique for describing the social relationship among individual in a group. It attempts to describe attraction or repulsions between individual by asking them to indicate whom they would choose or reject in various situations.

13. **In-depth Interview**

These are those interviews that are designed to discover underlying motives and desires and are often used in motivational research. Such interviews are held to explore needs, desires and feelings of respondents.

14. **Content Analysis**

It consists of analyzing the contents of documentary materials such as books, magazines, newspapers and the content of other verbal materials which can be either spoken or printed.

Primary data versus secondary data

OBSERVATION METHOD

BASIS FOR COMPARISON	PRIMARY DATA	SECONDARY DATA
Data	Real time data	Past data
Meaning	Primary data refers to the first hand data gathered by the researcher himself.	Secondary data means data collected by someone else earlier.
Process	Very involved	Quick and easy
Source	Surveys, observations, experiments, questionnaire, personal interview, etc.	Government publications, websites, books, journal articles, internal records etc.
Cost effectiveness	Expensive	Economical
Collection time	Long	Short
Specific	Always specific to the researcher's needs.	May or may not be specific to the researcher's need.
Available in	Crude form	Refined form
Accuracy and Reliability	More	Relatively less

It may be defined as "sensible application of sense organs in understanding less explained or unexplained phenomena". Using the sense organs, one could see and understands things. Whenever a researcher is unable to compile information through any other method, then he has to effectively apply his sense organs to observe and explain So it may be said that observation involves recording of information applying visual understanding backed by alert sense organs.

TYPES

1. **Structured Observation** When observation takes place strictly in accordance with a plan or a design prepared in advance, it is called structured observation. In such a type the observer decided what to observe what to focus on, who are all to be observed etc.

2. **Unstructured Observation** In this type of observation there is no advance designing of what, how, when, who etc of observation. The observer is given the freedom to decide on the spot, to observe everything that is relevant.

3. **Participant Observation** In this, the observer is very much present in the midst of what is observed. He is physically present on the spot to observe and not influencing the activities. It will help him to continuously observe and not everything that is happening around him.

4. **Non Participant Observation** In this observer remains detached from whatever is happening around and does involve himself in any activities taking place. He is present only to observe and not to take part in the activities.

5. **Controlled Observation** In this case, the observer performs his work in the environment or situation, which is very much planned or designed or set.

6. **Uncontrolled Observation** The observer is at freedom to observer whatever is taking place around him in the natural set up.

MERITS:-
  1. The scope for bias is very much minimized.
  2. The current scenarios in which anything is happening, notices & explained.
  3. As there is no need to get any reply or details from the respondent observation does not required any co-operation of the respondents.
  4. This is a fairly reliable method.
  5. Whenever respondent are illiterate or incapable of answering any question it is only method of data collection available.

LIMITATION:
  1. This is a relatively costly method of data collection, because the observer has to be present on the spot to observer whatever is happening.
  2. Training an observer is the additional cost to be incurred.]
  3. The scope for the biases of the observe interfering in what is observed and understood is high.
  4. It could be noticed that what is observed may bring out only part of the facts.
  5. It may not be possible to observe what is targeted.

INTERVIEW

Interview method involves direct or indirect meeting of the respondent by the researcher. The researcher determines the questions to be raised at the time of interview and then elicit the response for them. The reply given is either written down in a notebook or recorded in audio or videocassette.

TYPES OF INTERVIEW

1. Direct Interview:

In this type of interview, the interviewer and the interviewee meet personally either with prior appointment or not. This method requires a interviewer to ask questions in a face to face contact to the other person or persons.

a. **Structured Interview:**

In this type of interview the person collecting information decided in advance the nature, scope, questions to be asked the persons to be contacted etc in advance. At the time of interview no deviation is made from the questions to be asked.

b. **Unstructured Interview:**

In this type of interview, interview is conducted on the spot without any preparation or advance information to the respondent. It does not follow a system of pre-determined questions standardized techniques of recording information. The interviewer has much freedom to ask in case of need supplementary questions or at time he may omit certain question of the situation so required.

c. **Focused Interview**

In this type of interview the object of the interviewer is to focus the attention of the respondent on a specific issue or point. The interviewer has the freedom to plan the interview and conduct it they way wants it. The interviewer on the spot decides all the question sequence, wording of questions etc.

d. **Clinical Interview** The clinical interview is concerned with broad underlying feeling a motivations or with the course of individuals life experience.

2. Non-Directive In this interviewer's function is simply to encourage the respondent to talk about the given topic with a bare minimum of direct questioning.

f. **Telephonic Interview:**

This method of collecting information consists in contacting respondent on telephone itself. It is not a very widely used method but play, important part in industrial survey. There is no scope for physical presence of both the partial to the interview.

Merits:

1. Interview enables personal contact with which factual information could be obtained.
2. the interviewer can guide the respondent to understand the question and suitably rephrase or modify the question.
3. The non response in this category of data collection is low
4. Spontaneous reply of the respondent can be obtained which would truly reflect their opinion.
5. Interviewer has the flexibility to handle the interview to collect relevant information.

Demerits:

1. This method presupposes the existence of rapport between the respondent and the interviewer.
2. It is costly method of data collection, as the interviewer should be trained, oriented and supported.
3. The time taken for covering a large sample of respondents is more than what it is under questionnaire method.
4. It is possible for a respondent to conceal his real opinion or views and so genuine data may not be available.
5. The interviewer may also be biased and thereby his bias may influence the interview outcome.
6. Interview method requires an elaborate organizational arrangement.

HOW TO MAKE INTERVIEW SUCCESSFUL?

1. The interviewer should be carefully selected.
2. The interviewer should be trained properly.
3. Different methods of obtaining the response from the informants have to be explored and the interviewer should be trained in all these aspects.
4. Unless the interviewer is experienced he would not be able to conduct the interview properly. But without conducting interview he cannot be experience co care, should be taken while selecting this method of data collection.
5. Honesty and integrity of the interviewer determine the outcomes of the interview so the qualities of the interviewer should be objectively studied.

QUESTIONNAIRE

A questionnaire is the sheets of paper containing questions relating to certain specific aspect regarding which the researcher collects the data. The questionnaire is given to the informant or respondent to be fitted up. This method of data collection is quite popular, particularly in case of big enquiries.

Merits:

1. It involves lesser cost as questionnaire could be send by post to a wide area.
2. It does not interfere with the respondent while answering the question.
3. The bias of the investigator is completely eliminated.
4. Respondents are given sufficient time to fill up the questionnaire.
5. If respondents cannot be reached personally, questionnaire is the alternative method available.

Demerits:

1. It is always found that the response rate in questionnaire is very poor compared to using schedules.
2. Bias of the respondent cannot be determined easily.

3. Only if the respondent is educated questionnaire could be used for collecting information.

4. Follow up of non-response or unfilled questionnaire only adds to the cost and time.

5. There is no scope for giving any clarification to the respondent in case of need.

TYPES OF QUESTIONNAIRES

1. **Structured Questionnaire** It pose definite, concrete and preordained questions. Additional questions may be thought of and asked only when some clarification is needed or additional information is sought from the respondent. Answers to these questions are normally very precise without any vagueness & ambiguity.

2. **Closed Form Questionnaire** Questions are set in such a manner that leaves only a few alternatives answers.

3. **Open Ended Questionnaire** Here the respondent has the choice of using his own style. Diction, expression of language, length and perception. The respondent are

4. **Unstructured Questionnaire** These contain a set of questions that are not structured in advance. It gives sufficient scope for a variety of answers. It is used mainly for conduction interview. Its merit is flexibility. It aims to secure the maximum possible information from the respondent.

5. **Pictorial Questionnaire** In a pictorial questionnaire alternative answer in the form of pictures are given and the respondent is required to tick the picture concerned to indicate his selection. This type of questionnaire is useful for illiterate and less knowledgeable respondent.

CONSTRUCTION OF QUESTIONNAIRE AND INSTRUMENT

The questionnaire is considered as the heart of a survey operation. Hence it should be very carefully constructed. If it is not properly set up then the survey is bound to fail. This fact requires us to study the main aspect of a questionnaire.

1. **General Form** The questionnaire can either be structured or unstructured questionnaire. The form of the question may be either closed or open, but should be stated in advance and not constructed during questioning. The question is presented with exactly the same wording and in the same order to all respondents.

2. **Question Sequence** The question-sequence must be clear and smoothly moving meaning thereby that the relation of one question to another should be readily apparent to the respondent with question that are easiest to answer being put in the beginning. The opening questions should be such to arouse human interest after that questions that are really vital to the research problem and a connecting thread should run through successive questions.

3. **Question formulation and Wording**: Questions should be constructed with a view to their forming a logical plan. The questions can be of any forms like:-

i. **Multiple Choices**

It refers to one which provides several set alternatives for its answer.

ii. **Dichotomous** It refers to one which offers the respondent a choice between only two alternatives, and reduces the issue to its simplest terms.

iii. **Close End Question**: It refers to those questions in which the respondent is given a limited number of alternative responses from which he is to select the one that most closely matches his/ her opinion or attitude.

iv. **Open Ended Question:** It refers to a question that has no fixed alternatives to which the answer must conform.

v. **Direct Question:** They explicitly ask for the desired data.

vi. **Indirect Data:**

It refers to those whose responses are used to indicate or suggests data about the respondent other than the actual facts given in the answer.

vii. **Checklists:**

It is simply a statement on a problem followed by a series of answers from which the respondent can choose. A single questionnaire may contain all type of questions. Researcher must pay proper attention to the wordings of questions since reliable and meaningful returns depend on it to a large extent. Simple words which are familiar to all respondent should be employed. Words with ambiguous meanings must be avoided.

ESSENTIALS OF A GOOD QUESTIONNAIRE:

     1. It should be comparatively short and simple.

     2. Questions should proceed in logical sequence moving from easy to more difficult questions.

     3. Personal and intimate questions should be left to the end.

     4. Technical terms and vague expressions capable of different interpretations should be avoided in a questionnaire.

     5. Questions affecting the sentiments should be avoided.

Experiment: Experiments involve manipulating the independent variable to determine how it affects the dependent variable. Experiment require one or more experimental groups that are exposed to the treatment(s) And a control group that is not exposed. After the researcher randomly assigns participants to either experimental group or a control group, it measures the dependent variable. After the experimental groups are exposed to the treatment, the researcher measures the dependent variable again. If partipacants have been randomly assigned to the different groups, the researcher may conclude that any difference in the dependent variable among the groups is due to the effect of the independent variable. The major strength of the experiment methods is that provide evidence for casual relationship, i.e., how one variable affects another. Primary weaknesses that experiments are often conducted on small samples, usually in artificial laboratory setting: thus the finding may not be generalized to other people in natural settings.

Step in conducting experiments: In a well- executed experiment, researcher must complete a series of activities to carry out their craft successfully. There are seven activities the researcher must accomplish to make the effort of the research.

Selecting relevant variable: researcher's task is to translate an amorphous problem into the question or hypothesis that best states the objectives of the research. Depending on the complexity of the problem, investigative questions and additional hypotheses can be create to address specific facets of the study or data that need to be gathered . A hypothesis is a relational statement because it describes a declaration between two or more variables, it must also be operationalised.

Specifying treatment levels: In an experiment, participants experience a manipulation of the independent variable, called the experiment treatment. The treatment levels of the independent variable are the arbitrary or natural groups the researcher makes within the independent variable of an experiment.

Controlling the experiment environment: extraneous variables can appear as differences in age, gender, race, dress, communications competence, and many other characteristics of the presenter, the massage, or the situation. These have the potential for distorting the effect of the treatment on the dependent variable and must be controlled or eliminated. However, at this stage, we are principally concerned with environment control. Holding constant the physical environment of the experiment.

Choosing the experimental design:

Experimental designs are unique to the experimental method. they serve as potential and statistical plans to designate relationship between experiment design and experimenter's observations or measurement points in the temporal scheme of the study. In the conduct of the experiment, the researcher's apply their knowledge to select one design that is best suited to the goal of the research.

Selecting the assigning participants:

The participants selected for the experiment should be representative of the population to which wishes to generalize the study's results. This may seem self- evident, but we have witnessed several decades of experimentation with college sophomores that contradict that assumption.

Pilot testing, revising, and testing: pilot testing is intended to reveal errors in the design and improper control of extraneous or environmental conditions, per testing the instruments permits refinement before the final test. This is the researcher's best opportunity to revise scripts, look for control problems with laboratory conditions and scan the environment for factors that might confound the results.

Analyzing the data:

If adequate planning and pre-testing have occurred, the experimental data will take in order and structure uncommon to surveys and unstructured observational studies. It is not that data from experiments are easy analyzed; they are simply more conveniently arranged because of the levels of the treatment condition, pretests and posttest, and the group structure. The choice of statistical techniques is commensurately simplified.

SELECTION OF APPROPRIATE METHOD OF DATA COLLECTION: -

There are various methods of data collection; as such the researcher must judiciary selects the method of his own study.

1. **Nature, Scope and Object of enquiry**: This constituted the most important factors affecting the choice of a particular method. The method selected should be such that it suits the type of enquiry that is to be conducted by the researcher.

2. **Availability of Funds**: Availability of funds for the research project determines to a large extent the method to be used for the collection of data. When funds at the disposal of the researcher are very limited, he will have to select a comparatively cheaper method, which may not be as efficient and efficient as some other costly method.

3. **Time Factor**: Availability of time has also to be taken into account in deciding a particular method of data collection. Some method, take relatively more time whereas with others the data can be collected in a comparatively shorter duration.

4. **Precision Required**: The very important condition is the level of accuracy of the data collected. In cases of compilation of data regarding the deviation from the standard measurements in a workshop, the data should be sent % accurate. Similarly the data regarding the patient condition explained through various parameters should be very accurate.

5. **Period of Study**: A study based on historical data requires secondary data source while the study on the patient status in a hospital require primary data.

Validation of questionnaire: To achieve high quality survey results, a critical component is validating the instruments (questionnaire) reliability and validity. The validity of the questionnaire is assessed by three components:

Content validity: If often refers to face validity was also determined by comparing the questionnaire with other similar questionnaire surveys. Face validity was also determined through pre-testing such as the initial pilot survey.

Sampling validity: it is another component of validation. A large sample size (i.e., 1380 companies) can ensure low sampling errors and high sampling validity.

Empirical validity: it examines the survey results by comparison with other studies. The aim to check consistency with pervious results. Empirical validation of the questionnaire reliability of ten involves two techniques:

1. **Reset techniques**: it determines stability of measured indictors (items).

2. **Construct validity:** it is a score to determine internal consistency – reliability, measured by the cooronbach alpha.

Survey methods: Survey means a planned effort to collect the desired information from a representative sample of the relevant population generally known as respondents. It can also be defined as systematic gathering of data from respondent through questionnaires. Here the observation is directly gathered from the respondents. The administration of questionnaires to an individual or group of individuals is called interview.

Survey Vs observation methods:

Basis of comparison	Survey method	Observation method
Objective	This method of collecting data is 00useful when population size is very large	Observation method is decidedly superior to survey research, experimentation, or document study for collecting data in behavior research.
Response	It can clearly cause bias in the data collected that researchers are attempting to study	Response in observation is neither as restrictive nor as artificial as either the survey or the experiment.

Difficulties of quantification	Survey researchers tend to be more quantitative types who are seeking more rational sort of data	Observation methods tend to be non-quantitative types who are seeking more emotional and Humanistic relationship with subject.
Sample size	It is very useful when sample size is very large	Observational studies tend to use a smaller sample then survey studies

SAMPLING PLAN:

A sampling plan is a detailed outline of which measurements will be taken at what times, on which material, in what manner, and by whom. Sampling plans should be designed in such a way that the resulting data will contain a representative sample of the parameters of interest and allow for all questions, as stated in the goals, to be answered. The steps involved in developing a sampling plan are.

TYPES OF SAMPLING PLAN

It is the procedure required right from defining a population to the actual selection of sample elements. There are seven steps involved in this process.

Define the population

It is the aggregate of all the elements defined prior to selection of the sample. It is necessary to define population in terms of

1) Elements
2) Sampling units
3) Extent
4) Time.

Examples, If we were to monitor the sales of a product recently introduced by us, the population might be
Element Our product
Sampling units Retail outlets, super markets, then our product
 Extent Delhi and New Delhi
 Time January 7-14, 2021
It may be emphasized that all these four specifications must be contained in the designated population Omission of any of them would render the definition of population incomplete

Identify the sampling frame: Identifying the sampling frame, which could be a telephone directory, a list of blocks and localities of a city, a map or any other list consisting of all the sampling units? It may be pointed out that if the frame is incomplete or otherwise defective, sampling will not be able to overcome these shortcomings The question is—How to ensure that the frame is perfect and free from any defect Leslie Kish has observed that a perfect frame is one where "every element appears on the list separately, once only once, and nothing else appears on the list" This type of perfect frame would indicate one-to-one correspondence between frame units and sampling units But such perfect frames are rather rare Accordingly, one has to use frames with one deficiency or another, but one should ensure that the frame is not too deficient so as to be given up altogether

Specify the sampling unit

The sampling unit is the basic unit containing the elements of the target population. The sampling unit may be different from the element. For example, if one wanted a sample of housewives, it might be possible to have access to such a sample directly. However, it is easier to select households as the sampling unit and then interview housewives in each of the households. As mentioned in the preceding step, the sampling frame should be complete and accurate otherwise the selection of the sampling unit might be defective. It is necessary to get a further specification of the sampling unit both in personal interviews and in telephone interviews. Thus, in personal interviews, a pertinent question is—of the several persons in a household, who should be interviewed? If interviews were held during office timings when the heads of families and other employed persons are away, interviewing would under-represent employed persons and over-represent elderly persons, housewives and the unemployed. In view of these considerations, it is necessary to have a random process of selection of the adult residents of each household. One method that could be used for this purpose is to list all the eligible persons living at a particular address and then select one of them.

Specify the sampling method: It indicates how the sample units are selected. One of the most important decisions in this regard is to determine which of the two—probability and non-probability sample—is to be chosen. In case of a probability sample, the probability or chance of every unit in the population being in the sample is known. Further, the selection of specific units in the sample depends entirely on chance. No substitution of one unit for another is permissible. This means that no human judgment is involved in the selection of a sample. In contrast, in a non-probability sample, the probability of inclusion of any unit in the population in the sample is not known. In addition, the selection of units within a sample involves human judgment rather than pure chance. In case of a probability sample, it is possible to measure the sampling error and thereby determine the degree of precision in the estimates with the help of the theory of probability. This theory also enables us to consider, from amongst the various possible sample designs, the one that will give the maximum information per rupee. This is not possible when a non-probability sample is used. Probability sampling enables us to choose representative sample designs. It also enables us to estimate the extent to which the results based on such a sample are likely to be different from what we would have obtained had we covered the population in our study. Conversely, the use of probability sampling enables us to determine the sample size for a given degree of precision, indicating that our sample results do not differ by more than a specified amount from those yielded by a study covering entire population. Although non-probability sampling does not yield these benefits, on account of its convenience and economy, it is often preferred to probability sampling. If the researcher is convinced that the risks involved in the use of a non-probability sample are more than offset by its being relatively cheap and convenient, his choice should be in favor of non-probability sampling.

Determine the sample size
In other words, one has to decide how many elements of the target population are to be chosen.
Select the sample
This is the final step in the sampling process. A good deal of office and fieldwork is involved in the actual selection of the sampling elements. Most of the problems in this stage are faced by the interviewer while contacting the sample-respondents
Sampling size: The sample size of a statistical sample is the number of observation that constitutes it. It is typically denoted n, a positive integer (natural number)
Determine of sample size
1)   **Size of universe:** the larger the size of the universe, the bigger should be the sample size.
2)   **Resources available**: if the resources available are vast a larger sample size could be taken. However, in most cases resources constitute a big constraint on sample size.
3)   **Homogeneity or heterogeneity**: if the universe consists of homogenous units a small way serve the purpose but if the universe consists or heterogeneous units a large sample may be inevitable.
4)   **Nature of study:** For intensive and continuous study a small sample may be suitable. But for studies which are not likely to be repeated and are quite extensive in nature, it may be necessary to take a larger sample size.
5)   **Nature of respondents:** where it is expected a larger number of respondents will not cooperate and send back the questionnaire, a large sample should be selected.
6)   **Degree of accuracy or precision:** the greater the degree of accuracy desired, the larger should be the sample size. However, it does not necessarily mean that bigger samples always ensure greater accuracy. If a sample is selected by experts by following scientific method, it may ensure better result even when it is small compared to a situation in which a large sample size is selected by inexperienced people.
7)   **Method of sampling adopted**: the size of sample is also influenced by the type of sampling plan adopted. For example, if the sample is the simple random sample it may necessitate bigger sample size. However, in a properly drawn stratified sampling plan, even a small sample may give better results.
8)   **The level of precision:** the level of precision, sometime called sampling error, is the range in which the true value of the population estimated to be. This range is often expressed in percentage points (e.g., $\pm$ 5 percent). Thus, if a researcher finds that 60 % of farmers in the sample have adopted a recommended

practice with a precision rate of.,±5% , then he or she can conclude that between 55% and 65% of farmers in the population have adopted the practice.

9)   The confidence level: the confidence or risk level based on ideas encompassed under the central limit theorem. The key idea is encompassed in the central limit theorem is that when a population is repeatedly sampled; the average value of the attributes obtained by that sample is equal to the true population value. Furthermore, the value obtained by these samples is distributed normally about the true value, with some samples having a higher value and some obtaining a lower score than the true population value. in normal distribution, approximately 95% of the sample values are within two standard deviations of the true population value (e.g., mean)

10)   Degree of variability; the third creation, the degree of variability in the attributes being measured, refers to the distribution of attributes in the population. The more heterogeneous a population, the larger the sample size required to obtain a given level of precision. The less variable (more homogenous) a population, the smaller the sample size. A proportion of 50% indicates a greater level of variability than either 20% or 80 %.

Sampling technique: There are different types of sample designs based on two factors viz., the representation basis and element selection technique. On the representation basis, the sample may be probability sampling or it may be non- probability sampling.

PROBABILITY SAMPLING TECHNIQUE

       Probability samples are characterized by the fact that, the sampling units are selected by chance. In such case, each member of the population has a known, non-zero probability of being selected. However, it may not be true that all samples would have the same probability of selection, but it is possible to say the probability of selecting any particular sample of a given size. It is possible that one can calculate the probability that any given population element would be included in the sample. This requires a precise definition of the target population as well as the sampling frame. Probability sampling techniques are broadly classified as simple random sampling, systematic sampling, and stratified sampling.

Simple Random Sampling:

       This is the most important and widely used probability sampling technique. They gain much significance because of their characteristic of being used to frame the concepts and arguments in statistics. This means that every element is selected independently of every other element. This method resembles lottery method where a in a system names are placed in a box, the box is shuffled, and the names of the winners are then drawn out in an unbiased manner. Random numbers are generated either using random number table or a computer to determine which elements to include in the sample. For example, a researcher is interested in investigating the behavioral pattern of customers while making a decision on purchasing a computer. Accordingly, the researcher is interested in taking 5 samples from a sampling frame containing 100 elements. The required sample may be chosen using simple random sampling technique by arranging the 100 elements in an order and starting with row 1 and column 1 of random table, and going down the column until 5 numbers between 1 and 100 are selected. Numbers outside this range are ignored.

The researcher may begin reading from anywhere in the random number table, however, once started the researcher should continue to read across the row or down a column. The most important feature of simple random sampling is that it facilitates representation of the population by the sample ensuring that the statistical conclusions are valid

Stratified Sampling: Stratified sampling is a two-way process. It is distinguished from the simple random sampling and systematic sampling, in that:

a) It requires division of the parent population into mutually exclusively and exhaustive subsets;

b) A simple random sample of elements is chosen independently from each group or subset.

Therefore, it characterizes that, every population element should be assigned to one and only

Stratum and no population elements should be omitted. Next, elements are selected from each stratum by simple random sampling technique. Stratified sampling differs from quota sampling in that the sample elements are selected probabilistically rather than based on convenience or on judgmental basis.

Strata are created by a divider called the stratification variable. This variable divides the population into strata based on homogeneity, heterogeneity, relatedness or cost. Sometimes, more than one variable is used for stratification purpose.

The reasons for using stratified sampling are as follows:

a) It ensures representation of all important sub-populations in the sample;

b) The cost per observation in the survey may be reduce

c) It combines the use of simple random sampling with potential gains in precision

d) Estimates of the population parameters may be wanted for each sub-population and;

e) Increased accuracy at given cost.

Systematic sampling

Sometimes we might need the sample of trees from a forest or house in a city. In such case, a sampling plan is known as systematic random sampling is applied. According to this method, a list of the population is prepared on the some basis. For this we arrange the item in numerical, alphabetical or geographical or any other order. Now the items are serially numbered. The first item is selected at random. For example, if we want select a sample of 10 trees from 100 trees of a forest by taking every k^{th} tree where k refers to the sampling interval.

Cluster sampling

It is also known as stage sampling. In the cluster sampling method, the population is divided in to some recognizable subgroups which are called clusters. Now the random sample of these clusters is drawn and all the units belonging to the selected cluster constitute the sample. However it refers to the procedure which is carried out in several stages. Cluster sampling is widely used for geographical studies of many kinds. When the units are spread over a large geographical area, selecting a sampling unit becomes expensive. The area may be dived into convenient subgroups called clusters; select a sample of clusters and collect the data on all units in each of the selected clusters. For example, to estimate the cattle population in a district of Haryana state, one may consider the villages of the district as clusters and a random sample of villages to collect the data on each farm of the selected villages. Similarly if one wants to conduct an opinion poll of Hyderabad city, then the city may be divided into 20 blocks and from these blocks, 5 blocks may be taken by random sampling. The inhabitants of these 5 blocks can be interviewed for their opinion. In these methods, the cluster should be of small size and the number of sample units in each cluster should be more or less the same.

Multi-Stage Sampling: The four methods we've covered so far -- simple, stratified, systematic and cluster -- are the simplest random sampling strategies. In most real applied social research, we would use sampling methods that are considerably more complex than these simple variations. The most important principle here is that we can combine the simple methods described earlier in a variety of useful ways that help us address our sampling needs in the most efficient and effective manner possible. When we combine sampling methods, we call this multi-stage sampling.

Non-probability Sampling Methods: non-probability sampling does not involve random selection. It involves personal judgment of the researcher rather than chance to select sample elements. Sometimes this judgment is imposed by the researcher, while in other cases the selection of population elements to be includes is left to the individual field workers. The decision maker may also contribute to including a particular individual in the sampling frame. Evidently, non probability sampling does not include elements selected probabilistically and hence, leaves an degree of „sampling error" associated with the sample. The most commonly used non-probability sampling methods are convenience sampling, judgment sampling, quota sampling, and snowball sampling.

Convenience Sampling

Convenience samples are sometimes called accidental samples because the elements included in the sample enter by „accident". It is a sampling technique where samples are obtained from convenient elements. This refers to happening of the element at the right place at the right time, that is, where and when the information for the study is being collected. The selection of the respondents is left to the discretion of the interviewer. The popular examples of convenience sampling include (a) respondents who gather in a church (b) students in a class room (c) mall intercept interviews without qualifying the respondents for the study (d) tear-out questionnaire included in magazines and (e) people on the street. In the above examples, the people may not be qualified respondents, however, form part of the sample by virtue of assembling in the place where the

researcher is conveniently placed. Convenience sampling is the least expensive and least time consuming of all sampling techniques. The disadvantage with convenience sampling is that the researcher would have no way of knowing if the sample chosen is representative of the target population.

Judgment Sampling: This is a form of convenience sampling otherwise called as purposive sampling because the sample elements are chosen since it is expected that they can serve the research purpose. The sample elements are chosen based on the judgment that prevails in the researcher's mind about the prospective individual. The researcher may use his wisdom to conclude that a particular individual may be a representative of the population in which one is interested. The distinguishing feature of judgment sampling is that the population elements are purposively selected. Again, the selection is not based on that they are representative, but rather because they can offer the contributions sought. In judgment sampling, the researcher may be well aware of the characteristics of the prospective respondents, in order that, he includes the individual in the sample. It may be possible that the researcher has ideas and insights about the respondent's requisite experience and knowledge to offer some perspective on the research question.

Quota Sampling: Quota sampling is another non-probability sampling. It attempts to ensure that the sample chosen by the researcher is a representative by selecting elements in such a way that the proportion of the sample elements possessing a certain characteristic is approximately the same as the proportion of the elements with the characteristic in the population. Quota sampling is viewed as two-staged restricted judgmental sampling technique. The first stage consists of developing control categories, or quotas, of population elements. Control characteristics involve age, sex, and race identified on the basis of judgment. Then the distribution of these characteristics in the target population is determined. For example, the researcher may use control categories in that, he/she intends to study 40% of men and 60% of women in a population. Sex is the control group and the percentages fixed are the quotas.In the second stage, sample elements are selected based on convenience or judgment. Once the quotas have been determined, there is considerable freedom to select the elements to be included in the sample. For example, the researcher may not choose more than 40% of men and 60% of women in the study. Even if the researcher comes across qualified men after reaching the 40% mark, he/she would still restrict entry of men into the sample and keep searching for women till the quota is fulfilled.

Snowball sampling: This is another popular non-probability technique widely used, especially in academic research. In this technique, an initial group of respondents is selected, usually at random. After being interviewed, these respondents are asked to identify others who belong to the target population of interest. Subsequent respondents are selected based on the information provided by the selected group members. The group members may provide information based on their understanding about the qualification of the other prospective respondents. This method involves probability and non-probability methods. The initial respondents are chosen by a random method and the subsequent respondents are chosen by non-probability

Probability versus non probability

BASISFOR COMPARISON	PROBABILITY SAMPLING	NON-PROBABILITY SAMPLING
Meaning	Probability sampling is a sampling technique, in which the subjects of the population get an equal opportunity to be selected as a representative sample.	Non-probability sampling is a method of sampling wherein, it is not known that which individual from the population will be selected as a sample.
Alternately known as	Random sampling	Non-random sampling
Basis of selection	Randomly	Arbitrarily
Opportunity of selection	Fixed and known	Not specified and unknown
Research	Conclusive	Exploratory
Result	Unbiased	Biased
Method	Objective	Subjective
Inferences	Statistical	Analytical
Hypothesis	Tested	Generated

***********End of Unit III**********

UNIT -IV
DATA PREPARATION AND ANALYSIS
DATA ANALYSIS AND INTERPRETATION

Data preparation and analysis are essential in recording information, analyzing the information, and communicating analysis. The first stage in data analysis is the preparation of an appropriate from in which the relevant data can be collected and coded in a format suitable for entry in to a computer: this stage is referred to as data processing. After the collection of the data has been done, it as to be then processed and then finally analyzed. The processing of the data involves Editing, Coding, Classifying, and Tabulating and after all this analysis of the data takes place.

DATA EDITING AND CODING

Authenticity and relevance of a research investigation is based on the assurance of error-free qualitative reliability of the collected data. Data processing has to be carried out in an appropriate manner. Processing comprises the task of editing, coding classification and tabulation. In spite of a careful collection by a researcher, there may be a possibility for errors of omission and commission arising and it is for this purpose that the process of editing becomes Necessary.

The editor, while examining certain responses of the respondents, may find some mistakes in the form of incomplete, vague or irrelevant answers. Such inconsistent answers have to be eliminated or suitably and reasonably modified. Further, there should be no room for fictitious data to creep in. Hence the editor has to take care to see that the authenticity of the data is in a perfect shape. For the purpose of classification of the data into meaningful and useful classes, the procedure of coding has to be used. This procedure would be advantageous in dealing with the data having a number of characteristics. Also, a large volume of data can be processed accurately. Manual processing and analysis can be carried out by using measures of central tendency, dispersion, correlation regression and other statistical methods if the volume of data is not very

large. In case a researcher is confronted with a very large volume of data then it is imperative to use' computer processing'. For this purpose necessary statistical packages such as SPSS etc. maybe used. Computer technology can prove to be a boon because a huge volume of complex data can be processed speedily with greater accuracy

Validity of Data.: Validating and analyzing more variables and case increase the work load of All data handlers including coding staff, Entry clerks and data editors. When there is a combination of pressure to complete the analysis on time and in efficiencies in training and recruiting staff the quality of data transmitted from the data manager to the analysts can be questionable. In some cases, Survey have been planned without including a step to check the coding or to verify that the data have been planned without including a step to check the coding or to verify that the data have been entered accurately.

For Primary data: Prior to using questionnaire to collect data it should be pilot tested. The purpose of the pilot test is to refine the questionnaire so that respondents will have on problems in answering the questions and there will be no problems in recording the data. In addition, it will be able assessment of the questions' validity and the likely reliability of the data collected. Preliminary analysis using the pilot test data can be undertaken to ensure that the data collected will enable investigative question to be answered. Initially it should ask an expert or group of experts to comment on the represevtativeness and suitability of questions. As well as allowing suggestions to be made on the structure of questionnaire , this will help establish content validity and enable to make necessary amendments prior to pilot testing with as group as similar as possible to the finial population in sample. For any research project there is a temptation to skip the pilot testing.

For secondary data; Secondary data that fails to provide the information that needs to answer research question(s) or meet objectives will results in invalid answers. Often when it is using secondary data it will find that the measures used do not quite match those that need. for example , a manufacturing organization may record monthly sales whereas researchers are interest in monthly orders. This may cause problem when the analyses is done believing that researcher have found a relationship with sales whereas in fact the relationship is with the number of orders. Alternatively, it may be using minutes of company meetings as a proxy for what actually happened, the events being recorded from a particular view point, often the chairperson's. Therefore needs to be cautions before accepting such records at face value. Unfortunately, there are no clear solutions to problem of measurement in validity. All that one can do is tried to evaluate the extent of the data's validity and makes ones own decision. A common way of doing this is to examine how other researchers have coped with this problem for a similar secondary data set i n a similar context . if researcher finds that the measures, while not exact, were suitable then he can be more certain that they will be suitable for the research question(s) and objectives. If they had problems then researcher may be able to incorporate their suggestions as to how to overcome them.

Data entry:

It covers information gathered by secondary or primary methods to a medium for viewing and manipulation. Keyboarding remains a mainstay for researchers who need to create a data file immediately and store it in a minimal space on a variety of media. However, researchers have profited form more efficient ways of speeding – up the research process, especially from bar coding and optical character and mark recognition.

Alternative data entry:

- Keyboarding
- Optical recognition
- Voice recognition
- Digital
- Bar code

Data analysis:

Data analysis is a process of gathering, modeling and transforming data with the goal of highlighting useful information suggesting conclusions and supporting decision-making.

Preliminary data analysis:

In order to acquire knowledge of the characteristics and properties of the collected data some preliminary data analysis are conducted usually before performing measurement quality assessment or test of hypothesis.

Hypothesis testing:

Before testing hypothesis it is useful to check the assumptions underlying the tests and to get a feeling for the data, in order to better interpret the results of the tests. Hypothesis testing determines the validity of the

assumptions (technically described as null hypothesis) with a view to choose between two conflicting hypothesis about the value of a population parameter.

Basis of difference	Qualitative data analysis	Quantitative data analysis
Procedures and rules	Qualitative analysis has no set rules, but rather guidelines are there to support the analysis	Quantitative analysis follows agreed upon standardized procedures and rules.
Occurrence	Qualitative analysis occurs Simultaneously with data collection	Quantitative analysis occurs only after data collection is finished
Methodology	Qualitative analysis may very methods depending on the situations	Methods of quantitative analysis are determined in advance as part of the study design.
Questions	Open-ended questions and probing yield detailed information that illuminates nuances and highlights divers it.	Specific questions obtain predetermined responses to standardized questions.
suitability	More suitable when time and resources are limited.	Relies on more extensive interviewing

Bivariate analysis:
Bivariate analysis is concerned with the relationship between Paris of variables(X,Y) in a data set . The following data analysis situations can be visualized, depending on the measurement levels of variables and whether there is any distinctions between independent and dependent variables
For example suppose we wanted to find out if gender was related to attitudes towards equality between men and women and had measured each variable at the nominal level. The variables are:
Gender: measured as male or female and
Attitudes: measured simply as a "in favour of" or as "opposed to "gender equality.
Bivariate statistical techniques: Bivariate analysis is the simultaneous analysis of two variables. It is usually undertaken to see if one variable, such as gender, is related to another variable, perhaps attitudes towards male\female equality. The bivariate statistical techniques include the following:
• Linear correlation
• Simple regression
• Two-way ANOVA.
On the basis of ratio of change direction: on the basis the correlation is categorized as:
Linear correlation: the correlation between two variables is said to be linear if corresponding to a unit changes in the value of one variable there is a constant change in the value of the other variable i.e. incase of linear correlation the relationship between the variables x and y is of the type, y=a+bx ,if a=0, the relation becomes y=bx , in such cases the values of the variables are in constant ratio.
Non- linear (curvilinear) correlation: the correlation between two variables is said to be non-linear or curvilinear if corresponding to a unit change in the value of one variable dose not change at a constant rate but at a fluctuating rate.
On the basis of the number of variables: this category includes:
Simple correlation: in simple correlation we study only two variables: say price and demand.
Multiple correlations: in multiple correlations we study together the relationship between two or more factors like production, rainfall and use of fertilizers.
Partial correlation: in partial correlation though more than two factors are involved but correlation is studied only between two factors and the other factors are assumed to be constant.
For example, if out of the related variables, say, marks in statistics, marks in accountancy, and marks in English, we study the correlation between the two variables, viz., marks in statistics, and marks in accountancy ignoring the effect of the other variables, i.e., marks in English , it will be a case of partial correlation. On the other hand, when the relationship between any two or more variables is studied at a time, it is a case of sales at a time are studied it will be a case of multiple correlation. In actual practices, however, the study of multiple correlation is not popular.

Simple regression: the dictionary meaning of the term 'regression' is the act of the returning or going back. The term 'regression' was first used by Sir Francis Galton in 1877 while studying the relationship between the heights of father and sons.

Regression coefficients:

Let 'b' is the slope of line of regression of Yon X also called coefficient of regression of Yon X also called coefficient of regression of X on Y. It represent the increment in the values of dependent variable Y corresponding to a unit change in the value of the independent variable X.

b_{xy}= regression coefficient of Yon X = $r\dfrac{\sigma_y}{\sigma_x}$

Similarly, the coefficient of regression of X on Y indicates the change in the value of variable X corresponding to a unit change in the value of the variable Y.

b_{yx}= regression coefficient of Yon X = $r\dfrac{\sigma_x}{\sigma_y}$

Regression equation: the regression equations express the regression lines, As there are two regression lines, so there are two regression equations.

Regression equation of Y on X: following equations are usually called the normal equations.

$$\sum Y = Na + b\sum X$$

$$\sum XY = a\sum Y + \sum Y^2$$

Regression equation of X on Y: following equations are usually called the normal equations.

$$\sum X = Na + b\sum Y$$

$$\sum XY = a\sum X + \sum X^2$$

Two-way ANOVA: The variance in the value of a variable, say sale that is studied with references to the combined effect of two other variables, say efforts of salesmen, and seasons, is called variance due to two variables. Such variances are taken into account in two way classification for which also, we are to conduct the experiments through a number of sample studies. For example, if the combined effect of the salesmen and the seasons on the sales is to be studied, the collected samples of sales are arranged in the binary forms as under.

	Samples of sales in '000Rs				
	Salesmen				
	P	**Q**	**R**	**S**	**Total**
Summer	32	31	29	28	120
Mon soon	36	35	36	21	128
Winter	26	29	28	29	112
Total	94	95	93	78	360

Multivariate analysis

Multivariate analysis is the analysis of the simultaneous relationship among three or more phenomena. While in univariate analysis the focus is on the level(average) and distribution (variance) of the phenomenon, in a bivariate analysis the focus shifts to the degree of relationship (correlation of covariance) between the phenomena. In a multivariate analysis, the focus shifts from paried relationship to the more complex simultaneous relationship among phenomena.

Uses of Multivariate analysis:

Multivariate analysis (MVA) is based on the statistical principle of multivariate statistics, which involves observations and analysis of more than one statistical variable at a time. In design and analysis, the techniques are used to perform trade studies across multiple dimensions while taking into account, the effects of all variables on the responses of interest.

Tabulation of Data

Meaning:

By tabulation we mean, a systematic presentation of numerical data in columns and rows in accordance with some salient features or characteristics. Columns are vertical arrangement and rows are horizontal arrangement. Croxton and Cowden state that *"Either for one's own use or for the use of others, the data must be presented in a suitable form."* It facilitates comparison. It also facilitates analysis.

Definition:

According to Secrist, "Classification is the process of arranging data into sequences and groups according to their common characteristics, or separating them into different but related parts."

Rules of tabulation

1. Table number

A table should be numbered for easy reference and identification. This number if possible, should be written in the center at the top of the table.

2. Title of the table

Each table should be given a suitable title. It must be written on the top of Table. A complete title has to answer the questions, what, where, and when in that sequence.

3. Head Note

It is a statement, given below the title and enclosed in brackets. For example

The unit of measurement is written as a head note, such as "in millions" or "in hundreds"

4. Captions or Column Headings

These are headings for the vertical columns. They must be brief and self-explanatory. They have main heading and sub-headings and must be written in small letters.

5. Stub or Row heading

These are the headings or designation for the horizontal rows. The stubs are usually wider than column headings.

6. Body of the table

The body of the table contains the numerical information in the different cells. This arrangement of data is according to the description of captions and stubs.

7. Footnote

Footnotes are given at the foot of the table for explanation of any fact or information included in the table, which needs some explanation.

8. Source Note: One should also mention the source of information from which data are taken. This may include the name of the author, volume, page, and year of publication.

TYPES OF TABLES.

Based on its purpose, a table is called General Purpose Table or Special Purpose Table. Based on the number of characteristics and variables considered, a table is called- Simple Table or Complex Table.

General Purpose Table: General purpose tables are known also as Reference Tables or Repository Tables. These are designed for storing information. These are tables of reference found as appendices. For eg Tables given in census reports are of this kind.

Special Purpose Table: Special purpose tables are known also as Summary Tables. These are generally derived from general purpose tables. These contain less information but highlight any one aspect. These find place in the body of the reports. For eg All the tables in this book are of this kind.

Simple Table. Simple tables are the one-way tables based on me criterion of classification. For eg frequency tables

Complex table: Complex tables are the two-way and the higher order tables. Bivariate frequency table are of this kind.

1. Positive correlation:

If two variables tend to move together in the same direction, i.e, an increase or decrease in the value of one variable is accompanied by increase or decrease of another variance then the correlation is called positive or direct correlation. For example: Heights and Weights of a persons, price and demand are positive correlation.

2. Negative correlation: If two variables tend to move together in opposite direction, i.e, an increase or decrease in the one variable is accompanied by increase or decrease of another variable is called negative or indirect correlation. For example: price and supply .work and energy are negative correlation.

3. Non-linear Correlation: If the ratio of change between two variables is uniform, then there will be linear relationship between them. The ratio of change between the variables is the same, if we plot these on the graph, we get a straight line. In a curvilinear or non-linear correlation, the amount of change in one variable does not bear a constant ratio of the amount of change in the other variables. The graph of non-linear or curvilinear relationship will form a curve.

METHOD OF STUDYING CORRELATION
1. Scatter Diagram Method
        Let us consider a set paired values of the variable X and Y. For example X represent the heights of persons and Y their weights. Along the horizational axis we represents the height and along the vertical axis The weight plot the values (X,Y) on a graph paper to get a collections of dots. The figure so obtained is called scatter diagram from the scatter diagram. We can obtain a rough idea of the correlation between variables.

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2. Karl Pearson's Coefficient of Correlation: Karl Pearson (1857-1936) was a great statistics. He gave the following mathematical formula for measuring the magnitude of linear correlation coefficient between two variables. If X and Y are two variable, then the correlation coefficient $\rho(X, Y)$ between them in given by..

$$\gamma = \frac{Cov(x, y)}{\sigma_x \sigma_y} , \quad cov(x,y)= N\sum XY - \sum X \sum Y \quad \gamma = \frac{N\Sigma XY - \Sigma X \Sigma Y}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}} ,$$

$$\gamma = \frac{\Sigma xy}{N\sigma_x \sigma_y} , \quad \gamma = \frac{\Sigma xy}{\sqrt{(\Sigma x^2 * \Sigma y^2)}} \quad \text{Where} \quad x = X - \overline{X} \quad \text{and } y = Y - \overline{Y}$$

Properties of Correlation
The coefficient of correlation lies between -1 to +1. Symbolically $-1 \le r \le 1$.
It is the measure of the closeness of a fit in a relative sense.
The coefficient of correlation is independent of change of origin and scale.
The coefficient of correlation is the geometric mean of two regression coefficients.
When $r = +1$, then there is perfect positive correlation between the variables.
When $r = -1$, then there is negative correlation between the variables.

Spearman's Rank coefficient of Correlation
        Rank correlation is application only individual observations. The results we get this method is only an approximate one, because under ranking method original value are not taken into account. The formula for spearman's rank correlation which is denoted by ρ

$$\rho = 1 - \frac{6 \sum D^2}{N(N^2 - 1)}$$

Where ρ =   Rank Correlation Coefficient
        D^2 =   Sum of square of the difference of two ranks
        N   =   Number of paired observations

MULTIVARIATE ANALYSIS

It is the analysis of the simultaneous relationship among three or more variables. In a multivariate analysis, the focus shift from paired relationships to the more complex simultaneous relationships among three or more variables.

The multivariate technique can be broadly classified as dependence technique or interdependence techniques.

Dependence techniques are appropriate when one or more variables can be identified as dependent variable and the remaining as independent variables.

In the interdependence techniques the variables are not classified as dependant or independent.

Multivariate statistical techniques:

Multivariate statistical techniques can be broadly defined as 'a collection of producers for analyzing the association between two or more set of measurements that were made on each object in one or more samples of objects". In inter-dependence technique, the variables are not classified as dependent are independent: rather, the whole set of inter- dependent relationships are examined.

Dependence techniques

Multiple regression analysis: multiple regression analysis represents a logical extension of two variables regression analysis. Instead of s single independent variable, two or more independent variables are used to estimate the values of a dependent variable. However, the fundamental concepts in the analysis remain same.

Discriminate analysis: discriminate analysis techniques are described by the number of categories possessed by the creation variable. When the criterion variable has two categories, the technique is known as two- group discriminate analysis. When three or more categories are involved, the technique

Is known as multiple discriminate analysis

MANOVA: multivariate analysis of variance (MANOVA) is simply an extension of the univariate analysis of variance. In analysis of variance, we examine the one metric dependent variable with the grouping independent variable. Analysis of variance fails to compare the group when the dependent variables become more than one dependent metric variable.

Inter- dependent variable:

Multi- dimensional scaling (MDS)

Factor analysis

Cluster analysis

Conjoint analysis: conjoint analysis attempts to determine the relative importance consumers attach to salient attributes and the utilizes they attach to the level of attributes. This information is derived from consumer's evaluations of brands, or brand profiles composed of these attributes and their levels

FACTOR ANALYSIS

It is a multivariate statistical technique that is used to summarize the information contained in a large number of variables into smaller number of subsets or factors. The purpose of factor analysis is to simplify the data with factory analysis there is no distinction between dependent and independent variables rather all variables under investigation are analyzed together to identify underlying factor.

There are two objects of factor analysis:-

1. It simplifies the data by reducing a large number of variables to a set of a small number of variables.
2. It analyses the interdependence of interrelationship among a total set of variables.

Factor analysis is an appropriate technique in case where the variables have a high degree of Interco relation.

DISCRIMINATE ANALYSIS

• It is a multivariate technique used for predicting group membership on the basis of two or more independent variables. A discriminate function is a regression equation with a dependant variable that represents group membership. This function maximally discriminates between members of the group. It tells us to which group each member probably belongs.

• It can be used to assign individual to groups on the basis of their scores on two or measure. From those scores the best composite score based on least squares is calculated. Then the higher R^2 is the better predictor of the group membership.

• One can use discriminate analysis to classify objects into two groups (ie.) success, failure, default, non- default.

• In discriminate analysis a scoring system is used on the basis of which an individual is classified as category.

• Suppose an individual is 25 years of age earns an annual income of Rs.60000/- and has undergone formal education for a period of 17years. Each of three variables is given a weight indicating its relative importance. Y=dependant variable.

• A certain limit is fixed of the value of y below which all values will be classified in Group I and the others in Group II. The values of b1, b2 and b3 indicate their importance. The numerical value of y can be transformed into t probability of the individual being credit worthy.

• It may be noted that in the linear discriminate, the "b" co-efficient are similar to the regression co-efficient. However the main difference is that while the regression co-efficient are used to predict the value of the dependant variable. The discriminate co-efficient are used to classify correctly as many individual or object as possible.

CLUSTER ANALYSIS

• The basic idea of cluster analysis is to group similar objects together.

• A cluster is consists of variables that have high correlation with one another and comparatively low correlation with variables other clusters.

• The objective of cluster analysis is to determine how many mutually and exhaustive groups or clusters, based on the similarities profiles among entities really exist in the population and then to state the composition of such groups.

• There are two approaches to clustering. Hierarchical and Non-Hierarchical.

• Hierarchical clustering can start and divide and in one cluster and divide and subdivide them until all objects are in their own singly object cluster. This is called the top-down or decision approach.

• In contrast the bottoms up or agglomerate approach can start with each object in its own cluster and systematically combine cluster until all objects are in one cluster.

• When one object is associated with another in a cluster, it remains clustered with that object.

• The non-Hierarchical clustering differs from clustering only in that it permits objects to leave one cluster and join another as clusters are being formed if the clustering criterion is improved by doing so.

• Instead of using the tree like construction process found Hierarchical clustering, cluster seeds are used to group objects within a pre-specified distance of the seeds. Cluster seeds are initial centroids or starting points of the cluster.

• Hence in this approach a cluster center is initially selected and all objects within apre-specified threshold distance are included in that cluster.

Multiple regression and correlation: Multiple regression analysis represents logical extensions of two-variable regression analysis. Instead of a single independent variable, two or more independent variables are used to estimate the values of a dependent variable. However, the fundamental concepts in the analysis remain the same.

MULTIPLE REGRESSION

When there are two or more than two independent variables, the equation describing such a relationship is the multiple regression equation. In this situation the results are interpreted as

Y= a + b1 x1+ b2 x2

X1, x2 = independent variable y = dependent variable

a, b1, b2 = constant

The constant can be solved by solving the following equation

• The no of normal equation would depend upon the number of independent variable. If there are two independent variables, then three equations, if there are three independent variable then four equations and so on are used.

• In multiple regression analysis the regression co-efficient (b1, b2) become less reliable as the degree of correlation between the independent variable (x1,x2).

• If there is high degree of correlation between independent variables. We have what is commonly described as the problem of multicollinearity. In such a situation we should use only one set of the independent variable to make our estimate.

• Adding a second variable say x2 which is correlated with the first variable say x1 distorts the values of the regression co-efficient.

• The main objective in using this technique is to predict the variability the dependent variable based on its covariance with all the independent variables.

We can predict the level of the dependant variable through the multiple regression analysis model given the levels of independent variables.

Combine cluster until all objects are in one cluster.

• When one object is associated with another in a cluster, it remains clustered with that object.

• The non-Hierarchical clustering differs from clustering only in that it permits objects to leave one cluster and join another as clusters are being formed if the clustering criterion is improved by doing so.

Multiple correlation analysis: multiple correlation analysis is part of the multiple regressions analysis, and under normal circumstance there is no need for a separate programme or algorithm. The multiple correlation programmes is therefore used, when the primary data is unavailable, and analysis has to begin with only the correlation matrix being available. The results produced by this programme are therefore the partial correlation coefficient, the partial standardized correlation coefficient, and the multiple correlation coefficients. The programme also conducts step-wise deletion until only one independent variable remains.

Properties of Multiple correlation

• The coefficient of a multiple correlation has a number of useful properties some of which may be cited here as under.

• It values range between 0 and1 and it never results in a negative. thus, $0 \leq R \leq 1$

• The position of the subscripts to the right of the dot does not make any differences. Thus, $R_{1.23} = R_{1.32}$, and $R_{2.123} = R_{2.341} = R_{2.431}$

• If $r_{12} = 0$ and $r_{13} = 0$, then $R_{1.23} = 0$ and vice versa.

• The square of the coefficient of a multiple correlation gives the coefficient of a multiple determination. Thus, $R^2 = \dfrac{Explained\ variation}{Total\ variation}$ = Coefficient of multiple determination.

Applications of Statistical Software for Data Analysis: Statistics is the science of making effective use of numerical data relating to groups of individuals or experiments. It deals with all aspects of this, including not only the collection, analysis and interpretation of such data, but also the planning of the collection of data, in terms of the design of surveys and experiments. Traditional or manual method takes lot of time. Whereas statistical software makes the statistical analysis more simpler and accurate result

Multidimensional scaling (**MDS**) is a means of visualizing the level of similarity of individual cases of a dataset. It refers to a set of related ordination techniques used in information visualization, in particular to display the information contained in a distance matrix. It is a form of non-linear dimensionality reduction. An MDS algorithm aims to place each object in *N*-dimensional space such that the between-object distances are preserved as well as possible. Each object is then assigned coordinates in each of the *N* dimensions. The number of dimensions of an MDS plot *N* can exceed 2 and is specified a priori. Choosing *N*=2 optimizes the object locations for a two-dimensional scatter plot.

STATISTICAL SOFTWARE1.SAS/STAT:SAS/STAT software is designed for both specialized and enterprise wide analytical needs. SAS/STAT software provides a complete, comprehensive set of tools that can meet the data analysis needs of the entire organization.

Analysis of variance: Balanced and unbalanced designs; multivariate analysis of variance and repeated measurements; linear and nonlinear mixed models.

Mixed models

Linear mixed models.

Nonlinear mixed models.

Generalize linear mixed models.

Regression

Least squares regression with nine model selection techniques, including stepwise regression.
Diagnostic measures.
Robust regression; Loess regression.
Nonlinear regression and quadratic response surface models.
Partial least square

Categorical data analysis
Contingency tables and measures of association.
Logistic regression and log linear models; generalized linear models.
Bioassay analysis.
Generalized estimating equations.
Weighted least squares regression.
Exact methods.

Bayesian analysis
Bayesian modeling and inference for generalized linear models, accelerated life failure models,
Cox regression models and piecewise exponential models.
General procedure fits Bayesian models with arbitrary priors and likelihood functions.

Multivariate analysis
Factor analysis; principal components; canonical correlation and discriminate analysis; path analysis; structural equations.
Survival analysis: Comparison of survival distributions; accelerated failure time models; proportional hazards models.
Psychometric analysis: Multidimensional scaling; conjoint analysis with variable transformations; correspondence analysis.
Cluster Analysis: Hierarchical clustering of multivariate data or distance data; disjoint clustering of large data sets; nonparametric clustering with hypothesis tests for the number of clusters.

Nonparametric analysis
Nonparametric analysis of variance.
Exact probabilities computed formany nonparametric statistics.
Kruskal-Wallis, Wilcoxon-
Mann-Whitney and
Friedman tests.
Other rank tests for balanced or unbalanced one-way or two-waydesigns.

Survey data analysis
Sample selection; descriptive statistics and
t -tests; linear and logisticregression; frequency table analysis.

Multiple imputation for missing values
Regression and propensity scoring for monotone missing patterns.
MCMCmethod for arbitrary missing patterns.
Combine results for statistically valid inferences.

Study planning: Power and Sample Size application provides interface for computation of sample sizes and characterization of power fort -tests, confidence intervals, linear models, tests of proportions and rank tests for survival analysis.

STATA: Stata is a complete, integrated statistical package that provides everything you need for data analysis, data management, and graphics. Stata is not sold in pieces, which means you get everything you need in one package without annual license fees. sata 11 adds many new features such as multiple imputations, factor variables, generalized method of moments (GMM), competing-risks regression, state-space modeling, predictive margins, Variables Manager and more.Find out more about these features atNew in Stata 11.

Fast, accurate, and easy to use: With a point-and-click interface, an intuitive command syntax, and online help, Stata is easy to use, fast, and accurate (see certification results and FDA document compliance for details). All analyses can be reproduced and documented for publication and review.

Broad suite of statistical capabilities: Stata puts hundreds of statistical tools at your fingertips, from advanced techniques, such as survival models with frailty, dynamic panel data (DPD)regressions, generalized estimating equations (GEE), multilevel mixed models, models with sample selection, multiple imputation, ARCH, and estimation with complex survey samples; to standard methods, such as linear and generalized linear models (GLM), regressions with count or binary outcomes, ANOVA/MANOVA, ARIMA, cluster analysis, standardization of rates, case-control analysis, and basic tabulations and summary statistics.

Complete data-management facilities: Stata's data-management commands give you complete control of all types of data: you can combine and reshape datasets, manage variables, and collect statistics across groups or replicates. You can work with byte, integer, long, floats, double, and string variables. Stata also has advanced tools for managing specialized data such as survival/duration data, time-series data, panel/longitudinal data, categorical data, multiple-imputation data, and survey data.Explore all of Stata's capabilities.

Publication-quality graphics: Stata makes it easy to generate publication-quality, distinctly styled graphs, including regression fit graphs, distributional plots, time-series graphs, and survival plots. With the integratedGraph Editor you click to change anything about your graph or to add titles, notes, lines, arrows, and text. You can choose between existing graph styles or create your own.

UNIT-V
RESEARCH REPORT

According to Lancaster, "A report is a statement of collected and considered facts, so drawn-up as to give clear and concise information to persons who are not already in possession of the full facts of the subject matter of the report.

A research report is a written document specifying the purpose, scope, objective(s), hypothesis, methodology, findings, limitations and finally recommendation of a research project to others.

Characteristics of research report:

Accuracy: information presented in reports should be accurate. In accurate information may often land the managers in trouble. The report must present information as accurately as possible.

Simplicity: A report should be complete in simple. This would help in arriving at descision quickly and easily

Clarity and completeness: the report should be complete in all respects. There should be no room for ambiguity.

Brevity : executives do not find sufficient time to read lengthy reports. Therefore, the report should briefly reflect the essential points.

Appearance: the arrangement, organization, format, layout and make-up of a report should be pleasing and as far as possible, eye-catching.

Comprehensibility and readability: reports must be easy to read and understand. They must avoid technical languages as far as possible. The writer must present facts through elegant and grammatically correct English

Reliability : reports should be reliable and should not create an erroneous impression in the minds of readers either due to oversight or neglect.

Economy: report writing should not be a costly exercise. The most economical methods and standard quality must be employed while conveying the matter.

Timelines: to be useful and purposive , report should reach the readers well in time. Any delay in submission of reports makes the preparation of reports a futile exercise and sometimes obsolete too.

Logical content: the content of the report must be presented in a logical manner. The facts must be reported in an unbiased manner. Distinctive points must bear self- explanatory heading and sub-headings.

Different types of research report

Technical report: In the technical report the main emphasis is onthe methods employed,assumptions made in the course of the study,the detailed presentation of the findings including their limitations and supporting data.A general outline of a technical report can be as follows:

Summary of results: A brief review of the main findings just in two or three pages.

Nature of the study*:* Description of the general objectives of study, formulation of the problem in operational terms, the working hypothesis, the type of analysis and data required, etc.

Methods employed: Specific methods used in the study and their limitations. For instance, in sampling studies we should give details of sample design viz., sample size, sample selection, etc.

 Discussion of data collected, their sources, characteristics and limitations. If secondary data are used, their suitability to the problem at hand be fully assessed. In case of a survey, the manner in which data were collected should be fully described.

Analysis of data and presentation of findings*:* The analysis of data and presentation of the findings of the study with supporting data in the form of tables and charts be fully narrated. This, in fact, happens to be the main body of the report usually extending over several chapters.

Conclusions*:* A detailed summary of the findings and the policy implications drawn from the results be explained.

Bibliography: Bibliography of various sources consulted be prepared and attached.

Technical appendices: Appendices be given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular technique of analysis and the like ones.

Index: Index must be prepared and be given invariably in the report at the end.

The order presented above only gives a general idea of the nature of a technical report; the order of presentation may not necessarily be the same in all the technical reports. This, in other words, means that the presentation may vary in different reports; even the different sections outlined above will not always be the same, nor will all these sections appear in any particular report. It should, however, be remembered that even in a technical report, simple presentation and ready availability of the findings remain an important consideration and as such the liberal use of charts and diagrams is considered desirable.

Popular Report; The popular report is one which gives emphasis on simplicity and attractiveness. The simplification should be sought through clear writing, minimization of technical, particularly mathematical, details and liberal use of charts and diagrams. Attractive layout along with large print, many subheadings, even an occasional cartoon now and then is another characteristic feature of the popular report. Besides, in such a report emphasis is given on practical aspects and policy implications. We give below a general outline of a popular report.

Interim report: When there is a long time lag between data collection and presentation of the results as in the case of a sponsored project, the study may lose its significance and usefulness and the sponsor may also lose interest in it one of the most effective ways to avoid such eventualities is to present an interim report.

Summary report: a summary report is generally prepared for the consumption of the lay audience, viz., the general public. the preparation of this type of report is desirable for any study whose findings are of general interest. It is written in non-technical, simple language with a liberal use of pictorial charts. It just contains a

brief reference to the objective of the study, its major findings and their implications. It is a short report of two or three pages. Its size is so limited as to be suitable for publication in daily newspapers.

Algorithmic research report: there are problems. Viz., production scheduling, JIT, supply chain management, line balancing, layout design, portfolio management, etc., which exist in reality. The solution for each of the above problems can be obtained through algorithms. So, the researchers should come out with newer algrothims or improved algorithms for such problem. For a combinational problem, the researcher should attempt to develop an efficient heuristic. The algorithmic research report can be classified into the following categories;

Algorithmic research report for combinatorial problem

Exact algorithmic research report for polynomial problem.

Content of research reports

There is on one best structure for all report. However, the physical structure can be employed to create desirable emphasis and clarity. The use of widely spaced paragraphs, varied margins, separated headings, different type of sizes, and colors- all make it possible to emphasis major points and to clarify the sequence and relationship of ideas.

Title page: the title page should indicate the topic on which the report has been papered- the person or agency, who has papered it, the person or agency who has prepared it, the person or agency for whom it has been prepared and the data of submission (or completion) of the report. If it is intended for the attainment of some degree it should also be specified on title page.

Table of content: the table of contents is an outline of the order of the chapters, sections and sub-sections with their respective pages. If report includes a number of charts, figures, tables, maps, diagrams, and graphs etc., a spate table for category would immediately follow the table of contents.

Foreword: this section serves to introduce the reader to the research project. It should give the background of the problem (eg., how and when it come into existence):the importance of the problem: the various dimensions of the problem, and whether any previous research was done that is pertinent to the specific project being reported.

Statement of objectives: the specific objectives of the report need to be set forth clearly. The reader must know exactly what the report covers. If the particular project is part of a large problem, it is desirable to state the overall problem and the problem solution process. Sometimes it may even be wise to provide some background information on how the problem arose and what previous research work, if any, has been carried out. If such information will help in understanding the report, it should be furnished: but it should be kept as brief as possible.

Literature review; the review is a careful examination of a body of literature pointing towards the answer to the research question. Literature reviewed typically includes scholarly journals.scholoary books, authoritative database and primary sources. Sometimes it includes newspapers, magazines, other books, films, and audio and video taps, and other secondary data

Bibliography and references; the bibliography contains the detailed information on books, journals and other materials, showing the title of the books/ reports used in the preparation of the reports, names of authors, publishers, the year of publication and, impossible, the page numbers.A references list is a subset of bibliography including details of all the citations used in a literature survey and elsewhere in the research report, arrangement in alphabetical order of the last names of the author.

Readability:

sensitive writers consider the reading ability of their audience to achieve high readership. One can obtain high readership more easily if the topic interests the readers and is in their field of expertise. In addition, he can show the usefulness of the report by pointing-out how it will help the readers. Finally, he can write at a level that is appropriate to the audience's reading abilities. To test writing for difficulty level, use a standard readability index. The flesh reading ease score gives a score

Between 0and 100. The lower score, the harder material is to read. The flesh – Kincaid grade level and gunning's fog index both provide a score that corresponds with the grade level needed to easily read and understand the document. Although it is possible to calculate these indexes by hand , some software packages will do it automatically . The most sophisticated packages allow specifying the preferred reading level. Words that are above that level are highlighted to allow choosing an alternative.adcovates

Of readability measurement do not claim that all written material should be at the simplest level possible. They argue only that the level should be appropriate for the audience. They point out that comic book scores about 6 on the gunning scale (i.e ., a person with a sixth-grade education should be able to read that material). Time usually score about 10, while the Atlantic is reported to have a score of 11 or 12. Material that score much above 12 becomes difficult for the public to read comfortably.such measure obviously give only a rough idea of the true readability of a report . good writing calls for a veriety of other skills to enhance reading comprehension.

Comprehension: good writing varies with the writing objective . Research writing is designed to convey information of a precise nature. Avoid ambiguity, multiple meanings, and allusions. take care to choose the right words – words that convey thoughts accurately, clearly and efficiency, when concepts and contracts are used, they must be defined, either operationally or descriptively. words and sentences should be carefully organized and edited. Misplaced modifiers run rampant in carelessly written reports. Subordinate ideas mixed with major ideas make the report confusing to readers, forcing them to sort out what is important and what is secondary when this should have been done for them. finally , there is the matter of pace. Pace is defined as: the rate at which the printed page presents information to the reader.

Research report format

Introduction: there is no one best format for all reports. However , the physical format can be employed to create desirable emphasis and clarity. The use of widely spaced paragraphs, varied margins

Title of the report : the title page should indicate the topic on which the report has been prepared-the person or agency who has prepared it, the person are agency for whom it has been prepared and the date of submission (or completion) of the report. The topic of the study be defined in specific, self- explanatory terms and the title should not be too long.

The title of the report should succinctly indicate what the study is all about. For example,

A study of customer satisfaction indicates with the pizza hut at sunshine city, Illinois.

• Factors influencing the burn out of nurses in Monroe hospital.

• Factors affecting the upward mobility of women in accounting firms.

• A study of portfolio balancing and risk management in investment firms.

• The first two project will relate to applied research, whereas the last three will be in the realm of basic research. In addition to the title page will indicate the name of the sponsor of the study . the names of the researchers and their affiliations, and the date of the final report.

Table of content and chapterisation

The table of content is an outline of the order of the chapters, sections and sub-sections with their respective pages. If report includes a number of charts, figures, tables, maps, diagrams and graphsetc., a separate table for each category would immediately follow the table contents. The section lists all the main chapter headings and the essential sub-heading in each with the appropriate page numbers, against each. The listing of main chapters is generally preceded by some preliminaries like preface or acknowledgement, list of tables, list of figures, abstract or synopsis and their respective pages in small roman numbers are followed at the end by appendices, and indexes.

Content should neither be too detailed, nor should it be too sketchy. The table of contents serves as important purpose in providing an outline of the content of the report. The capitalized title 'contents' should be the central heading of the page and the capitalized word'CHAPTER' and'PAGE' should lead to the number of chapters and those page respectively on the left and right margins. An example has been .chapterisation means scanning of the entire project taken-up by the learner . the subject of the project is to be divided into different parts, arrange them in a systematic way and mention which aspect of the work will be studied in which chapter. It should be so planned that one chapter will seem to be a continuation of the pervious one. The last chapter will contain an analysis of the data/facts collected in the previous chapter and interpretation of the same to arrive at a conditions.

Content of chapter :

Content of chapter consists of the contents of individual chapter in more detail, the topic which are going to discuss in the chapter. Sometime objectives of learning the chapter are also mentioned in the content of chapter . while table of content contain outlines of over chapter. A working content of chapter provide information about the sequence of topic in the chapter or flow of idea in the chapter. The content of chapter , writing outline formally lists the sequence of topics a way that is hierarchical and logically exhaustive. A

system of text heading and sub-headings, on the other hand, is functional and natural for learning a subject rather than for expressing a from. Heading in a table content chunk information in a way that tells readers what to learn. The content of chapter thus helps the reader to construct meaning from text.

Executive summary:

The executive summary provides the reader with an over wise of the report's essential information. It is designed to be read by people who will not have to read the whole report or are deciding . if this is necessary : therefore , in executive summary one needs to say as much as possible in the fewest worlds. The executive summary should briefly outline the subject matter, the background problem,and the scope of the investigation , the method of analysis, the important findings arguments, and important issues that rose in the discussion, the conclusion and recommendations. The executive summary should not just be an outline of the points to be covered in the report with no detail of the analysis that has taken place or conclusion that have been reached.

Need of executive summary:

The executive summary is the research report in miniature. it should be logical, clear, interesting-and exciting. A reader should be able to read through it in four or five minutes and understand. The executive summary should be more than two pages long. The farther it goes past that point. The less it qualifies as an effective executive summary. If capturing an entire research in two pages or less, sounds like a tall order, it is , in fact , it is probably the most difficult part of the report to write. That is because it is usually more difficult to write concisely than it is to write at length . the executive summary should sever several purpose, both for researcher and for readers of the business plan.for researcher, it should be accomplish the following ;

Crystallises the thoughts: since the executive summary is the research report in miniature, it contains the report's highlights, its key points . to write an executive summary , focus on the issues that are most important to the research's success- past and future-and set aside those matters that are tangential.

Sets priorities: the executive summary, like the research report , should be organized according to the item ' order of importance. Writing it forces researcher to pick and choose from among the many points that make researcher report and decide on their order of importance.

Provides the foundation of the full plan: once researchers have written a version of the executive summary researchers have made the process of writing the plan much easier. Suddenly , it has provide with a take- off point for each section to the plan. The four or five sentences that summarizes the means of making the product or providing the service give the basis for that section of plan ,. It is much easier to begin writing with something on the page than it is to begin with the blank page.for readers , the executive summary is usally the first stop in the reading process.(this assume that the executive summary is at the very beginning of the report and that the reader goes from to back . it can control the former, but not the latter, some investors, e.g., turn first to the foundders' resume and others to the marketing section).

Writing the report:

Once the outline is complete, decision can be made on the placement of graphics, tables, and charts. Each should be matched to a particular section in the outline. While graphics might be added later or table changed into charts, it is helpful to make a first approximation of the graphics before beginning to write. Each writer uses different mechanisms for getting thoughts into written form. Some will write in long- hand, relying on some one else to transcribe their prose into word – processed format. Others are happiest in front of a word processor, able to add, delete, and move sections at will. Whichever works in the best approach to use.

Computer software package check for spelling errors and provide a thesaurus for looking-up alternative of expressing a thought. A CD-ROM can call upto 20-volume oxford English dictionary, be livered to be the greatest dictionary in any language. Common word confusion(there for their, to for too, or effect for affect) will not be found by standard spelling checkers. Advanced programs will scrutinize the report for grammar, punctuation, capitalization. Doubled words, transposed letters, homonyms, style problems, and readability level. The style checker will reveal misused words and indicate awkward phrasing.

Role of audience:

In any writing situation, the audience has a role. Like actors in a drama. Audience members play a part, using the document as a 'script". They perform action after receiving the information in the document. Those who take the most active role are users or decision makers. Users need a document that gives specific

instructions for physically carrying- out a process. Decision – makers need denouements that give them information they can use to come to an informed decision. A good writer changes documents to accommodate different audience roles. The topic (and even the sub-topics) may be similar, but the documents will be quite different because of the different roles of the intended audiences. To determine the audience's role, ask these questions:

Who will read this documents? : The audience could be a single person (supervisor), a small group(members of a committee), or a large group(the readers of a user manual). Sometimes the researchers has both a primary audience, the person to whom he address the document, and a secondary audience, other people who could read it for information but not immediate action.

What is the audience's need?: why is the reader concerned with the content of the documents?. It may be assured that the matter should serve the purpose for which they were papered. It needs to be aware of possible problems so that it can keep the customer happy with the product and with the

Company 's service. It must use that information in different ways with various people- the customer and other people in the company. In shot, it needs the information to help in carrying- out job responsibilities.

How does the writer's goal fulfill the audience's need?: As a writer , the basic goal is to enable the audience to act .one can do so by creating a specific message that has a specific purpose. One needs to answer two questions:

What is basic massage?

What is the purpose?

In general, the massage is the basic facts the researchers wants to present : the purpose is to inform, instruct, or persuade the audience. The combination of the two is goal. For example, if the goal is to inform the reader of the result of a survey. The researcher should write a memo that enables the reader to find the correct data. If the goal is to persuade. The reader to act in a certain manner because of the data , the researcher should write report that clearly points out the significance of the data and the action they support.

What is the audience task?: what will the reader do after reading the document? This is why the audience is involved in the situation. This involvement can have many factors, but a key one is a need for information that will allow the reader to carry out a task demanded by a role.

 Is there more than one audience?: sometime a document has more than one audience. In these situations, the researchers must decide whether to write for the primary or the secondary audience. The primary audience is the person actually addressed in the document. A secondary audience is someone other than the intended receiver who will also read the document. Often the researcher write with such a reader in mind. The secondary reader is often far form the writer, so that document must be formal. The following two example show a writer changes a document to accommodate primary and secondary audience.

The proper pace in technical writing is one that enables the reader to the reader to keep his mind working just a fraction of a second behind his eyes as he read along. It logically would be slow when the information is complex or difficult to understand : fast when the information is straightforward and familiar . if the reader's mind lags behind his eye, the pace is too much information per sentence. By contrast, sparse writing has too few significant idea per sentence. Writers use a variety of methods

To adjust the pace of their writing:

Use sample white space and wide margins to create a positive psychological effect on the reader.

Break large units of text into smaller units with heading to show organization of the topics.

Relive difficult text with visual aids when possible.

Emphasize   important material and deemphasize secondary material through sentence construction and judicious use of italicizing , underlining, capitalization, and parentheses.

Repeat and summaries critical and difficult ideas so that the readers have time to observe them.

Tone:

 proper use of tone is essential for better reading effects . this highlights the attitude of the writer the reflect his understanding of the reader . the report should make tactful use of details and generalizations . it should focus on facts and not the opinions of the writer. The report should make use of passive voice as far as possible and should avoid the use of first person. Recommaditions should not undergo any sort of alternations to give them a positive image. Review the writing to ensure the tone is appropriate. The reader can, and should be referred to, but researchers should avoid referring to themselves . one author notes that the "application of the 'you' attitude.. makes the massage sound like it is written to the reader, not sent by

the author. A massage prepared for the reader conveys sincerity, personalization, warmth, and involvement on the part of the author". To accomplish this,remove negative phrasing and rewrite the throught positively. Do not change the recommendation or the findings to make them positive. Instead , review the phrasing. Which of the following sounds better?

End users do not want the information system department telling them what software to buy.

End users want more autonomy over their computer software choices.

The massage convey the same information , but the positive tone of the second message does not put readers from the information system department on the defective

Final proof:

final editing of the draft should be taken-up after a gap of atleast a day. This helps in identifying , mistakes , if any better and correcting the mistake . final editing requires questions to be answered pertaining to the organization , contextual and layout of the final report . this can be done a couple of times and looking at the report with a different focus each time. The executive summary follows the final stage of editing. It is helpful to put the draft away for a day before doing the final editing. Go to the beach, ride a bicycle in the park, or see a movie- do anything that is unrelated to the research project. Then return to the report and read it with a critical eye. Does the writing flow smoothly? Are there transitions where they are needed? is the organization apparent to the reader? Do the findings and conclusions adequately meet the problem statement and the research objectives? Are the tables and graphics displaying the proper information in an easy-to-read format? After assuring that the draft is complete, write the executive summary.

Ethics in research:

The field of researcher nowadays is a prominent field concern. With the increase in the popularity of the field there are various new trends entering into the field. Ethics is used to be followed while undertaking the process of research. Certain issues needed to the considered widely while undertaking any kind of research . theses issues range from the issues of personal concern to the issues of social concern. Researchers are not always tactful or candid with subject when they do their studies . for example , questions in field surveys may be perceived as embarrassing by respondents or as an invasion of privacy. Also , researchers in laboratory studies have been known to deceive participants about the true purpose of their experiment because they felt deception was necessary to get honest responses.

Ethical behavior of research:

Ethical issues in business research are more important today than ever. A number of ethical issues are present in the practice of business research. Ethics is defined as a field of inquiry into determining what behaviors are deemed appropriate under certain circumstances, as prescribed by codes of behavior that are set by society. How one responds to ethically sensitive situations depends on his philosophy- deontology or teleology. several organizations in the research industry have codes of ethical behavior for both buyers and suppliers of research. Sagging is illegal. Frugging is very unethical. Ethical issues includes in research integrity, treating others (buyers, suppliers, the public, and respondents) fairly. Respondent fairness issues include deception, confidentiality, and invasion of privacy. Unassociated telephone calls and e-mail spam are an invasion of privacy. Researcher companies, faced with a declining pool of willing respondents in the general public , will rely more heavily on recruiting their own panel members. It is believed that by recruiting and maintaining their own panels of respondents, research companies will come to value their "panel equality" and it is seen even fairer treatment of respondent in the future.

There are many ways a society may prescribe wanted and unwanted behaviors. In business. If there are practices that are not illegal but are nevertheless thought to be wrong, trade associations or professional organizations will often prescribe a code of ethical behavior . this has been the case in marketing and, more specifically, in marketing research . the American marketing association (www.marketingpower.com). The council of American survey research organizations (www.casro.org), and qualitative research consultants associations (www.qrca.com) all have codes of ethics.

Codes of ethics:

Several associations have code of ethics. However , almost all of these different organizations have codes which address the following areas:

- Prohibiting selling (sugging) or fund-raising (frugging) under the guise of conducting research:
- Maintaining research integrity by avoiding misrepresentation and omission of pertinent research data
- Treating outside clients and suppliers fairly.

Subjectivity in research:

subjectivity refers so that the results are researcher- dependent. Different researchers may reach different conclusions based on the same interview. In contrast, when a survey respondent provides a commitment score a quantitative scale, it is thought to be more objective because the number will be the same no matter what researcher is involved in the analysis. Subjectivity guides everything from the choice of topic that one studies, to formulating hypotheses, to selecting methodologies, and interpreting data . in qualitative researchers counterpoise subjectivity and objectivity.

Objectivity is said to negate subjectivity since it renders the observer a passive recipient of external information, devoid of agency. And the researcher's subjectivity is said to negate the possibility of objectivity knowing a social psychological world. The investigator's values are said to define the world that is studied. One never really sees or talks about the world. *Per se*. one only sees and talks about what one's value dictate.

A world may exist beyond values, but it can never be known as it is, only as values shape our knowledge of it. Subjectivism is often regarded as the *sine qua non* of qualitative methodology however, this is untrue. Qualitative methodology has an objectivist strand as well. Objectivism states that the researcher's subjectivity can enable her to accurately comprehend the world as it exists in itself.of courses, subjectivity can bias the researcher and preclude objectivity understanding a subject 's psychological reality. However , this is not inevitable. In fact, one of the advantage of recognizing subjectivity is to reflect on whether if facilities or impleds objective comprehension. Distorting values can then be replaced by values that enhance objectivity. Objectivism integrates subjectivity and objective because it argues that objective knowledge requires active, sophisticated subjectivity processes- such as perception, analytical reasoning, synthetic reasoning, logical deduction, and the distinction of essences from appearances. Conversely, subjective processes can enhance objective comprehensions of the world.

Objectivity of research:

Objectivity per-suppose an independent reality that can be grasped. If there is no independent reality. Or if reality is merely the concoction of the observer, then the notion of objectivity is moot.To objectivity comprehend people's psychology, the researcher must organize his subjectivity appropriately . hypothetical concepts must be well-defined so that they can be identified unambiguously. An appropriate methodology must be adopted in order to solicit complete , meaningful evidence that can be used to test the validity of hypothetical concepts.And the evidence must be analyzed through sensitive, systematic procedures which can detect its feature and compare them to the characteristics of hypothetical concepts. In this way , the researcher can be warrant in believing that his\her concepts illuminate the true nature of people's psychology. Nebulous hypothetical concepts, insufficient or inappropriate behavioral evidences, and arbitrary analyses vitiate objectivity and allow the researcher to impose his\her theoretical constructs on the data.

When measuring something is considered , we encounter the concepts of subjectivity and objectivity. A subjective phenomenon is that only the subject himself or herself can perceptive . other people cannot see or feel or directly measure an individual's subjective perceptions. On the other hand, an objective phenomenon is one that can be observed and\or directly measured by someone other than the subject it is happening to. For example, pain and fatigue are subjective phenomena frequently encountered in medical and allied medical fields. they are subjective, because they are the perectible only to the person experiencing them, although, an outside observer may be able to point to some of the effects of each subjective phenomena in another person.whilst the early psychological method of introspection was ousted by more scientific and objective experimental ones, psychology has seen a recent return to more subjective techniques. E.g., discourse analysis, such as qualitative methods make use of subjectivity as an advantage: subjective data, such as individual experiences and opinions, are include in the research rather than being deliberately screened –out. In such, objectivity is considered superior to subjectivity to the extent that subjectivity has been demonized, associated with distortion and bias and ought to be erased from the research process. It is

not argued that objectivity should be discouraged, but that subjectivity should be not defined only in terms of what objectivity is not. Subjectivity can be seen as a unique, useful, and personal quality of the researcher.

Measures for achieving objectivity of researcher.

The following measure may contribute to some degree of objectivity in research:

- Patience and self-control,
- Open –mindedness,
- Use of standardized concept,
- Use of quantitative method.
- Group research or cooperative research, and
- Use of random sampling techniques.

Procedure for hypothesis testing:

Test a hypothesis means to tell (on the basis of the data the researcher has collected) whether or not the hypothesis seems to be valid. In hypothesis testing the main question is: whether to accept the null hypothesis or not to accept the null hypothesis? Procedure for hypothesis testing refers to all those steps that we undertake for making a choice between the two actions i.e., rejection and acceptance of a null hypothesis. The various steps involved in hypothesis testing are stated below:

Making a formal statement:

The step consists in making a formal statement of the null hypothesis (H_0) and also of the alternative hypothesis (H_a). This means that hypotheses should be clearly stated, considering the nature of the research problem. For instance, Mr. Mohan of the Civil Engineering Department wants to test the load bearing capacity of an old bridge which must be more than 10 tons, in that case he can state his hypotheses..The formulation of hypotheses is an important step which must be accomplished with due care in accordance with the object and nature of the problem under consideration.

Selecting a significance level:

The hypotheses are tested on a pre-determined level of significance and as such the same should be specified. Generally, in practice, either 5% level or 1% level is adopted for the purpose. The factors that affect the level of significance are:

e)   The magnitude of the difference between sample means,

f)   The size of the samples,

g)   The variability of measurements within samples

Deciding the distribution to use:

 After deciding the level of significance, the next step in hypothesis testing is to determine the appropriate sampling distribution. The choice generally remains between normal distribution and the t-distribution. The rules for selecting the correct distribution are similar to those which we have stated earlier in the context of estimation.

Selecting a random sample and computing an appropriate value: Another step is to select a random sample(s) and compute an appropriate value from the

***********End of Unit V***********

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