BUSINESS RESEARCH METHODS

STUDY MATERIAL

FIFTH SEMESTER
CORE COURSE : BC5B08

For

B.Com.

(2017 ADMISSION ONWARDS)
(CUBCSS)

UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

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CORE COURSE

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CHAPTER -1

BUSINESS RESEARCH

The word research is composed of two syllables, re and search. The dictionary defines the former as a prefix meaning again, anew or over again and the latter as a verb meaning to examine closely and carefully, to test and try, or to probe. Together they form a noun describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles. According to Robert Ross, "research is essentially an investigation, a recording and an analysis of evidence for the purpose of gaining knowledge". It can generally be defined as a systematic method of finding solutions to problems.

A research need not lead to ideal solution but it may give rise to new problems which may require further research. In other words research is not an end to a problem since every research gives birth to a new question. It is carried on both for discovering new facts and verification of old ones.

Features of Research

- It means the discovery of new knowledge
- Is essentially an investigation
- Is related with the solution of a problem
- It is based on observation or experimental evidences.
- It demands accurate observation or experimentation.
- In research, the researchers try to find out answers for unsolved questions
- It should be carefully recorded and reported

Business Research

Business research refers to systematic collection and analysis of data with the purpose of finding answers to problems facing management. It can be carried out with the objective to explore, to describe or to diagnose a phenomenon. It involves establishing objectives and gathering relevant information to obtain the answer to a business issue and it can be conducted to answer a business related question, such as: What is the target market of my product? Business research can also be used

to solve a business-related problem, such as determining how to decrease the amount of excess inventory on hand.

When deciding whether business research is to be conducted or not, the firm keeps in mind factors like the availability of data, time constraints and the value of the research information to the company. Adequate planning and information-gathering are essential to derive results for business.

Social Research

Social research refers to research conducted by social scientists. It is the scientific investigation conducted in the field of social sciences and also in the behavioral sciences. Social research methods can generally vary along a quantitative/qualitative dimension. While various methods may sometimes be classified as quantitative or qualitative, most methods contain elements of both. Social scientists employ a range of methods in order to analyse a vast breadth of social phenomena; from census survey data derived from millions of individuals, to the in-depth analysis of a single agents' social experiences; from monitoring what is happening on contemporary streets, to the investigation of ancient historical documents.

The social science research is a systematic method of exploring, analyzing and conceptualizing social life in order to expand, correct or verify knowledge whether that knowledge aids in the construction of theory or in the practice of an art.

Educational Research

Educational Research is that activity which is directed towards development of a science of behaviour in educational situations. The ultimate aim of this research is to provide knowledge that will permit the educator to achieve his goals by most effective methods. Educational research refers to a variety of methods, in which individuals evaluate different aspects of education including: “student learning, teaching methods, teacher training, and classroom dynamics”.

Educational researchers have come to the consensus that, educational research must be conducted in a rigorous and systematic way although what this implies is often debated. There are a variety of disciplines which are each present to some degree in educational research. These include psychology, sociology, anthropology, and philosophy. The overlap in disciplines creates a broad range from which methodology can be drawn. The findings of educational research also need to be interpreted within the context in which they were discovered as they may not be applicable in every time or place.

Need For Research (Importance of Research)

The main importance of research is to produce knowledge that can be applied outside a research setting. Research also forms the foundation of program development and policies everywhere around the universe. It also solves particular existing problems of concern. Research is important because we are able to learn more about things, people, and events. In doing research, we are able to make smart decisions.

Marketing research is important because it allows consumers and producers to become more familiar with the products, goods, and services around them. Research is important to society because it allows us to discover more and more that might make are lives easier, more comfortable, and safer. It presents more information for investigation. This allows for improvements based on greater information and study. It is very important. Research encourages interdisciplinary approaches to find solution to problems and to make new discoveries. Research is a basic ingredient for development and therefore serves as a means for rapid economic development.

The main importance or uses may be listed as under:

- It provides basis for government policies
- Helps in solving various operational and planning problems of business and industry
- Research helps in problem solving
- Is useful to students, professionals, philosophers, literary men, analysts and intellectuals.

Purpose / Aims / Objectives of Research

1. To find out the truth which is hidden and which has not been discovered so far.

2. Aims at advancing systematic knowledge and formulating basic theories about the forces influencing the relation between groups as well as those acting on personality development and is adjustment with individuals.

3. Try to improve tools of analysis or to test these against the complex human behaviour and institutions.

4. To understand social life and thereby to gain a greater measure of control over social behaviour.

5. To provide an educational program in the accumulated knowledge of group dynamics, in skills of research, in techniques of training leaders and in social action.

Criteria of good research

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

1. The purpose of the research should be clearly defined and common concepts be used.
2. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping the continuity of what has already been attained.
3. The procedural design of the research should be carefully planned to yield results that are as objective as possible.
4. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.
5. The analysis of data should be sufficiently adequate to reveal its significance and the methods of analysis used should be appropriate. The validity and reliability of the data should be checked carefully.
6. Conclusions should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis.
7. Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

Limitations of Research

- Conclusions in research are based upon data collected. Therefore when the data collected are not valid or adequate, the conclusion will not be conclusive or appropriate.
- Research results in theory
- Activities in a society are influenced by various internal and external factors
- Small organizations cannot afford to have research on various issues
- Many people in society depend on customs, traditions, routines and practices for taking decision; instead of going for research.

Research is usually based on sample studies. But in many cases samples are not true representatives. Therefore the research reports based on these samples may not be accurate.

Research process

Before embarking on the details of research methodology and techniques, it seems appropriate to present a brief overview of the research process. Research process consists of series of

actions or steps necessary to effectively carry out research and the desired sequencing of these steps. One should remember that the various steps involved in a research process are not mutually exclusive; nor they are separate and distinct. They do not necessarily follow each other in any specific order and the researcher has to be constantly anticipating at each step in the research process the requirements of the subsequent steps. However, the following order concerning various steps provides a useful procedural guideline regarding the research process: (1) formulating the research problem; (2) extensive literature survey; (3) developing the hypothesis; (4) preparing the research design; (5) determining sample design; (6) collecting the data; (7) execution of the project; (8) analysis of data; (9) hypothesis testing; (10) generalisations and interpretation, and (11) preparation of the report or presentation of the results, i.e., formal write-up of conclusions reached.

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

1. **Formulating the research problem:**

There are two types of research problems, viz., those which relate to states of nature and those which relate to relationships between variables. At the very outset the researcher must single out the problem he wants to study, i.e., he must decide the general area of interest or aspect of a subject-matter that he would like to inquire into. Initially the problem may be stated in a broad general way and then the ambiguities, if any, relating to the problem be resolved. Then, the feasibility of a particular solution has to be considered before a working formulation of the problem can be set up. The formulation of a general topic into a specific research problem, thus, constitutes the first step in a scientific enquiry. Essentially two steps are involved in formulating the research problem, viz., understanding the problem thoroughly, and rephrasing the same into meaningful terms from an analytical point of view.

The researcher must at the same time examine all available literature to get himself acquainted with the selected problem. He may review two types of literature—the conceptual literature concerning the concepts and theories, and the empirical literature consisting of studies made earlier which are similar to the one proposed. The basic outcome of this review will be the knowledge as to what data and other materials are available for operational purposes which will enable the researcher to specify his own research problem in a meaningful context. The problem to be investigated must be defined unambiguously for that will help discriminating relevant data from irrelevant ones.

2. **Extensive literature survey:**

Once the problem is formulated, a brief summary of it should be written down. It is compulsory for a research worker writing a thesis for a Ph.D. degree to write a synopsis of the topic and submit it to the necessary Committee or the Research Board for approval.

At this juncture the researcher should undertake extensive literature survey connected with the problem. For this purpose, the abstracting and indexing journals and published or unpublished bibliographies are the first place to go to. Academic journals, conference proceedings, government reports, books etc., must be tapped depending on the nature of the problem.

3. **Development of working hypotheses**:

After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses. Working hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. As such the manner in which research hypotheses are developed is particularly important since they provide the focal point for research. They also affect the manner in which tests must be conducted in the analysis of data and indirectly the quality of data which is required for the analysis. In most types of research, the development of working hypothesis plays an important role. Hypothesis should be very specific and limited to the piece of research in hand because it has to be tested. The role of the hypothesis is to guide the researcher by delimiting the area of research and to keep him on the right track.

4. **Preparing the research design:**

The research problem having been formulated in clear cut terms, the researcher will be required to prepare a research design, i.e., he will have to state the conceptual structure within which research would be conducted. The preparation of such a design facilitates research to be as efficient as possible yielding maximal information. In other words, the function of research design is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money. But how all these can be achieved depends mainly on the research purpose. Research purposes may be grouped into four categories, viz., (i) Exploration, (ii) Description, (iii) Diagnosis, and (iv) Experimentation. A flexible research design which provides opportunity for considering many different aspects of a problem is considered appropriate if the purpose of the research study is that of exploration. But when the purpose happens to be an accurate description of a situation or of an association between variables, the suitable design will be one that minimises bias and maximises the reliability of the data collected and analysed.

5. **Determining sample design:**

All the items under consideration in any field of inquiry constitute a 'universe' or 'population'. A complete enumeration of all the items in the 'population' is known as a census inquiry. It can be presumed that in such an inquiry when all the items are covered no element of chance is left and highest accuracy is obtained. But in practice this may not be true. Even the slightest element of bias in such an inquiry will get larger and larger as the number of observations increases. Moreover, there is no way of checking the element of bias or its extent except through a resurvey or use of sample checks. Besides, this type of inquiry involves a great deal of time, money and energy. Not only this, census inquiry is not possible in practice under many circumstances. For instance, blood testing is done only on sample basis. Hence, quite often we select only a few items from the universe for our study purposes. The items so selected constitute what is technically called a sample. The sample design to be used must be decided by the researcher taking into consideration the nature of the inquiry and other related factors.

6. **Collecting the data**:

In dealing with any real life problem it is often found that data at hand are inadequate, and hence, it becomes necessary to collect data that are appropriate. There are several ways of collecting the appropriate data which differ considerably in context of money costs, time and other resources at the disposal of the researcher.

Primary data can be collected either through experiment or through survey. If the researcher conducts an experiment, he observes some quantitative measurements, or the data, with the help of which he examines the truth contained in his hypothesis. The researcher should select one of these methods of collecting the data taking into consideration the nature of investigation, objective and scope of the inquiry, finanical resources, available time and the desired degree of accuracy.

7. **Execution of the project:**

Execution of the project is a very important step in the research process. If the execution of the project proceeds on correct lines, the data to be collected would be adequate and dependable. The researcher should see that the project is executed in a systematic manner and in time. If the survey is to be conducted by means of structured questionnaires, data can be readily machine-processed. In such a situation, questions as well as the possible answers may be coded. If the data are to be collected through interviewers, arrangements should be made for proper selection and training of the interviewers. The training may be given with the help of instruction manuals which explain clearly the job of the interviewers at each step. Occasional field checks should be made to ensure that the interviewers are doing their assigned job sincerely and efficiently. A careful watch should be kept for

unanticipated factors in order to keep the survey as much realistic as possible. This, in other words, means that steps should be taken to ensure that the survey is under statistical control so that the collected information is in accordance with the pre-defined standard of accuracy.

8. **Analysis of data:**

After the data have been collected, the researcher turns to the task of analysing them. The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding, tabulation and then drawing statistical inferences. The unwieldy data should necessarily be condensed into a few manageable groups and tables for further analysis. Thus, researcher should classify the raw data into some purposeful and usable categories. Coding operation is usually done at this stage through which the categories of data are transformed into symbols that may be tabulated and counted. Editing is the procedure that improves the quality of the data for coding. With coding the stage is ready for tabulation. Tabulation is a part of the technical procedure wherein the classified data are put in the form of tables. The mechanical devices can be made use of at this juncture. A great deal of data, specially in large inquiries, is tabulated by computers. Computers not only save time but also make it possible to study large number of variables affecting a problem simultaneously. Analysis work after tabulation is generally based on the computation of various percentages, coefficients, etc., by applying various well defined statistical formulae.

9. **Hypothesis-testing:**

After analysing the data as stated above, the researcher is in a position to test the hypotheses, if any, he had formulated earlier. Do the facts support the hypotheses or they happen to be contrary? This is the usual question which should be answered while testing hypotheses. Various tests, such as Chi square test, t-test, F-test, have been developed by statisticians for the purpose. The hypotheses may be tested through the use of one or more of such tests, depending upon the nature and object of research inquiry.

10. **Generalisations and interpretation:**

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

11. **Preparation of the report or the thesis:**

Finally, the researcher has to prepare the report of what has been done by him. Writing of report must be done with great care keeping in view the following:

1. The layout of the report should be as follows: (i) the preliminary pages; (ii) the main text, and (iii) the end matter.

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

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

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

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

Research Problem

Problem means a question or an issue to be examined. A research problem refers to some kind of problem which a researcher experiences or observes in the context of either a theoretical or practical situation. The researcher has to find out suitable course of action by which the objective can be attained optimally in the context of given environment. Thus, selection of research problem has high value to the society and the researcher must be able to identify those problems that need an urgent solution.

Requisites or Characteristics of a Good Research Problem

- clear and unambiguous
- logical and systematic
- empirical
- relation between variables
- verifiable
- interesting

Various Aspects of a Research Problem

For an effective formulation of the problem following aspects of the problem are to be considered by the researcher.

• Definition of the problem: - Before one takes up a problem for the study one needs to define it properly. The issues for inquiry are to be identified clearly and specified in details. If any existing theoretical framework is tested, the particular theorem or theories must be identified.

Similarly if there are any assumptions made and terms used the meaning of them must be madeclear. As far as possible the statement of the problem should not give any scope for ambiguity.

• Scope of the problem: - The research scholar has to fix up the four walls of the study. The researcher must identify which of the aspects he is trying to prove. Taking the example of sickness he should specify. (1) Whether his study extends to all types of small scale industries, or limited to only few of them. (2) Whether the study is limited to find cause for sickness or also to prescribe certain prescriptions etc.

• Justification of the problem: - Many a time research studies are put to the test of justification or relevance. In the scientific curiosity of the problems, th problem that needs urgent solution must be given preference.

• Feasibility of the problem: - Although a problem needs urgent attention and is justifiable in several respects, one has to consider the feasibility of the same. Feasibility means the possibility of conducting the study successfully. The elements of time, data, Cost is to be taken into consideration before a topic is selected for study.

• Originality of the problem: - In social sciences, particularly in commerce and management, there is no systematic compilation of the works already done or on hand. Two people may be doing a work more or less on similar topic. In such situations it is not advisable to continue work in the same manner. What is advisable is that, each of them should try to focus ondifferent aspects, so that they could enrich the field of knowledge with their studies. Another problem faced by a researcher is that a problem which he intends to do is already worked out. Should he repeat the same or not? This depends upon the situation or circumstances which engage his attention.

Relevant Variables

A variable is a measurable concept such as height, age, income etc. it takes quantitative values. It may vary from individuals to individuals or groups to groups. When there are two variables in a study such that the values of one variable change in response to the change in the values of the other variable, then the former is said to be depending variable and latter is said to be independent variable. A variable may be discrete or continuous. When a variable assumes only certain specified values in an interval, it is called discrete variable. But a continuous variable is one which can assume any number of values in an interval.

Extraneous variables: Besides the independent variable, a dependent variable can be influenced by other variables, which are not part of the study. They are called extraneous variable. They are variables working from outside.

Unit of analysis: A variable can be measured and analyzed by statistical units. The statistical units used for analysis and interpretation are known as units of analysis. Rations percentages, coefficients etc are such units. They can be used for the purpose of comparison.

Proposition

Propositions are statements concerned with the logical relationships among concepts. A proposition explains the logical linkage among certain concepts by a universal connection between concepts. Concepts are the basic units of theory development.

Types of Research

Research may be broadly classified as (1) Fundamental and Applied Research (2) Descriptive and Analytical Research or (3) Quantitative and Qualitative Research or (4) Conceptual and Empirical Research

Fundamental (or Basic) and Applied Research

Fundamental research is mainly concerned with generalization with the formulation of a theory. It is a research concerning principles or laws or rules. It aims at the achievement of knowledge and truth. Research studies concentrating on some natural phenomenon or relating to pure mathematics are examples of fundamental research. It aims at some theoretical conclusions. It may verify the old theory or establish a new one. It tries to explain the cause and effect relationship in

social phenomena. It is essentially positive and not normative. That is, it explains the phenomena as they are and not as they should be.

Applied research is concerned with the solution of particular problems. It aims at finding a solution for an immediate problem facing a society or an industrial organization. It is empirical and practical. It is concerned with applied aspects of life. Research to identify social, economic or political trends that may affect a particular institution or the marketing research are examples of applied research.

Exploratory research and causal research

Exploratory research is research conducted for a problem that has not been studied more clearly, intended to establish priorities, develop operational definitions and improve the final research design. Exploratory research helps determine the best research design, data-collection method and selection of subjects. It should draw definitive conclusions only with extreme caution.

Causal research: The objective of causal research is to test hypotheses about cause-and-effect relationships. If the objective is to determine which variable might be causing a certain behavior, i.e. whether there is a cause and effect relationship between variables, causal research must be undertaken. In order to determine causality, it is important to hold the variable that is assumed to cause the change in the other variable(s) constant and then measure the changes in the other variable(s). This type of research is very complex and the researcher can never be completely certain that there are not other factors influencing the causal relationship, especially when dealing with people's attitudes and motivations. There are often much deeper psychological considerations, that even the respondent may not be aware of this is not true.

Descriptive Research and Analytical Research

Descriptive research includes survey and fact finding enquiries of different kinds. It describes the state of affairs as it exists at present. The researcher has no control over the variables. He can only report what has happened or what is happening.

In Analytical research one has to use facts or information already available and analyse these to make a critical evaluation of the material.

Quantitative Research and Qualitative Research

Quantitative research is applicable to phenomena that are measurable so that they can be expressed in terms of quantity.

Qualitative research is concerned with qualitative phenomenon. Research designed to find out how people feel or what they think about a particular subject is a qualitative research. Qualitative research is especially important in the behavioural sciences where the aim is to discover underlying motives of human behaviour.

Conceptual Research and Empirical Research

Conceptual research is that related to some abstract ideas or theory. It is generally used by philosophers and thinkers to develop new concepts or to interpret existing ones.

Empirical research relies on experience or observation alone. It is data based research coming up with conclusions capable of being verified by observation or experiment. It can be experiment research. In empirical research, the researcher has to first set up a hypothesis or guess as to the probable results. He then works out to get enough facts to prove or disprove his hypothesis. Empirical studies have a great potential for they lead to inductions and deductions. Thus research enables one to develop theories and principles and to arrive at generalizations. As research is based on observations and empirical evidences it improves knowledge and understanding as well as decision making skill and ability.

Phases of business research

The important phases of business research consists of

- Problem definition
- Development of an approach to the problem
- Research design formulation
- Data collection
- Data preparation and analysis
- Report preparation and presentation

Research hypothesis

Ordinarily, when one talks about hypothesis, one simply means a mere assumption or some suppositionto be proved or disproved. But for a researcher hypothesis is a formal question that he

intends to resolve. Thus a hypothesis may be defined as a proposition or a set of proposition set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation or accepted as highly probable in the light of established facts. Quite often a research hypothesis is a predictive statement, capable of being tested by scientific methods, that relates an independent variable to some dependent variable.

Characteristics of hypothesis:

Hypothesis must possess the following characteristics:

(i) Hypothesis should be clear and precise. If the hypothesis is not clear and precise, the inferences drawn on its basis cannot be taken as reliable.

(ii) Hypothesis should be capable of being tested. In a swamp of untestable hypotheses, many a time the research programmes have bogged down. Some prior study may be done by researcher in order to make hypothesis a testable one. A hypothesis "is testable if other deductions can be made from it which, in turn, can be confirmed or disproved by observation."1

(iii) Hypothesis should state relationship between variables, if it happens to be a relational hypothesis.

(iv) Hypothesis should be limited in scope and must be specific. A researcher must remember that narrower hypotheses are generally more testable and he should develop such hypotheses.

(v) Hypothesis should be stated as far as possible in most simple terms so that the same iseasily understandable by all concerned. But one must remember that simplicity of hypothesishas nothing to do with its significance.

(vi) Hypothesis should be consistent with most known facts i.e., it must be consistent with a substantial body of established facts. In other words, it should be one which judges accept as being the most likely.

(vii) Hypothesis should be amenable to testing within a reasonable time. One should not use even an excellent hypothesis, if the same cannot be tested in reasonable time for one cannot spend a life-time collecting data to test it.

(viii) Hypothesis must explain the facts that gave rise to the need for explanation. This means that by using the hypothesis plus other known and accepted generalizations, one should be able to deduce the original problem condition. Thus hypothesis must actually explain what it claims to explain; it should have empirical reference.

Different Types of Hypothesis

- Descriptive Hypothesis – Describing the characteristics of a variable (may be an object, person, organisation, event, and situation) • Eg. Employment opportunity of commerce graduates is more than the arts students.

- Relational Hypothesis – Establishes relationship between two variables. It may be positive, negative or nil relationship. • Eg. High income leads to high savings.
- Causal Hypothesis – The change in one variable leads to change in another variable i.e. Dependent and independent variables, one variable is a cause and the other one is the effect.
- Statistical Hypothesis – association or difference between two variables are hypothesized
- Null Hypothesis – it points out there is no difference between two populations in respect of same property.
- Alternative Hypothesis- when we reject the null hypothesis, we accept another hypothesis known as alternate hypothesis.
- Working Hypothesis.

Theory

Theory is defined as a set of systematically interrelated concepts, definitions and propositions that are advanced to explain and predict a phenomenon. It may also specify causal relationship among variables. A theory is an integrated body of definitions, assumptions, and general propositions covering a given subject matter from which a comprehensive and consistent set of specific and testable principles can be deducted logically. This theory provides a basis for studying consumer behaviour and formulating appropriate marketing strategies.

Requisites (Criteria) of Theory

Theory starts out as ideas. The criteria to be met by the set of ideas are:

1. They must be logically consistent.
2. They must be interrelated.
3. The statements must be exhaustive.
4. The propositions should be mutually exclusive.
5. They must be capable of being tested through research.

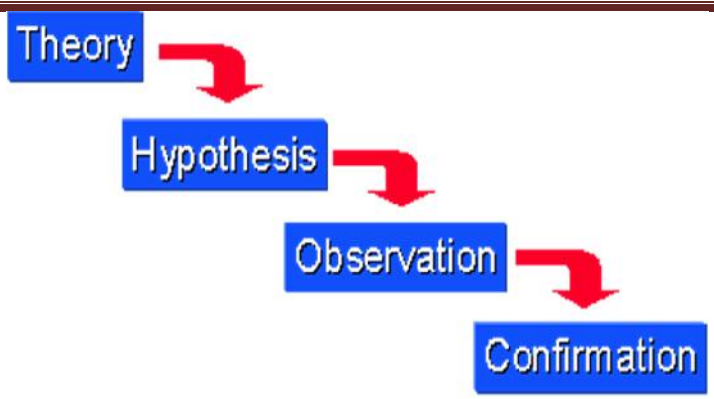
Methods of Formation of Theory

Deduction: It is one of the important methods employed in theory building. It is a process of drawing generalizations, through a process of reasoning on the basis of certain assumptions which are either self evident or based on observation. By deduction, is meant reasoning or inference from the general to particular or from the universal to the individual.

Eg., All men are mortal (Major Premise)

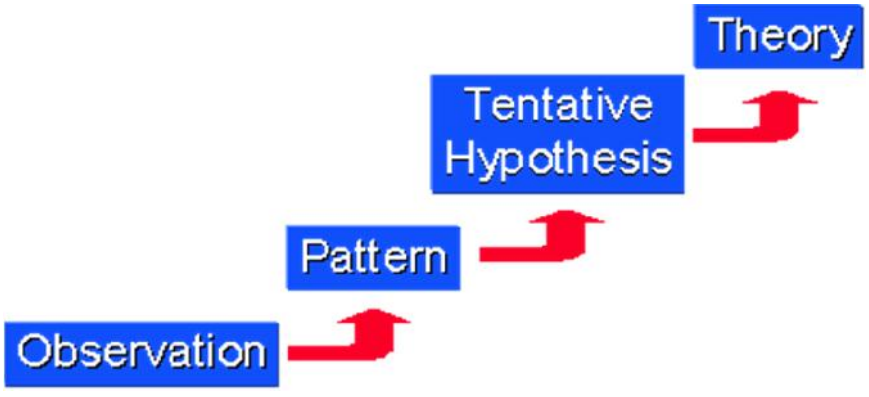
A is a man (Minor premise)

Therefore A is mortal (Conclusion)



The conclusion follows from the two premises logically. Therefore it is valid. The deduction is the logical conclusion obtained by deducting it from the statements, called premise of the argument. The argument is so constructed that if the premises are true, conclusion must also be true. The logical deduction derives only conclusions from given premises and it cannot affirm the truth of given statements. It serves in connecting different truths and thus logical derivation is not a means to find ultimate truth.

Induction: It is the process of reasoning from a part to the whole, from particular to general or from the individual to the universal. It gives rise to empirical generalizations. It is a passage from observed to unobserved. It involves two processes namely observation and generalization. Induction may be regarded as a method by means of which material truth of the premises is established. Generating ideas from empirical observation is the process of induction. As a matter of fact, concepts can be generated from experience which justifies the description of particular situations towards theory- building. It is generally observed that experience is regarded as a sum of individual observations held together by the loose tie of association and constantly extended by the idea of inductive inferences.



It is generally stated that knowledge is based on the foundations of particular facts. In empirical sciences, we start from the consideration of a single case, go on to prove many cases. Consider the following illustration. “I saw a raven in black colour. Other revens seen by me were also black in colour”. “All ravens are therefore black”.

Inductive method is classified into two types- enumerative induction and analytical induction.

Retroduction: It is a technique of successive approximation by which, the concepts and assumptions of theories are brought into closer alignment with relevant evidence. At the same time it maintains the logical consistency required of deductive systems.

Research in an evolutionary perspective

A research is the gathering of information or evidence for ascertaining an assumption or verifying some hypothesis. No research can be purely new, as even original discoveries are an extension of the research already undertaken, being shaped generally as expressing agreement or denial or natural addition. The following examples indicate the contribution done by eminent researchers in different fields. Archimedes introduced the Archimedes principles. AryaBhatta found digit 0. In management Hamel and CK Prahld introduced core competence model. In marketing four P’s was introduced by EJ McCarthy. There is no end for this list. Research is an on going activity in every field. Research helps to acquire knowledge and it helps to change the world into global village. Acquired human knowledge does not flow backwards. It will flow. So it’s a continuum.

CHAPTER II

RESEARCH DESIGN

MEANING OF RESEARCH DESIGN

The formidable problem that follows the task of defining the research problem is the preparation of the design of the research project, popularly known as the "research design". Decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study constitutea research design. "A research design is the arrangement of conditions for collection and analysis ofdata in a manner that aims to combine relevance to the research purpose with economy in procedure."

In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data. As such the design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data. More explicitly, the decisions happen to be in respect of:

(i) What is the study about?

(ii) Why is the study being made?

(iii) Where will the study be carried out?

(iv) What type of data is required?

(v) Where can the required data be found?

(vi) What periods of time will the study include?

(vii) What will be the sample design?

(viii) What techniques of data collection will be used?

(ix) How will the data be analysed?

(x) In what style will the report be prepared?

Keeping in view the above stated design decisions; one may split the overall research design into the following parts:

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

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

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

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

From what has been stated above, we can state the important features of a research design asunder:

(i) It is a plan that specifies the sources and types of information relevant to the research problem.

(ii) It is a strategy specifying which approach will be used for gathering and analysing the data.

(iii) It also includes the time and cost budgets since most studies are done under these two constraints.

In brief, research design must, at least, contain—(a) a clear statement of the research problem; (b) procedures and techniques to be used for gathering information; (c) the population to be studied; and (d) methods to be used in processing and analysing data.

FEATURES OF A GOOD DESIGN

A good design is often characterised by adjectives like flexible, appropriate, efficient, economical and so on. Generally, the design which minimises bias and maximises the reliability of the data collected and analysed is considered a good design. The design which gives the smallest experimental error is supposed to be the best design in many investigations. Similarly, a design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered most appropriate and efficient design in respect of many research problems. Thus, the question of good design is related to the purpose or objective of the research problem and also with the nature of the problem to be studied. A design may be quite suitable in one case, but may be found wanting in one respect or the other in the context of some other research problem. One single design cannot serve the purpose of all types of research problems.

A research design appropriate for a particular research problem, usually involves the consideration of the following factors:

(i) the means of obtaining information;

(ii) the availability and skills of the researcher and his staff, if any;

(iii) the objective of the problem to be studied;

(iv) the nature of the problem to be studied; and

(v) the availability of time and money for the research work.

If the research study happens to be an exploratory or a formulative one, wherein the major emphasis is on discovery of ideas and insights, the research design most appropriate must be flexible enough to permit the consideration of many different aspects of a phenomenon. But when the purpose of a study is accurate description of a situation or of an association between variables (or in what arecalled the descriptive studies), accuracy becomes a major consideration and a research design which minimises bias and maximises the reliability of the evidence collected is considered a good design.

Important concepts relating to research design

Before describing the different research designs, it will be appropriate to explain the various concepts relating to designs so that these may be better and easily understood.

1. Dependent and independent variables: A concept which can take on different quantitative values is called a variable. As such the concepts like weight, height, income are all examples ofvariables. Qualitative phenomena (or the attributes) are also quantified on the basis of the presenceor absence of the concerning attribute(s). Phenomena which can take on quantitatively different values even in decimal points are called 'continuous variables'. But all variables are not continuous. If they can only be expressed in integer values, they are non-continuous variables or in statistical language 'discrete variables'. Age is an example of continuous variable, but the number of childrenis an example of non-continuous variable. If one variable depends upon or is a consequence of the other variable, it is termed as a dependent variable, and the variable that is antecedent to the dependent variable is termed as an independent variable.

2. Extraneous variable: Independent variables that are not related to the purpose of the study, butmay affect the dependent variable are termed as extraneous variables. Suppose the researcher wants to test the hypothesis that there is a relationship between children's gains in social

studies achievement and their self-concepts. In this case self-concept is an independent variable and social studies achievement is a dependent variable. Intelligence may as well affect the social studies achievement, but since it is not related to the purpose of the study undertaken by the researcher, it will be termed as an extraneous variable. Whatever effect is noticed on dependent variable as a result of extraneous variable(s) is technically described as an 'experimental error'.

3. Control: One important characteristic of a good research design is to minimise the influence or effect of extraneous variable(s). The technical term 'control' is used when we design the study minimising the effects of extraneous independent variables. In experimental researches, the term 'control' is used to refer to restrain experimental conditions.

4. Confounded relationship: When the dependent variable is not free from the influence of extraneous variable(s), the relationship between the dependent and independent variables is said to be confounded by an extraneous variable(s).

5. Research hypothesis: When a prediction or a hypothesised relationship is to be tested by scientific methods, it is termed as research hypothesis. The research hypothesis is a predictive statement thatrelates an independent variable to a dependent variable. Usually a research hypothesis must contain, at least, one independent and one dependent variable. Predictive statements which are not to be objectively verified or the relationships that are assumed but not to be tested are not termed research hypotheses.

6. Experimental and non-experimental hypothesis-testing research: When the purpose of research is to test a research hypothesis, it is termed as hypothesis-testing research. It can be of the experimental design or of the non-experimental design. Research in which the independent variable is manipulated is termed 'experimental hypothesis-testing research' and a research in which an independent variable is not manipulated is called 'non-experimental hypothesis-testing research'.

7. Experimental and control groups: In an experimental hypothesis-testing research when a group is exposed to usual conditions, it is termed a 'control group', but when the group is exposed tosome novel or special condition, it is termed an 'experimental group'. In the above illustration, theGroup A can be called a control group and the Group B an experimental group. If both groups A and B are exposed to special studies programmes, then both groups would be termed 'experimental groups.' It is possible to design studies which include only experimental groups or studies which include both experimental and control groups.

8. **Treatments:** The different conditions under which experimental and control groups are put are usually referred to as 'treatments'. In the illustration taken above, the two treatments are the usual studies programme and the special studies programme. Similarly, if we want to determine through an experiment the comparative impact of three varieties of fertilizers on the yield of wheat, in that case the three varieties of fertilizers will be treated as three treatments.

9. **Experiment**: The process of examining the truth of a statistical hypothesis, relating to some research problem, is known as an experiment.

10. **Experimental unit**(s): The pre-determined plots or the blocks, where different treatments are used, are known as experimental units. Such experimental units must be selected (defined) very carefully.

DIFFERENT RESEARCH DESIGNS

Different research designs can be conveniently described if we categorize them as:

(1) research design in case of exploratory research studies;

(2) research design in case of descriptive and diagnostic research studies, and

(3) research design in case of hypothesis-testing research studies.

We take up each category separately.

1. **Research design in case of exploratory research studies**: Exploratory research studies are also termed as formulative research studies. The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the working hypotheses from an operational point of view. The major emphasis in such studies is on the discovery of ideas and insights. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. Inbuilt flexibility in research design is needed because the research problem, broadly defined initially, is transformed into one with more precise meaning in exploratory studies, which fact may necessitate changes in the research procedure for gathering relevant data. Generally, the following three methods in the context of research design for such studies are talked about: (a) the survey of concerning literature; (b) the experience survey and (c) the analysis of 'insight-stimulating' examples.

Categories of Exploratory Research

1. Experience Surveys: - Issues and ideas may be discussed with persons who have had personal experience in the field.
2. Secondary data analysis:- Another quick and economical source of background information is existing literature containing data that has been compiled for some purpose other than the purpose in hand
3. Case Study method: -obtains information from one or a few situations that are similar to the problem situation. Primary advantage is that an entire organisation or entity can be investigated in depth and with meticulous attention to detail.
4. Pilot Studies are used in different types of designs. - Within the context of exploratory research it covers some part of the research on a small scale. Major categories of pilot study include focus group interviews, projective techniques, and depth interviews.

Categories of Pilot Studies

1. Focus Group interviews: - Unstructured, free flowing, group dynamic sessions that allow individuals the opportunity to initiate the topics of discussion. There is synergistic and spontaneous interaction among the respondents. Found to be highly advantageous.
2. Projective techniques; - An indirect means of questioning the respondents. Uses word association tests, sentence completion test, third person test, role playing technique and Thematic Apperception Test.
3. Depth interviews:- unstructured, extensive interviews that encourage an individual to talk freely and in depth about a topic.

2. Research design in case of descriptive and diagnostic research studies: Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group, whereas diagnostic research studies determine the frequency with which something occurs or its association with something else. The studies concerning whether certain variables are associated are examples of diagnostic research studies. As against this, studies concerned with specific predictions, with narration of facts and characteristics concerning individual, group orsituation are all examples of descriptive research studies. Most of the social research comes underthis category. From the point of view of the research design, the descriptive as well as diagnostic studies share common requirements and as such we may group together these two types of research studies. In descriptive as well as in diagnostic studies, the researcher must be able to define clearly,

what he wants to measure and must find adequate methods for measuring it along with a clear cut definition of 'population' he wants to study.

The design in such studies must be rigid and not flexible and must focus attention on the following:

(a) Formulating the objective of the study (what the study is about and why is it being made?)

(b) Designing the methods of data collection (what techniques of gathering data will be adopted?)

(c) Selecting the sample (how much material will be needed?)

(d) Collecting the data (where can the required data be found and with what time period should the data be related?)

(e) Processing and analysing the data.

(f) Reporting the findings.

Research Design	Exploratory of Formulative	Descriptive/Diagnostic
Overall design	Flexible design (design must provideopportunity for considering different aspects of the problem)	Rigid design (design must make opportunity for considering different enough provision for protection aspects of the problem) against bias and must maximise reliability)
(i) Sampling design	Non-probability sampling design (purposive or judgement sampling) No pre-planned design for analysis	Probability sampling design (random sampling)
(ii) Statistical design	Unstructured instruments forcollection of data	Pre-planned design for analysis
(iii) Observationaldesign	No fixed decisions about theoperational procedures	Structured or well thought out collection of data instruments for collection of data
(iv) Operational design		Advanced decisions about operational procedures.

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

4.Research design in case ofCausal research: It is used to obtain evidence of cause-and-effect relationships with is otherwise known as the independent-dependent relationship or the

predictive relationships. This is an important type of research useful for marketers as this allows marketers to base their decision on assumed causal relationships. Causal research is done in the following situations : **(a)** To identify which variables are the cause and which are the effect. In statistical terms, causal variables are called independent variables and effectual variables are called dependent variables. **(b)** To determine the nature of the relationship between the causal variables and the effect to be predicted. Causal research requires a strong degree of planning on the design as its success depends onthe structure of the design.

VALIDITY

Internal Validity – The degree to which changes in the dependent variable are affected by the manipulated independent variable. Maintaining high internal validity means controlling for all other independent variables other than the one(s) being studied

External Validity – The degree to which the results of a study can be generalized to the "real world". Factors that negatively affect external validity also negatively affect the generalizability of the results. Instrument Validity Does an instrument measure what it is supposed to measure? Four types of instrument validity are as follows:

–Construct

–Criterion related

–Content–Inter-rater / Intra-rater

Construct Validity : It is the most important type of validity. Construct validity is the degree to which the instrument actually measures whether or not an underlying construct is being measured. For example, does a math test actually measure math achievement? Does a personality test actually measure personality?

Criterion Related Validity Criterion Related Validity is of two types:-

- Concurrent validity–Degree to which scores on one test are correlated with scores on another test administered at the same time. Only one group is used.
- Predictive validity–Degree to which scores on one test predicts scores on a test administered in the future. Only one group is used.

RELIABILITY

Reliability is the consistency with which an instrument measures the construct or content area it is intended to measure. Reliability is established using such techniques as

- Split-half,
- Rationale equivalence andinter-rater

Reliability is reported as a coefficient ranging from 0.00 (low) to +1.00 (high). Anything above .70is considered sufficient for most cases

Measures of Reliability

- Stability (test / re-test)
- Equivalence (alternate forms)
- Equivalence and Stability Combined
- Internal consistency
- Scorer / Rater

Variables in research

Variable is a measurable characteristic that varies. It may change from group to group, person to person, or even within one person over time. There are four common variable types:

Dependent Variables

Dependent Variables show the effect of manipulating or introducing the independent variables. For example, if the independent variable is the use or non-use of a new language teaching procedure, then the dependent variable might be students' scores on a test of the content taught using that procedure. In other words, the variation in the dependent variable depends on the variation in the independent variable.

Independent Variables

Independent Variables are those that the researcher has control over. This "control" may involve manipulating existing variables (e.g., modifying existing methods of instruction) or introducing new variables (e.g., adopting a totally new method for some sections of a class) in the research setting. Whatever the case may be, the researcher expects that the independent variable(s) will have some effect on (or relationship with) the dependent variables.

Intervening Variables

Intervening Variables refer to abstract processes that are not directly observable but that link the independent and dependent variables. In language learning and teaching, they are usually inside the subjects' heads, including various language learning processes which the researcher cannot observe. For example, if the use of a particular teaching technique is the independent variable and mastery of the objectives is the dependent variable, then the language learning processes used by the subjects are the intervening variables.

Moderating Variables

Moderating Variables affect the relationship between the independent and dependent variables by modifying the effect of the intervening variable(s). Unlike extraneous variables, moderator variables are measured and taken into consideration. Typical moderator variables in TESL and language acquisition research (when they are not the major focus of the study) include the sex, age, culture, or language proficiency of the subjects.

MEASUREMENT IN RESEARCH

In our daily life we are said to measure when we use some yardstick to determine weight, height, or some other feature of a physical object. We also measure when we judge how well we like a song, a painting or the personalities of our friends. We, thus, measure physical objects as well as abstract concepts. Measurement is a relatively complex and demanding task, specially so when it concerns qualitative or abstract phenomena. By measurement we mean the process of assigning numbers to objects or observations, the level of measurement being a function of the rules under which the numbers are assigned.

Measurement is defined as the assignment of numbers to characteristics of objects or events according to rules. The definition of measurement clearly states that the researcher should know that the measurement scale measures the characteristics of the objects or event and not the objects or events.

Level of Measurement

I. Nominal scales
II. Ordinal scales
III. Interval scales
IV. Ratio scale

1. Nominal scale are categorical scales used to identify, label or categorise objects or persons or events. A familiar example is the use of alternative numbering system by our Physical Education Teacher in our school days to engage us in a game. The teacher as a result would form two groups one labelled 1 and the other 2. The numbers 1 and 2 are assigned to two groups and the members belonging to group 1 would exclusively be a part of group 1 and the members belonging to group 2 would exclusively be a part of group 2. However, assigning the numbers does not indicate any order or position to the group it represents. Interchanging the numbers otherwise would also result in the same effect in that, the order or position would not change. Nominal scales are the lowest form of measurement. The simple rule to be followed while developing a nominal scale: Do not assign the same numerals to different objects or events or different numbers to the same object or event. In marketing nominal scales are used substantially in many occasions. For example, nominal scale is used to identify and classify brands, sales regions, awareness of brands, working status of women etc.
2. Ordinal scale is a ranking scale that indicates ordered relationship among the objects or events. It involves assigning numbers to objects to indicate the relative extent to which the objects possess some characteristic. It measure whether an object or event has the same characteristic than

some other object or event. It is an improvement over nominal scale in that it indicates an order. However, this scale does not indicate on how much more or less of the characteristic various objects or events possess. The term how much refers to ranks that it do not indicate if the second rank is a close second or a poor second to the first rank. Data generated using ordinal scale appears as ranks where the object which has ranked first has more of the characteristic as compared to those objects ranked second or third. Hence, the important feature of ordinal scale over nominal scale is that it indicates relative position, not the magnitude of the difference between the objects. In research, ordinal scales are used to measure relative attitudes, opinions, perceptions etc.,

3. Interval scale is otherwise called as rating scale. It involves the use of numbers to rate objects or events. It interval scales, numerically equal distances on the scale represent equal values in the characteristic being measured. Interval scale is an advancement over the ordinal scale that it has all the properties of an ordinal scale plus it allows the researcher to compare the differences between objects. It also possesses the property of equality of difference between each levels of measurement. The feature of this scale is that the difference between any two scale values is identical to the difference between any other two adjacent values of an interval scale. Examples of interval scales are the Fahrenheit and Celsius scales.
4. Ratio scales differ from interval scales in that it has a natural/absolute zero. It possesses all the properties of the normal, ordinal and interval scales. Data generated using ratio scales may be identified, classified into categories, ranked and compared with others properties. It could also be expressed in terms of relativity in that one can be expressed in terms of a division of the other. Hence, it may be called as relative scales.

Sources of Error in Measurement

Measurement should be precise and unambiguous in an ideal research study. This objective, however, is often not met with in entirety. As such the researcher must be aware about the sources of error in measurement. The following are the possible sources of error in measurement.

(a) Respondent: At times the respondent may be reluctant to express strong negative feelings or it is just possible that he may have very little knowledge but may not admit his ignorance. All this reluctance is likely to result in an interview of 'guesses.' Transient factors like fatigue, boredom, anxiety, etc. may limit the ability of the respondent to respond accurately and fully.

(b) Situation: Situational factors may also come in the way of correct measurement. Any condition which places a strain on interview can have serious effects on the interviewer-respondent rapport. For instance, if someone else is present, he can distort responses by joining in or merely by being present. If the respondent feels that anonymity is not assured, he may be reluctant to express certain feelings.

(c) Measurer: The interviewer can distort responses by rewording or reordering questions. His behaviour, style and looks may encourage or discourage certain replies from respondents. Careless mechanical processing may distort the findings. Errors may also creep in because of incorrect coding, faulty tabulation and/or statistical calculations, particularly in the data-analysis stage.

(d) Instrument: Error may arise because of the defective measuring instrument. The use of complex words, beyond the comprehension of the respondent, ambiguous meanings, poor printing, inadequate space for replies, response choice omissions, etc. are a few things that make the measuring instrument defective and may result in measurement errors. Another type of instrument deficiency is the poor sampling of the universe of items of concern.

Construction of instrument

Instrument is the general term that researchers use for a measurement device (survey, test, questionnaire, etc.). Instruments fall into two broad categories, researcher-completed and subject-completed, distinguished by those instruments that researchers administer versus those that are completed by participants. Researchers chose which type of instrument, or instruments, to use based on the research question.

Researcher-completed Instruments	**Subject-completed Instruments**
Rating scales	Questionnaires
Interview schedules/guides	Self-checklists
Tally sheets	Attitude scales
Flow charts	Personality inventories
Performance checklists	Achievement/aptitude tests
Time-and-motion logs	Projective devices
Observation forms	Sociometric devices

Tests of Sound Measurement

Sound measurement must meet the tests of validity, reliability and practicality. In fact, these are the three major considerations one should use in evaluating a measurement tool. “Validity refers to the extent to which a test measures what we actually wish to measure. Reliability has to do with the accuracy and precision of a measurement procedure.

1. Test of Validity

Validity is the most critical criterion and indicates the degree to which an instrument measures what it is supposed to measure. Validity can also be thought of as utility. In other words, validity is the extent to which differences found with a measuring instrument reflect true differences among those being tested. But one can certainly consider three types of validity in this connection: (i) Content validity; (ii) Criterion-related validity and (iii) Construct validity.

2. Test of Reliability

The test of reliability is another important test of sound measurement. A measuring instrument is reliable if it provides consistent results. Reliable measuring instrument does contribute to validity, but a reliable instrument need not be a valid instrument. For instance, a scale that consistently over weighs objects by five kgs., is a reliable scale, but it does not give a valid measure of weight. But the other way is not true i.e., a valid instrument is always reliable. Accordingly reliability is not as valuable as validity, but it is easier to assess reliability in comparison to validity.

3. Test of Practicality

The practicality characteristic of a measuring instrument can be judged in terms of economy, convenience and interpretability. From the operational point of view, the measuring instrument ought to be practical i.e., it should be economical, convenient and interpretable. Economy consideration suggests that some trade-off is needed between the ideal research project and that which the budget can afford. The length of measuring instrument is an important area where economic pressures are quickly felt.

Approaches of Scale Construction

Different methods or approaches of constructing scales or tests have been described over the past half-century. These different methods constitute alternate ways of analyzing items from a scale, retaining items that assess a construct well and deleting items that do not.

Arbitrary approach

Arbitrary scales are developed on ad hoc basis and are designed largely through the researcher's own subjective selection of items. The researcher first collects few statements or items which he believes are unambiguous and appropriate to a given topic. Some of these are selected for inclusion in the measuring instrument and then people are asked to check in a list the statements with which they agree. The chief merit of such scales is that they can be developed very easily, quickly and with relatively less expense.

Consensus approach

Under such an approach the selection of items is made by a panel of judges who evaluate the items in terms of whether they are relevant to the topic area and unambiguous in implication.

Item analysis approach

In item analysis approach 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.

Cumulative scales

Cumulative scales like other scales, consist of series of statements to which a respondent expresses his agreement or disagreement. The special feature of this type of scale is that statements in it form a cumulative series. This, in other words, means that the statements are related to one another in such a way that an individual, who replies favourably to say item No. 3, also replies favourably to items No. 2 and 1, and one who replies favourably to item No. 4 also replies favourably to items No. 3, 2 and 1, and so on.

Factor Scales

Factor scales are developed through factor analysis or on the basis of intercorrelations of items which indicate that a common factor accounts for the relationships between items. Factor scales are particularly "useful in uncovering latent attitude dimensions and approach scaling through the concept of multiple-dimension attribute space."

Frequently used Scaling techniques

Scales are devised for measuring variable in social science research. Scaling is the procedure fordetermining the quantitative measure of abstract concepts like leadership style, brand image ofproduct etc. It is therefore-

• Any series of items which is progressively arranged according to value or magnitude intowhich an item can be placed according to its quantification.

• A continuous spectrum or series of categories

• Used to represent, usually quantitatively, an item's or person's place in that spectrum

We now take up some of the important scaling techniques often used in the context of research specially in context of social or business research.

Rating scales :

The rating scale involves qualitative description of a limited number of aspects of a thing or of traits of a person. When we use rating scales (or categorical scales), we judge an object in absolute terms against some specified criteria i.e., we judge properties of objects without reference to other similar objects. These ratings may be in such forms as "like-dislike", "above average, average, below average", or other classifications with more categories such as "like very much—like some what—neutral—dislike somewhat—dislike very much"; "excellent—good—average—below average—poor", "always—often—occasionally—rarely—never", and so on. There is no specific rule whether to use a two-points scale, three-points scale or scale with still more points. In practice, three to seven points scales are generally used for the simple reason that more points on a scale provide an opportunity for greater sensitivity of measurement.

Ranking Scales:

Ranking scales are identical to rating scales. In ranking scales, we make relative the score will place judgements against other similar objects. There are two generally used approaches of ranking scales namely.

1.Method of Paired Comparison where the respondent can express his attitude by making a choice between two objects.

2.Method of Ranking Order where the respondents are asked to rank their choices.

Attitude Scales :

In this type of scale, the attitude of an individual towards a matter can be known from the score of his responses given on a questionnaire. The score will place him in a scale. He simply expresses his likes or dislikes, agreement or disagreement with the issue involved as given in the forms of questions. On the basis of reply, he is assigned a score which indicates his position. In the attitude scale some relevant statements are to be considered by the respondents. The statements are found in such a wayas to be intimately related to the attribute which is sought to be measured.

Factor Scaling :

This is a type of scaling in which multi dimensions of a complex attitude is identified.

Likert Scale

Respondents indicate their attitude by checking how strongly they agree or disagree with carefully constructed statements that range from the very positive to the very negative towards the attitudinal object. Individuals generally choose from five alternatives: strongly agree, agree, uncertain, disagree and strongly disagree.

Semantic Differential

An attitude measure consisting of a series of seven – point bipolar rating scales allowing response to a concept. Bi Polar adjectives such as "good and bad", "clean or dirty" anchor the beginning and end poles of the scale.

Numerical Scales

An attitude rating scale similar to a semantic differential except that it uses numbers as response options to identify response positions instead of verbal descriptions. Usually five point scale or seven point scale

Dichotomous scale

Dichotomous scale is used to draw out a Yes or No answer. A nominal scale is used to elicit the response.

CHAPTER III

DATA COLLECTION

The task of data collection begins after a research problem has been defined and research design/plan chalked out. While deciding about the method of data collection to be used for the study, the researcher should keep in mind two types of data viz., primary and secondary. The primary data are those which are collected afresh 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.

Methods of Data Collection

1. Primary data collection
2. Secondary data collection

Collection of Primary Data

Primary data are those data which are collected for the first time and these are in original in character.

Methods of Collecting Primary Data

1. Observation
2. Interview
3. Questionnaire
4. Schedule
5. Experimentation
6. Simulation
7. Use of telephone
8. Panel method
9. Mail survey
10. Projective technique
11. Sociometry
12. Focus group discussion
13. Content analysis

OBSERVATION

Observation is the systematic viewing of specific phenomenon in its proper setting for the specific purpose of gathering data for a particular study.

Features of observation

• Physical & mental activity

• Selective

• Purposive & not informal

• Grasps the significant events & occurrences

• Should be exact & based on standardized tools of research

Types of observation

1. Simple and systematic
2. Subjective and objective
3. Casual and scientific
4. Intra subjective and inter subjective
5. Factual and inferential
6. Direct and indirect
7. Participant and non participant
8. Structured and unstructured

Advantages

• Actual or habits of person are observed

• Obtain information from those who are unable to effectively communicate in written or oral form

• No better way to gather information than through observation

• Most reliable method of data collection

Disadvantages

• Result of observation depends on the skill of the observer

• Options and attitudes cannot be obtained by observation

• It should be expensive to tie up personnel in such tasks

• The researcher's findings are limited to those observed

Component of process of observation

1. Sensation : it is gained through sense organs. It depends upon the physical attentiveness and keenness of observer.
2. Attention: it depends upon the ability of the observer to concentrate on concerned studies.
3. Perception: it comprises the interpretation of sensory reports.

EXPERIMENTAL METHOD

It is the least used method for collecting primary data. This method is commonly used by marketers in test marketing.

Types;

1. Laboratory experiments
2. Field experiments

Laboratory experiment

A laboratory experiment is an investigation conducted in situation created specifically for that purpose

Field experiment

This is an experiment conducted in real life situation in which the experiments manipulate an independent variable in order to test a hypothesis

Advantages of experimental method

• the power to determine the causal relationship between variables is more compared with other methods

• The human errors can be reduced to the minimum

• It helps to produce exact measurement

Limitations of experimental method

• Difficult to establish comparable control & experimental group

• Limited scope

• Lacks realism

• Cannot be used for future study

• Not used for determine opinion,motive & intention of individual

SURVEY

The essence of survey method can be explained as "questioning individuals on a topic or topics and then describing their responses". In business studies survey method of primary data collection is used in order to test concepts, reflect attitude of people, establish the level of customer satisfaction, conduct segmentation research and a set of other purposes. Survey method can be used in both, quantitative, as well as, qualitative studies.

Types of Survey

1. Cross-sectional studies: Cross-sectional study is defined as an observational research type that analyzes data of variables collected at one given point of time across a sample population. Population or a pre-defined subset. This study type is also known as cross-sectional analysis,

transverse study or prevalence study. The data gathered in a cross-sectional study is from people who are similar in all variables except the one variable which is under study.

2. Longitudinal studies: Longitudinal study is an observational study that employs continuous or repeated measures to follow particular individuals over prolonged period of time often years or decades. Longitudinal study collects data that is either qualitative or quantitative in nature. In longitudinal study a survey creator is not interfering with survey respondents. Survey respondents are observed over a period of time ranging from months to even decades to observe any changes in them or their attitude.
3. Correlational studies: Correlational study is a non-experimental type of research design where two distinct variables are studied and a statistical analysis is run to study relation between them without the interference of external "variables". This study aims to understand the change and level of change in one of the two variables in study, if the other variable changes. It is close to impossible to understand in this research method though, that, the cause of change in either variable.

Census and Sample survey

A census is a study of every unit, everyone or everything, in a population. All items in any field of inquiry constitute a 'Universe' or 'Population.' A complete enumeration of all items in the 'population' is known as a census inquiry. It can be presumed that in such an inquiry, when all items are covered, no element of chance is left and highest accuracy is obtained.

When field studies are undertaken in practical life, considerations of time and cost almost invariably lead to a selection of respondents i.e., selection of only a few items. The respondents selected should be as representative of the total population as possible in order to produce a miniature cross-section. The selected respondents constitute what is technically called a 'sample' and the selection process is called 'sampling technique.' The survey so conducted is known as 'sample survey'.

MAIL SURVEY

A mail survey is one in which the postal service, or another mail delivery service, is used to mail the survey materials to sampled survey addresses. What is mailed usually consists of a cover letter, the survey questionnaire, and other materials, such as a postage-paid return envelope, an informational brochure to help legitimize the survey organization, detailed instructions about how to participate in the survey, and/or a non contingent cash incentive.

In some mail surveys, it is the household or the business at the address that is sampled, but in other mail surveys it is a specific person at the address who is sampled.

INTERVIEW

The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. This method can be used through personal interviews and, if possible, through telephone interviews.

Types of interview

Structured Interview

A structured interview is typically formal and organized and may include several interviewers, commonly referred to as a panel interview an interviewer who has a more structured style will usually begin with what is known as an "icebreaker" question. The icebreaker is used to relax you before the more serious questions are asked. A discussion about the weather might be used or perhaps a question about the traffic on your way to the office.

The Telephone Interview

Often companies request an initial telephone interview before inviting you in for a face to face meeting in order to get a better understanding of the type of candidate you are. The one benefit of this is that you can have your notes out in front of you. You should do just as much preparation as you would for a face to face interview, and remember that your first impression is vital. Some people are better meeting in person than on the phone, so make sure that you speak confidently, with good pace and try to answer all the questions that are asked.

The Face-to-Face Interview

This can be a meeting between you and one member of staff or even two members.

The Panel Interview

These interviews involve a number of people sitting as a panel with one as chairperson. This type of interview is popular within the public sector.

The Group Interview

Several candidates are present at this type of interview. You will be asked to interact with each other by usually a group discussion. You might even be given a task to do as a team, so make sure you speak up and give your opinion.

The Sequential Interview

These are several interviews in turn with a different interviewer each time. Usually, each interviewer asks questions to test different sets of competencies. However, if you are asked the same questions, just make sure you answer each one as fully as the previous time.

QUESTIONNAIRES

This method of data collection is quite popular, particularly in case of big enquiries. It is being adopted by private individuals, research workers, private and public organisations and even by

Governments. In this method a questionnaire is sent (usually by post) to the persons concerned with a request to answer the questions and return the questionnaire. A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms. The questionnaire is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant for the purpose in the questionnaire itself. The respondents have to answer the questions on their own.

Main aspects of a questionnaire : Quite often 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 aspects of a questionnaire viz., the general form, question sequence and question formulation and wording.

1. **General form :** So far as the general form of a questionnaire is concerned, it can either be structured or unstructured questionnaire. Structured questionnaires are those questionnaires in which there are definite, concrete and pre-determined questions. The questions are presented with exactly the same wording and in the same order to all respondents. Resort is taken to this sort of standardisation to ensure that all respondents reply to the same set of questions. The form of the question may be either closed (i.e., of the type 'yes' or 'no') or open (i.e., inviting free response) but should be stated in advance and not constructed during questioning. When these characteristics are not present in a questionnaire, it can be termed as unstructured or non-structured questionnaire.

2. Question sequence : In order to make the questionnaire effective and to ensure quality to the replies received, a researcher should pay attention to the question-sequence in preparing the questionnaire. A proper sequence of questions reduces considerably the chances of individual questions being misunderstood. 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 questions that are easiest to answer being put in the beginning. The first few questions are particularly important because they are likely to influence the attitude of the respondent and in seeking his desired cooperation. The opening questions should be such as to arouse human interest.

3. Question formulation and wording : With regard to this aspect of questionnaire, the researcher should note that each question must be very clear for any sort of misunderstanding can do irreparable harm to a survey. Question should also be impartial in order not to give a biased picture of the true state of affairs. Questions should be constructed with a view to their forming a logical part of a well thought out tabulation plan. In general, all questions should meet the following standards—(a) should be easily understood; (b) should be simple i.e., should convey only one thought at a time; (c) should be concrete and should conform as much as possible to the respondent's way of thinking.

Essentials of a good questionnaire:

- To be successful, questionnaire should be comparatively short and simple i.e., the size of the questionnaire should be kept to the minimum.
- Questions should proceed in logical sequence moving from easy to more difficult questions.
- Personal and intimate questions should be left to the end. Technical terms and vague expressions capable of different interpretations should be avoided in a questionnaire.
- Questions may be dichotomous (yes or noanswers), multiple choice (alternative answers listed) or open-ended. The latter type of questions are often difficult to analyse and hence should be avoided in a questionnaire to the extent possible.
- Thereshould be some control questions in the questionnaire which indicate the reliability of the respondent.

Type of Questions

Open-Ended questions

• The respondent is asked to provide his or her own answers.

• Open-ended questions must be coded before they can be processed for computer analysis.

Do you intend to go on an outstation holiday within the next six months?

Closed-Ended Questions

• Also known as *structured question*

• The respondents are offered a set of answers from which they are asked to select one thatmost closely represent their views.

• The response categories should be exhaustive and mutually exclusive.

• A structured question may be multiple-choice, dichotomous, or a scale.

Multiple-Choice Questions

• The researcher provides a choice of answers and respondents are asked to select one or More of the alternatives given.

Dichotomous Questions

• It has only two response alternatives:

Yes or no, agree or disagree, and so on.

Often, the two alternatives of interest are supplemented by a neutral alternative, such as "No opinion," "don't know," "both," or "none."

Contingency Question

A survey question is intended for only some respondents, determined by their responses to some other questions.

SCHEDULE

This method of data collection is very much like the collection of data through questionnaire, with little difference which lies in the fact that schedules (proforma containing a set of questions) are being filled in by the enumerators who are specially appointed for the purpose. These enumerators along with schedules go to respondents, put to them the questions from the proforma in the order the questions are listed and record the replies in the space meant for the same in the proforma. In certain situations, schedules may be handed over to respondents and enumerators may help them in recording their answers to various questions in the said schedules. Enumerators explain the aims and objects of the investigation and also remove the difficulties which any respondent may feel in understanding the implications of a particular question or the definition or concept of difficult terms.

Contents of Schedules

The schedule is divided in to three parts;

i) Introductory part : it includes (a) the introductory information about the problem under investigation and the respondent such as the name, serial number etc of the survey (b) general information about respondent like address, age, sex, education, income etc. (c) the date, place and time of interview.

ii) Main schedule : It consists of titles, columns, questions and blank tables that is meant for securing information from respondents in respect of the problem under investigation.

iii) Instructions Here, the researcher is given direction regarding the method of interview.

Secondary data

Secondary data are those which have been collected by some other persons for his purpose and published. They are usually in the shape of finished products.

Precautions to be Taken before Using Secondary Data

1. Suitability: - The investigator should satisfy him that the data available are suitable for the enquiry on hand.

2. Adequacy: - the adequacy of the data should be tested by studying the items covered by the original enquiry and the items to be covered by the enquiry.

3. Reliability:- The reliability of secondary data should be tested

Sources of Secondary Data

There are varieties of published sources from which one can get information for his research work.

The important such sources are;

1. Official report of the central, state and local Government.

2. Official publications of the foreign governments and international bodies like UNO and its

subordinate bodies.

3. Reports and publications of Trade Associations, Banks, Cooperative Societies and Similar Semi Government and Autonomous Organizations.
4. Technical journals, News papers, Books, Periodicals, etc
5. Publications of research Organizations, Centers, Institutes, and reports submitted by Economists, Research scholars etc.

Difference between Primary data and Secondary data

1. Primary data is Original in character. Secondary data is Not original
2. Collection of data is expensive in the case of primary data. Collection of secondary data is less expensive.
3. Primary data is in the shape of raw materials. Secondary data is the shape of finished products.
4. Primary data is adequate and suitable. Secondary data need no be ample and apposite.

Sampling Design

Sampling is concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population. Two advantages of sampling are that the cost is lower and data collection is faster than measuring the entire population. A Sample design is a definite plan for obtaining a sample from a given population.

Definition

According to Gerald Hursh "a Sample Design is the theoretical basis and the practical means by which we infer the characteristics of some population by generalizing from the characteristics of relatively few of the units comprising the population.

Steps in Sampling Design

1. Define the population or universe
2. State the sampling frame
3. Identify the sampling unit
4. State sampling method
5. Determine the sample size
6. Spell out the sampling plan
7. Select the sample

Population Definition

Successful statistical practice is based on focused problem definition. In sampling, this includes defining the population from which our sample is drawn. A population can be defined as including all people or items with the characteristic one wish to understand. Because there is very

rarely enough time or money to gather information from everyone or everything in a population, the goal becomes finding a representative sample (or subset) of that population.

Sometimes that which defines a population is obvious. For example, a manufacturer needs to decide whether a batch of material from production is of high enough quality to be released to the customer, or should be sentenced for scrap or rework due to poor quality. In this case, the batch is the population.

Sampling unit: A decision has to be taken concerning a sampling unit before selecting sample. Sampling unit may be a geographical one such as state, district, village, etc., or a construction unit such as house, flat, etc., or it may be a social unit such as family, club, school, etc., or it may be an individual. The researcher will have to decide one or more of such units that he has to select for his study.

Source list: It is also known as 'sampling frame' from which sample is to be drawn. It contains the names of all items of a universe (in case of finite universe only). If source list is not available, researcher has to prepare it. Such a list should be comprehensive, correct, reliable and appropriate. It is extremely important for the source list to be as representative of the population as possible.

Size of sample: This refers to the number of items to be selected from the universe to constitute a sample. This a major problem before a researcher. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility. While deciding the size of sample, researcher must determine the desired precision as also an acceptable confidence level for the estimate. The size of population variance needs to be considered as in case of larger variance usually a bigger sample is needed. The size of population must be kept in view for this also limits the sample size. The parameters of interest in a research study must be kept in view, while deciding the size of the sample. Costs too dictate the size of sample that we can draw. As such, budgetary constraint must invariably be taken into consideration when we decide the sample size.

Principles of sampling

1. Principle of 'Statastical Regularity': The principle of statistical regularity is derived from the theory of probability in mathematics. According to this principle, when a large number of items is selected at random from the universe, then it is likely to possess the same characteristics as that of the entire population.

This principle asserts that the sample selection is random, i.e. every item has an equal and likely chance of being selected.

2. Principle of 'Inertia of Large Numbers': The principle of Inertia of large numbers states that the larger the size of the sample the more accurate the conclusion is likely to be. This principle is based

on the notion, that large numbers are more stable in their characteristics than the small numbers, and the variation in the aggregate of large numbers is insignificant. It does not mean that there is no variation in the large numbers, there is, but is less than in the smaller numbers.

Probability and Non-Probability Sampling

A probability sampling is one in which every unit in the population has a chance (greater than zero) of being selected in the sample, and this probability can be accurately determined. The combination of these traits makes it possible to produce unbiased estimates of population totals, by weighting sampled units according to their probability of selection.

Example: We want to estimate the total income of adults living in a given street. We visit each household in that street, identify all adults living there, and randomly select one adult from each household. (For example, we can allocate each person a random number, generated from a uniform distribution between 0 and 1, and select the person with the highest number in each household). We then interview the selected person and find their income. People living on their own are certain to be selected, so we simply add their income to our estimate of the total. But a person living in a household of two adults has only a one-in-two chance of selection. To reflect this, when we come to such a household, we would count the selected person's income twice towards the total. (The person who is selected from that household can be loosely viewed as also representing the person who isn't selected.)

In the above example, not everybody has the same probability of selection; what makes it a probability sample is the fact that each person's probability is known. When every element in the population does have the same probability of selection, this is known as an 'equal probability of selection' (EPS) design. Such designs are also referred to as 'self-weighting' because all sampled units are given the same weight.

Probability sampling includes: Simple Random Sampling, Systematic Sampling, Stratified Sampling, Probability Proportional to Size Sampling, and Cluster or Multistage Sampling. These various ways of probability sampling have two things in common:

1. Every element has a known nonzero probability of being sampled and
2. Involves random selection at some point.

Non Probability Sampling ; - Non Probability Sampling is any sampling method where some elements of the population have no chance of selection (these are sometimes referred to as 'out of coverage'/'under covered'), or where the probability of selection can't be accurately determined. It involves the selection of elements based on assumptions regarding the population of interest, which forms the criteria for selection. Hence, because the selection of elements is nonrandom, non probability sampling does not allow the estimation of sampling errors. These conditions give rise to

exclusion bias, placing limits on how much information a sample can provide about the population. Information about the relationship between sample and population is limited, making it difficult to extrapolate from the sample to the population.

Example : We visit every household in a given street, and interview the first person to answer the door. In any household with more than one occupant, this is a nonprobability sample, because some people are more likely to answer the door (e.g. an unemployed person who spends most of theirtime at home is more likely to answer than an employed housemate who might be at work when theinterviewer calls) and it's not practical to calculate these probabilities.

Non probability sampling methods include accidental sampling, quotasampling and purposive sampling. In addition, non response effects may turn any probability design into a non probability design if the characteristics of non response are not well understood, sincenon response effectively modifies each element's probability of being sampled.

Sampling Methods

Within any of the types of frame identified above, a variety of sampling methods can beemployed, individually or in combination. Factors commonly influencing the choice between these designs include:

• Nature and quality of the frame

• Availability of auxiliary information about units on the frame

• Accuracy requirements, and the need to measure accuracy

• Whether detailed analysis of the sample is expected

• Cost/operational concerns

Simple Random Sampling

In a simple random sample (SRS) of a given size, all such subsets of the frame are given an equal probability. Each element of the frame thus has an equal probability of selection: the frame isnot subdivided or partitioned. Furthermore, any given pair of elements has the same chance ofselection as any other such pair (and similarly for triples, and so on). This minimises bias andsimplifies analysis of results. In particular, the variance between individual results within thesample is a good indicator of variance in the overall population, which makes it relatively easy toestimate the accuracy of results.

However, SRS can be vulnerable to sampling error because the randomness of the selection may result in a sample that doesn't reflect the makeup of the population. For instance, a simplerandom sample of ten people from a given country will on average produce five men and fivewomen, but any given trial is likely to over represent one sex and under represent the other.Systematic and stratified techniques, discussed below, attempt to overcome this problem by

usinginformation about the population to choose a more representative sample. SRS may also be cumbersome and tedious when sampling from an unusually large targetpopulation.

Systematic sampling: In some instances, the most practical way of sampling is to select every '*n*'th item on a list. Sampling of this type is known as systematic sampling. An element of randomness is introduced into this kind of sampling by using random numbers to pick up the unit with which to start. For instance, if a 4 per cent sample is desired, the first item would be selected randomly from the first twenty-five and thereafter every 25th item would automatically be included in the sample. Thus, in systematic sampling only the first unit is selected randomly and the remaining units of the sample are selected at fixed intervals.

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

Cluster Sampling: If the total area of interest happens to be a big one, a convenient way in which a sample can be taken is to divide the area into a number of smaller non-overlapping areas and then to randomly select a number of these smaller areas (usually called clusters), with the ultimate sample consisting of all (or samples of) units in these small areas or clusters. Thus in cluster sampling the total population is divided into a number of relatively small subdivisions which are themselves clusters of still smaller units and then some of these clusters are randomly selected for inclusion in the overall sample.

Multi-stage Sampling: Multi-stage sampling is a further development of the principle of cluster sampling. Suppose we want to investigate the working efficiency of nationalised banks in India and we want to take a sample of few banks for this purpose. The first stage is to select large primary sampling unit such as states in a country. Then we may select certain districts and interview all banks in the chosen districts. This would represent a two-stage sampling design with the ultimate sampling units being clusters of districts. If instead of taking a census of all banks within the selected districts, we select certain towns and interview all banks in the chosen towns. This would represent a three-stage sampling design. If instead of taking a census of all banks within the selected towns, we randomly sample banks from each selected town, then it is a case of using a four-stage sampling plan.

If we select randomly at all stages, we will have what is known as 'multi-stage random sampling design'.

Sequential Sampling: This sampling design is some what complex sample design. The ultimate size of the sample under this technique is not fixed in advance, but is determined according to mathematical decision rules on the basis of information yielded as survey progresses. This is usually adopted in case of acceptance sampling plan in context of statistical quality control. When a particular lot is to be accepted or rejected on the basis of a single sample, it is known as single sampling; when the decision is to be taken on the basis of two samples, it is known as double sampling and in case the decision rests on the basis of more than two samples but the number of samples is certain and decided in advance, the sampling is known as multiple sampling. But when the number of samples ismore than two but it is neither certain nor decided in advance, this type of system is often referred to as sequential sampling.

Non probability Sampling

Non-probability sampling is a sampling technique where the samples are gathered in a process that does not give all the individuals in the population equal chances of being selected.

Types of Non-Probability Sampling

Convenience Sampling: as the name suggests, this involves collecting a sample from somewhere convenient to you: the mall, your local school, your church. Sometimes called accidental sampling, opportunity sampling or grab sampling.

Purposive Sampling: where the researcher chooses a sample based on their knowledge about the population and the study itself. The study participants are chosen based on the study's purpose.

Accidental sampling; in this method the researcher simply contacts and picks up those cases which he come across and thus continuing the process till the total sample reaches a designated size.

Quota sampling is a non-probability sampling technique wherein the researcher ensures equal or proportionate representation of subjects depending on which trait is considered as basis of the quota.

Judgmental sampling is more commonly known as purposive sampling. In this type of sampling, subjects are chosen to be part of the sample with a specific purpose in mind. With judgmental sampling, the researcher believes that some subjects are more fit for the research compared to other individuals. This is the reason why they are purposively chosen as subjects.

Snowball sampling is usually done when there is a very small population size. In this type of sampling, the researcher asks the initial subject to identify another potential subject who also meets the criteria of the research. The downside of using a snowball sample is that it is hardly representative of the population.

Sample Size

The number (n) of observations taken from a population through which statistical inferences for the whole population are made. A lot of factors have to be considered while deciding the size of the sample. They are:

1. Nature of population
2. Complexity of tabulation
3. Problems related with collection of data
4. Types of sampling
5. Basic information
6. Degree of accuracy required

Errors in Sample Surveys

Survey results are typically subject to some error. Total errors can be classified into sampling errors and non-sampling errors. The term "error" here includes systematic biases as well as random errors.

Sampling Errors and Biases

Sampling errors and biases are induced by the sample design. They include:

1. Selection Bias: When the true selection probabilities differ from those assumed in calculating the results.

2. Random Sampling Error: Random variation in the results due to the elements in the sample being selected at random.

Sampling Bias

Sampling analysis involve to type of cost namely cost of collecting data and cost of an incorrect inference resulting from the data. They are to causes for incorrect inference resulting from data. They are

i. Systematic bias

ii. Sampling errors

Causes of systematic bias

- Unsuitable sample frame or source list.
- Faulty measuring device.
- Non respondent
- Indeterminacy principle.
- Usual bias in reporting data.

Sampling errors

The errors which arise due to the use of sampling survey are known as sampling errors. These are random variation in the sample estimate around the true population parameters.

Type of sampling errors

Biased errors: These errors are occurring due to the faulty selection of sampling method due to the prejudice of the researchers.

Unbiased errors: This type of bias is occurring due to chance difference between the items included in the sample.

Causes of bias

Bias may arise due to,

1. Faulty process selection.
2. Faulty work during the collection of information.
3. Faulty method of analysis.

Non-Sampling Error

Non-sampling errors are other errors which can impact the final survey estimates, caused by problems in data collection, processing, or sample design. They include:

1. Over coverage: Inclusion of data from outside of the population.
2. Under coverage: Sampling frame does not include elements in the population.
3. Measurement error: e.g. when respondents misunderstand a question, or find it difficult to answer.
4. Processing error: Mistakes in data coding.
5. Non-response: Failure to obtain complete data from all selected individuals.

After sampling, a review should be held of the exact process followed in sampling, rather than that intended, in order to study any effects that any divergences might have on subsequent analysis. A particular problem is that of non-response.

CAHPTER IV

DATA PROCESSING

Data continues to be in raw form, unless and until they are processed and analyzed. Processing is a statistical method by which the collected data is so organized the further analysis and interpretation of data become easy. It is an intermediary stage between the collection of data and their analysis and interpretation.

Processing stages

1. Editing: Editing of data is a process of examining the collected raw data (specially in surveys) to detect errors and omissions and to correct these when possible. As a matter of fact, editing involves a careful scrutiny of the completed questionnaires and/or schedules. Editing is done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as completed as possible and have been well arranged to facilitate coding and tabulation.

With regard to points or stages at which editing should be done, one can talk of field editing and central editing.

Field editing consists in the review of the reporting forms by the investigator for completing (translating or rewriting) what the latter has written in abbreviated and/or in illegible form at the time of recording the respondents' responses. This type of editing is necessary in view of the fact that individual writing styles often can be difficult for others to decipher. This sort of editing should be done as soon as possible after the interview, preferably on the very day or on the next day.

Central editing should take place when all forms or schedules have been completed and returned to the office. This type of editing implies that all forms should get a thorough editing by a single editor in a small study and by a team of editors in case of a large inquiry. Editor(s) may correct the obvious errors such as an entry in the wrong place, entry recorded in months when it should have been recorded in weeks, and the like. In case of inappropriate on missing replies, the editor can sometimes determine the proper answer by reviewing the other information in the schedule. At times, the respondent can be contacted for clarification.

2. Coding: Coding refers to the process of assigning numerals or other symbols to answers so that responses can be put into a limited number of categories or classes. Such classes should be appropriate to the research problem under consideration. They must also possess the characteristic ofexhaustiveness (i.e., there must be a class for every data item) and also that of mutual exclusively which means that a specific answer can be placed in one and only one cell in a given category set. Another rule to be observed is that of unidimensionality by which is meant that every class is defined in terms of only one concept.

Steps in coding

1. Study the answers carefully.
2. Develop a coding frame by listing the answers and by aligning codes to each of them.
3. Prepare a coding manual with the detail of variable names, codes and instructions.
4. If the coding manual has already been prepared before the collection of the data, make the required additions for the open ended and partially coded questions.

Coding rules

1. Give each respondent a code number for identification.
2. Provide code number for each question.
3. All responses including 'don't know', 'no opinion'. Etc is to be coded.
4. Assign additional codes to partially coded questions.

Classification

Classification is the process of reducing large mass of data in to homogeneous groups for meaningful analysis. It converts data from complex to understandable and unintelligible to intelligible forms. It divides data in to different groups or classes according to their similarities and dissimilarities. When the data are classified, they give summary of whole information.

Broadly speaking, there are four types of classification. They are:

(i) Geographical classification, (ii) Chronological classification,

(iii) Qualitative classification, and (iv) Quantitative classification**.**

Classification according to attributes: As stated above, data are classified on the basis of common characteristics which can either be descriptive (such as literacy, sex, honesty, etc.) or numerical (such as weight, height, income, etc.). Descriptive characteristics refer to qualitative phenomenon which cannot be measured quantitatively; only their presence or absence in an individual item can be noticed. Data obtained this way on the basis of certain attributes are known as statistics of attributes and their classification is said to be classification according to attributes.

Classification according to class-intervals: Unlike descriptive characteristics, the numerical characteristics refer to quantitative phenomenon which can be measured through some statistical units. Data relating to income, production, age, weight, etc. come under this category. Such data are known as statistics of variables and are classified on the basis of class intervals.

4. Tabulation

Tabulation is the next step to classification. It is an orderly arrangement of data in rows and columns. It is defined as the "measurement of data in columns and rows". Data presented in tabular form is much easier to read and understand than the data presented in the text the main purpose of

tabulation is to prepare the data for final analysis. It is a stage between classification of data and final analysis.

Objectives of Tabulation

1. To clarify the purpose of enquiry
2. To make the significance of data clear.
3. To express the data in least possible space.
4. To enable comparative study.
5. To eliminate unnecessary data
6. To help in further analysis of the data.

Generally accepted principles of tabulation: Such principles of tabulation, particularly of constructing statistical tables, can be briefly states as follows:

1. Every table should have a clear, concise and adequate title so as to make the table intelligible without reference to the text and this title should always be placed just above the body of the table.
2. Every table should be given a distinct number to facilitate easy reference.
3. The column headings (captions) and the row headings (stubs) of the table should be clear and brief.
4. The units of measurement under each heading or sub-heading must always be indicated.
5. Explanatory footnotes, if any, concerning the table should be placed directly beneath the table, along with the reference symbols used in the table.
6. Source or sources from where the data in the table have been obtained must be indicated just below the table.
7. Usually the columns are separated from one another by lines which make the table more readable and attractive. Lines are always drawn at the top and bottom of the table and below the captions.
8. There should be thick lines to separate the data under one class from the data under another class and the lines separating the sub-divisions of the classes should be comparatively thin lines.
9. The columns may be numbered to facilitate reference.
10. Those columns whose data are to be compared should be kept side by side. Similarly, percentages and/or averages must also be kept close to the data.
11. It is generally considered better to approximate figures before tabulation as the same would reduce unnecessary details in the table itself.
12. In order to emphasise the relative significance of certain categories, different kinds of type, spacing and indentations may be used.
13. It is important that all column figures be properly aligned. Decimal points and (+) or (–) signs should be in perfect alignment.

14. Abbreviations should be avoided to the extent possible and ditto marks should not be used in the table.

15. Miscellaneous and exceptional items, if any, should be usually placed in the last row of the table.

16. Table should be made as logical, clear, accurate and simple as possible. If the data happen to be very large, they should not be crowded in a single table for that would make the table unwieldy and inconvenient.

17. Total of rows should normally be placed in the extreme right column and that of columns should be placed at the bottom.

18. The arrangement of the categories in a table may be chronological, geographical, alphabetical or according to magnitude to facilitate comparison. Above all, the table must suit the needs and requirements of an investigation.

Data Entry

Once data collection has been completed and checked, the process of data entry and cleaning starts. During data entry the verbal or numeric data collected using questionnaires, abstraction forms, or observations are entered into a computer, principally as numeric data "codes."

Validity of Data

In general, validity is an indication of how sound your research is. More specifically, validity applies to both the design and the methods of your research. Validity in data collection means that your findings truly represent the phenomenon you are claiming to measure. Data validation means checking the accuracy and quality of source data before using, importing or otherwise processing data. Different types of validation can be performed depending on destination constraints or objectives. Data validation is a form of data cleansing.

Common Descriptive Techniques

The most common descriptive statistics used in research consist of percentages and frequency tables

(a)Percentages

Percentages are a popular method of displaying distribution. Percentages are the most powerful in making comparisons. In percentages, we simplify the data by reducing all numbers in a range of 10 to 100.

(b) Frequency Tables

One of the most common ways to describe a single variable is with a frequency distribution. Frequency distribution can be depicted in two ways, as table or as a graph. If the frequency distribution is depicted in the form of a table, we call it frequency table.

(c) Contingency Tables

A Contingency table shows the relationship between two variables in tabular form. The term Contingency table was first used by the statistician Karl Pearson in 1904. Contingency tables are especially used in Chi- square test.

Graphs and Diagrams

In research, the data collected may be of complex nature. Diagrams and graphs is one of the methods which simplifies the complexity of quantitative data and make them easily intelligible. They present dry and uninteresting statistical facts in the shape of attracting and appealing pictures. They have a lasting effect on the human mind than the conventional numbers.

Uses of Graphs and Diagrams

1. They help in presenting quantitative facts in simple, clear and effective pictures.
2. They make the whole data readily intelligible.
3. They can be used for comparison purpose.
4. They are useful in analyzing complex economic theories.
5. They save much time in understanding data.
6. Facts can be understood without doing mathematical calculations.
7. They help in lo0cating statistical measures such as median. quartile, mode etc

Types of Graphs

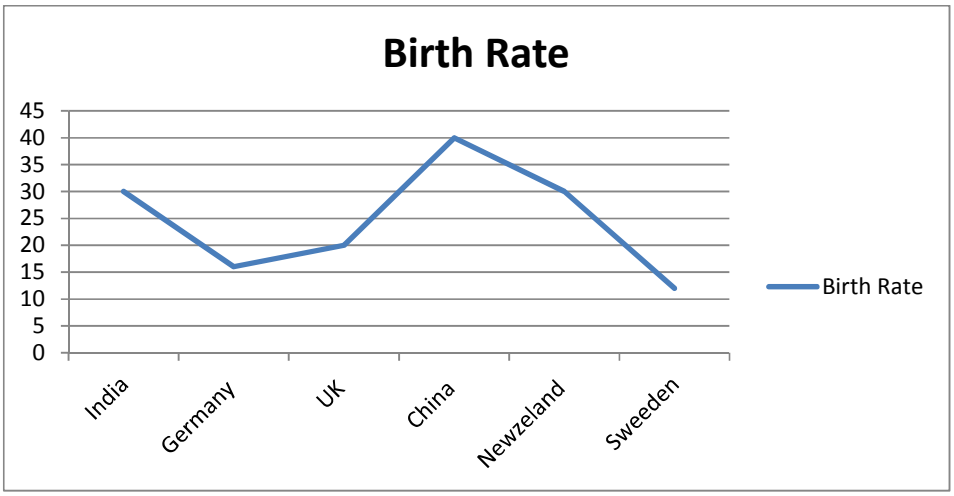
The following graphs are commonly used to represent data

1. Charts or line graphs
2. Bar charts
3. Circle charts or pie diagram
4. Pictograms

1. Line Graphs

A line graph displays information in a series of data points that each represents an individual measurement or piece of data. The series of points are then connected by a line to show a visual trend in data over a period of time. The line is connected through each piece chronologically. For eg; following data show birth rate per thousands of six countries over a period.

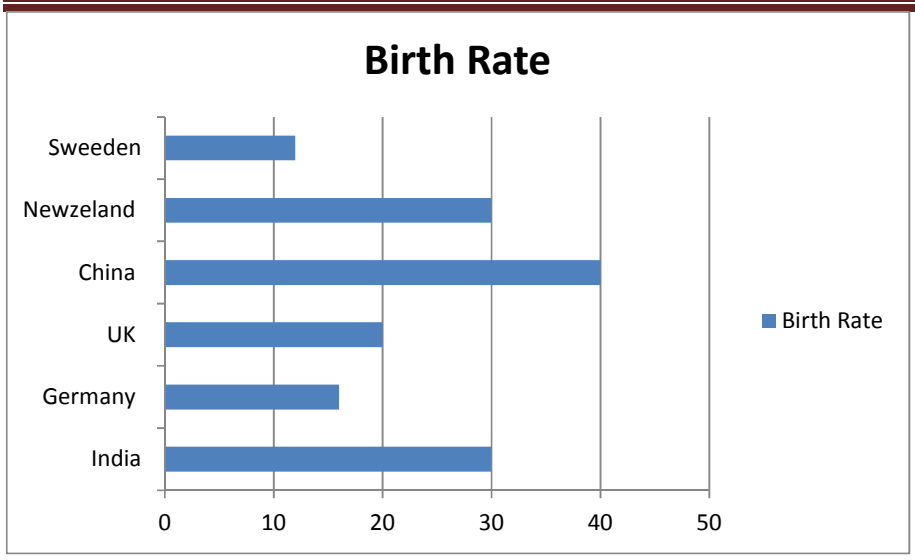
Country	Birth Rate
India	30
Germany	16
UK	20
China	40
Newzeland	30
Sweeden	12



2.Bar Charts

The bar graph is a common type of graph which consists of parallel bars or rectangles with lengths that are equal to the quantities that occur in a given data set. The bars can be presented vertically or horizontally to show the contrast and record information. Bar graphs are used for plotting discontinuous (discrete) data. Discrete data contains discrete values and are not continuous.

Country	Birth Rate
India	30
Germany	16
UK	20
China	40
Newzeland	30
Sweeden	12



Histogram

A histogram is a graph of frequency distributions. It is a set of vertical bars whose are proportional to the frequencies. While constructing histogram, the variable is always taken on the x-axis and the frequencies on y-axis.

Frequency Polygon

The frequency polygon is a graph of frequency distribution. Here we draw histogram of the data and then join by straight line and mid points of upper horizontal sides of these bars. Join both ends of the frequency polygon with the x- Axis.

Frequency Curves

A continuous frequency distribution can be represented by a smoothed curve known as Frequency curves.

Ogive or Cumulative Frequency Curve

A frequency distribution can be cumulated in two ways, less than cumulative series and more than cumulative series. Smoothed frequency curves drawn for these two cumulative series are called cumulative frequency curves or ogives.

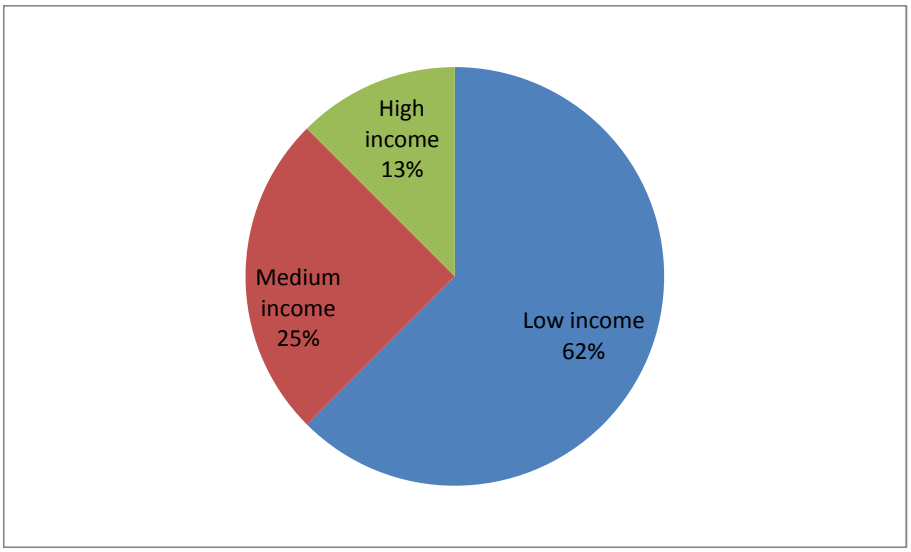
- Less than ogive curve: In less than ogive curve the upper limit per limit of each class interval is taken on x- axis in increasing order. For each such upper limit on x-axis, the cumulative frequency of all the class intervals from the first class interval to last class interval are taken on the y-axis.
- More than ogive curve: In more than ogive curve the lower limit of each class interval is taken on x- axis in increasing order. For each such lower limit on x- axis the cumulative

frequency of all the class interval from that class interval to the last class interval are taken on y-axis.

3. Circle Charts or Pie Diagram

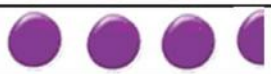
A pie graph is a circle divided into sections which each display the size of a relative piece of information. Each section of the graph comes together to form a whole. In a pie graph, the length of each sector is proportional to the percentage it represents. Pie graphs work particularly well when each slice of the pie represents 25 to 50 percent of the given data.

Income category	Perecntage
Low income	62.5
Medium income	25
High income	12.5



4.Pictograms

A pictogram, also called a pictogram or pictograph, is an ideogram that conveys its meaning through its pictorial resemblance to a physical object. Pictographs are often used in writing and graphic systems in which the characters are to a considerable extent pictorial in appearance. Pictography is a form of writing which uses representational, pictorial drawings. It is a basis ofcuneiform and, to some extent, hieroglyphic writing, which also uses drawings as phonetic lettersor determinative rhymes.

Colour	Number of Smarties	Frequency
Green		7
Orange		8
Blue		5
Pink		6
Yellow		11
Red		8
Purple		7
Brown		3
	Key  = 2 smarties	

ANALYSIS OF DATA

Analysis of data is considered to be highly skilled and technical job which should be carried out. Only by the researcher himself or under his close supervision. Analysis of data means critical examination of the data for studying the characteristics of the object under study and for determining the patterns of relationship among the variables relating to it's using both quantitative and qualitative methods.

Purpose of Analysis

Statistical analysis of data saves several major purposes.

1. It summarizes large mass of data in to understandable and meaningful form.
2. It makes descriptions to be exact.
3. It aids the drawing of reliable inferences from observational data.
4. It facilitates identification of the casual factors unde3rlyiong complex phenomena
5. It helps making estimations or generalizations from the results of sample surveys.
6. Inferential analysis is useful for assessing the significance of specific sample results under assumed population conditions.

Steps in Analysis

Different steps in research analysis consist of the following.

1. The first step involves construction of statistical distributions and calculation of simple measures like averages, percentages, etc.

2. The second step is to compare two or more distributions or two or more sub groups within a distribution.

3. Third step is to study the nature of relationships among variables.

4. Next step is to find out the factors which affect the relationship between a set of variables

5. Testing the validity of inferences drawn from sample survey by using parametric tests of significance.

Types of Analysis

Statistical analysis may broadly classified as descriptive analysis and inferential analysis

Descriptive Analysis

Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. Descriptive statistics is the discipline of quantitatively describing the main features of a collection of data or the quantitative description itself. In such analysis there are univariate analysis bivariate analysis and multivariate analysis.

• Univariate analysis

• Univariate analysis involves describing the distribution of a single variable, including its central tendency (including the mean, median, and mode) and dispersion (including the range and quartiles of the data-set, and measures of spread such as the variance and standard deviation). The shape of the distribution may also be described via indices such as skewness and kurtosis. Characteristics of a variable's distribution may also be depicted in graphical or tabular format, including histograms and stem-and-leaf display.

• Bivariate analysis

• Bivariate analysis is one of the simplest forms of the quantitative (statistical) analysis. It involves the analysis of two variables (often denoted as X, Y), for the purpose of determining the empirical relationship between them. Common forms of bivariate analysis involve creating a percentage table or a scatter plot graph and computing a simple correlation coefficient

• Multivariate analysis.

• In multivariate analysis multiple relations between multiple variables are examined simultaneously. Multivariate analysis (MVA) is based on the statistical principle of multivariate statistics, which involves observation and analysis of more than one statistical outcome variable at a time. In design

and analysis, the technique is used to perform trade studies across multiple dimensions while taking into account the effects of all variables on the responses of interest.

Usually the following analyses are involved when we make a reference of multivariate analysis:

(a) Multiple regression analysis: This analysis is adopted when the researcher has one dependent variable which is presumed to be a function of two or more independent variables. The objective of this analysis is to make a prediction about the dependent variable based on its covariance with all the concerned independent variables.

(b) Multiple discriminant analysis: This analysis is appropriate when the researcher has a single dependent variable that cannot be measured, but can be classified into two or more groups on the basis of some attribute. The object of this analysis happens to be to predict an entity's possibility of belonging to a particular group based on several predictor variables.

(c) Multivariate analysis of variance (or multi-ANOVA): This analysis is an extension of two way ANOVA, wherein the ratio of among group variance to within group variance is worked out on a set of variables.

Factor analysis

Factor analysis is a technique that is used to reduce a large number of variables into fewer numbers of factors. This technique extracts maximum common variance from all variables and puts them into a common score. As an index of all variables, we can use this score for further analysis. Factor analysis is part of general linear model (GLM) and this method also assumes several assumptions: there is linear relationship, there is no multicollinearity, it includes relevant variables into analysis, and there is true correlation between variables and factors. Several methods are available, but principle component analysis is used most commonly.

Types of factoring:

There are different types of methods used to extract the factor from the data set:

1. Principal component analysis: This is the most common method used by researchers. PCA starts extracting the maximum variance and puts them into the first factor. After that, it removes that variance explained by the first factors and then starts extracting maximum variance for the second factor. This process goes to the last factor.

2. Common factor analysis: The second most preferred method by researchers, it extracts the common variance and puts them into factors. This method does not include the unique variance of all variables.

Canonical analysis

Canonical analysis: This analysis can be used in case of both measurable and non-measurable variables for the purpose of simultaneously predicting a set of dependent variables from their joint covariance with a set of independent variables.

Cluster analysis

Cluster analysis is a multivariate method which aims to classify a sample of subjects (or objects) on the basis of a set of measured variables into a number of different groups such that similar subjects are placed in the same group. Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group are more similar to each other than to those in other groups.

Inferential analysis

Inferential analysis is concerned with the various tests of significance for testing hypotheses in order to determine with what validity data can be said to indicate some conclusion or conclusions. It is also concerned with the estimation of population values. It is mainly on the basis of inferential analysis that the task of interpretation (i.e., the task of drawing inferences and conclusions) is performed.

Tools and Statistical Methods For Analysis

The tools and technique of statistics can be studied under two divisions of statistics.

(A)Descriptive Statistics

In descriptive statistics we develop certain indices and measures of raw data. They are;

1. Measures of Central Tendency
2. Measures of Dispersion
3. Other measures

1. Measures of Central Tendency.

The central tendency of a distribution is an estimate of the "center" of a distribution of values. There are different types of estimates of central tendency such as mean, median, mode, geometric mean, and harmonic mean.

2. Measures of Dispersion.

Dispersion refers to the spread of the values around the central tendency. There are two common measures of dispersion, the range and the standard deviation. It can be used to compare the variability in two statistical series.

3. Measures of correlation

Correlation refers to any of a broad class of statistical relationships involving dependence.

When there are two variables, the correlation between them is called simple correlation. Whenthere are more than two variables and we want to study relation between two of them only, treating the others as constant, the relation is called partial correlation. When there are more than two variables and we want to study relation of one variable with all other variables together, the relation is called multiple correlations.

4. Regression analysis

Regression analysis is a statistical process for estimating the relationships among variables. It includes many techniques for modelling and analysing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables.

5. Index numbers

An index is a statistical measure of changes in a representative group of individual data points. Index numbers are designed to measure the magnitude of economic changes over time. Because they work in a similar way to percentages they make such changes easier to compare.

6. Time series analysis

A time series is a sequence of data points, measured typically at successive points in time spaced at uniform time intervals. Time series analysis comprises methods for analysing time series data in order to extract meaningful statistics and other characteristics of the data.

Measures of central tendency (averages)

An average is a single significant figure which sums up characteristic of a group of figures. The various measures of central tendency are;

(1) Arithmetic mean

(2) Median

(3) Mode

(4) Geometric mean

(5) Harmonic mean

Arithmetic Mean

The Mean or average is probably the most commonly used method of describing central tendency. To compute the mean all you do is add up all the values and divide by the number of value.

Arithmetic mean = $\overline{X} = \frac{\sum x}{n}$

where X = The symbol we use for mean (pronounced as X bar)

∑= Symbol for summation

Xi = Value of the ith item X, i = 1, 2, …, n

n = total number of items

For example, consider the test score values:

15, 20, 21, 20, 36, 15, 25, 15

The sum of these 8 values is 167, so the mean is 167/8 = 20.875.

Ex. 1 calculate mean from the following data

Value: 5 15 25 35 45 55 65 75

Freq: 1 20 25 24 12 31 71 52

value	freq	fx
5	1	5
15	20	300
25	25	625
35	24	840
45	12	540
55	31	1705
65	71	4615
75	52	3900
	250	12600

Arithmetic mean = $\overline{X} = \frac{\sum x}{n}$ ==12600/250=50.4

Median

The Median is the score found at the exact middle of the set of values. One way to compute the median is to list all scores in numerical order, and then locate the score in the center of the sample.

For example, if there are 500 scores in the list, score #250 would be the median. It is also, called {(n + 1) ÷ 2} th value, where n is the number of values in a set of data.

Example Imagine that a top running athlete in a typical 200-metre training session runs in the following times:

26.1, 25.6, 25.7, 25.2 et 25.0 seconds.

First, the values are put in ascending order: 25.0, 25.2, 25.6, 25.7, and 26.1. Then, using the following formula, figure out which value is the middle value. Remember that n represents the number of values in the data set.

Median= {(n+1) ÷2} th value = (5+1) ÷ 2 = 3

The third value in the data set will be the median. Since 25.6 is the third value, 25.6 seconds would be the median time.

= 25.6 seconds

In the case of continuous frequency distribution, median class corresponds to the cumulative frequency which includes N/2. After getting median class find median by using the following interpolation formula.

Median, m = L1 + [(N/2 – CF) / f]C

L1 means lower boundary of the median class

N means sum of frequencies

CF means cumulative frequency before the median class. Meaning that the class before the median class what is the frequency.

The various steps in the computations of median in a discrete series are as follows:

(i) Arrange the values in ascending or descending order of magnitude.

(ii) Find out the cumulative frequencies.

(iii) Find out the middle item by the formula N + 1/ 2

(iv) Now find out the value of (N + 1/2) th item. It can be found by first locating the cumulative frequency which is equal to or (N + 1/2) next higher to it, and then determining the value corresponding to it. This will be the value of the median.

Mode

Mode is the value of the item of a series which occurs most frequently. According to Kenny 'the value of the variable which occurs most frequently in a distribution is called a mode". In the case of individual series, the value which occurs more number of times is mode. For example, a set of students of a class report the following number of video movies they see in a month.

No of movies: 10,15,20,15,15,8

Mostly the students see 15 movies in a month. Therefore mode=15

Geometric mean

Geometric mean is also useful under certain conditions. It is defined as the nth root of the product of the values of n times in a given series. Symbolically, we can put it thus:

Geometric mean (or G.M.) = $n\sqrt{X_1 \times X_2 \times X_3 \ldots\ldots X_n}$

n= number of items X_1, X_2 = the various values

Harmonic Mean

The harmonic mean is a type of numerical average. It is calculated by dividing the number of observations by the reciprocal of each number in the series. Thus, the harmonic mean is the reciprocal of the arithmetic mean of the reciprocals.

$$H = \frac{n}{\frac{1}{x_1} + \frac{1}{x_2} + \cdots + \frac{1}{x_n}} = \frac{n}{\sum_{i=1}^{n} \frac{1}{x_i}}$$

Where:
n = count of the values in the given data set
$x_1 \ldots x_n$ = each value from the data set

MEASURES OF DISPERSION

An averages can represent a series only as best as a single figure can, but it certainly cannot reveal the entire story of any phenomenon under study. Specially it fails to give any idea about the scatter of the values of items of a variable in the series around the true value of average. In order to measure this scatter, statistical devices called measures of dispersion are calculated. Important measures of dispersion are (a) range, (b) mean deviation, and (c) standard deviation.

(a) Range is the simplest possible measure of dispersion and is defined as the difference betweenthe values of the extreme items of a series. Thus,

Range = (Highest value of anitem in a series) – (Lowest value of an item in a series)

The utility of range is that it gives an idea of the variability very quickly, but the drawback is that range is affected very greatly by fluctuations of sampling. Its value is never stable, being based on only two values of the variable. As such, range is mostly used as a rough measure of variability and is not considered as an appropriate measure in serious research studies.

(b) Mean deviation is the average of difference of the values of items from some average of the series. Such a difference is technically described as deviation. In calculating mean deviation we ignore the minus sign of deviations while taking their total for obtaining the mean deviation. Mean deviation is, thus, obtained as under:

- $MD = \frac{\sum|X-\bar{X}|}{n}$

(c) Standard deviation is most widely used measure of dispersion of a series and is commonly denoted by the symbol ‘s’ (pronounced as sigma). Standard deviation is defined as the square-rootof

the average of squares of deviations, when such deviations for the values of individual items in a series are obtained from the arithmetic average.

$$\mathrm{SD} = \sqrt{\frac{\sum |x - \bar{x}|^2}{n}}$$

Index Numbers

Index numbers are designed to measure the magnitude of economic changes over time. A statistic which assigns a single number to several individual statistics in order to quantify trends. Index numbers are the indicators of the various trends in an economy. Price index numbers indicate the position of prices whether they are rising or falling and at what rate. Similarly, index numbersregarding agricultural production indicates the trend of change whether it is rising or falling at what rate over a period of time. An index number is an economic data figure reflecting price or quantity compared with a standard or base value. The base usually equals 100 and the index number is usually expressed as 100 times the ratio to the base value. For example, if a commodity costs twice as much in 1970 as it did in 1960, its index number would be 200 relative to 1960. Index numbers are used especially to compare business activity, the cost of living, and employment.

An index number is specialized average. Index numbers may be simple or weighted depending on whether we assign equal importance to every commodities or different importance to different commodities according to the percentage of income spent on them or on the basis of some other criteria. In this chapter, we shall discuss both simple and weighted index numbers.

Simple and weighted index numbers

Simple index numbers are those in the calculation of which all the items are treated as equally important. Here items are not given any weight. Weighted index numbers are those in the calculation of which each item is assigned a particular weight.

Price Index Numbers

Price index numbers measure changes in the price of a commodity for a given period in comparison with another period.

Inferential Analysis

Parameters and Statistics

Parameters are numbers that summarize data for an entire population. Statistics are numbers that summarize data from a sample, i.e. some subset of the entire population.

Testing of hypothesis

Hypothesis testing is an act in statistics whereby an analyst tests an assumption regarding a population parameter. The methodology employed by the analyst depends on the nature of the data

used and the reason for the analysis. Hypothesis testing is used to infer the result of a hypothesis performed on sample data from a larger population.

In hypothesis testing, an analyst tests a statistical sample, with the goal of accepting or rejecting a null hypothesis. The test tells the analyst whether or not his primary hypothesis is true. If it isn't true, the analyst formulates a new hypothesis to be tested, repeating the process until data reveals a true hypothesis.

Statistical analysts test a hypothesis by measuring and examining a random sample of the population being analyzed. All analysts use a random population sample to test two different hypotheses: the null hypothesis and the alternative hypothesis.

Basic concepts in the context of testing of hypotheses need to be explained.

(a) Null hypothesis and alternative hypothesis : In the context of statistical analysis, we often talk about null hypothesis and alternative hypothesis. If we are to compare method A with method B about its superiority and if we proceed on the assumption that both methods are equally good, then this assumption is termed as the null hypothesis. As against this, we may think that the method A is superior or the method B is inferior, we are then stating what is termed as alternative hypothesis. The null hypothesis is generally symbolized as H0 and the alternative hypothesis as H_1.

(b) The level of significance : This is a very important concept in the context of hypothesis testing. It is always some percentage (usually 5%) which should be chosen with great care, thought and reason. In case we take the significance level at 5 per cent, then this implies that H0 will be rejectedwhen the sampling result (i.e., observed evidence) has a less than 0.05 probability of occurring if H0 is true. In other words, the 5 per cent level of significance means that researcher is willing to take as much as a 5 per cent risk of rejecting the null hypothesis when it (H0) happens to be true. Thus the significance level is the maximum value of the probability of rejecting H0 when it is true and is usually determined in advance before testing the hypothesis.

(c) Type I and Type II errors : In the context of testing of hypotheses, there are basically two types of errors we can make. We may reject H0 when H0 is true and we may accept H0 when in fact H0 is not true. The former is known as Type I error and the latter as Type II error. In other words, Type I error means rejection of hypothesis which should have been accepted and Type II error means accepting the hypothesis which should have been rejected.

Steps in testing hypothesis

1. State the problem
2. Set up a hypothesis
3. Decide the test statistics
4. Select a level of significance

5. Calculate the value of test statistic
6. Obtain the table value
7. Make decision to accept or reject hypothesis.

Test Statistic

The decision to accept or to reject a null hypothesis is made on the basis of a statistic computed from the sample. Such a statistic is called the test statistic. There are different types of test statistics. All these test statistics can be classified into two groups. They are a). Parametric Tests b). Non-Parametric Tests

PARAMETRIC TESTS

The statistical tests based on the assumption that population or population parameter is normally distributed are called parametric tests. The important parametric tests are:-

1.z-test

2.t-test

3.f-test

z-test

z-test is based on the normal probability distribution and is used for judging the significance of several statistical measures, particularly the mean. The relevant test statistic, z, is worked out and compared with its probable value (to be read from table showing area under normal curve) at a specified level of significance for judging the significance of the measure concerned. This is a most frequently used test in research studies. This test is used even when binomial distribution or t-distribution is applicable on the presumption that such a distribution tends to approximate normal distribution as 'n' becomes larger. z-test is generally used for comparing the mean of a sample to some hypothesised mean for the population in case of large sample, or when population variance is known. z-test is also used for judging he significance of difference between means of two independent samples in case of large samples, or when population variance is known. z-test is also used for comparing the sample proportion to a theoretical value of population proportion or for judging the difference in proportions of two independent samples when n happens to be large. Besides, this test may be used for judging the significance of median, mode, coefficient of correlation and several other measures.

t-test

t-test is based on t-distribution and is considered an appropriate test for judging the significance of a sample mean or for judging the significance of difference between the means of two samples in case of small sample(s) when population variance is not known (in which case we use variance of the sample as an estimate of the population variance). In case two samples are related, we

use paired t-test (or what is known as difference test) for judging the significance of the mean of difference between the two related samples. It can also be used for judging the significance of the coefficients of simple and partial correlations. The relevant test statistic, t, is calculated from the sample data and then compared with its probable value based on t-distribution (to be read from thetable that gives probable values of t for different levels of significance for different degrees of freedom) at a specified level of significance for concerning degrees of freedom for accepting or rejecting the null hypothesis. It may be noted that t-test applies only in case of small sample(s) when population variance is unknown.

1. The mean life of 100 bulbs produced by a company is computed to be 1570 hours with S.D. of 120 hours. The company claims that the average life of bulbs produced by the company is 1600 hours. Using 5% level of significance, is the claim acceptable?

H0 : $\mu = 1600$

H1 : $\mu \neq 1600$

Since sample is large apply z-test.

$$= \frac{\text{Difference between } \bar{X} \text{ and } \mu}{SE}$$

$$SE = \frac{S}{\sqrt{N}} = \frac{120}{\sqrt{100}}$$

$$= 12$$

$$Z = \frac{1600 - 1570}{12}$$

$$= \underline{2.5}$$

Table value at 5% level of significance and infinity d.f. is 1.96. As the calculated value is greater than the table value, we reject the H0. There is significant difference between mean life of sample and mean life of population. **Company's claim is not acceptable**

2. A typist claims that he can take dictations at the rate of more than 120 words per minute.
Of the 12 tests given to him, he could perform an average of 135 words with a S.D. of 40.
Is his claim valid. (use 1% level of significance).

Sol. H0 : $\mu = 120$ H1 : $\mu \neq 120$ Since small sample, apply t-test.

$$t = \frac{\text{Difference between } \bar{x} \text{ and } \mu}{SE}$$

$$= \frac{135 - 120}{SE}$$

$$SE = \frac{S}{\sqrt{n-1}} = \frac{40}{\sqrt{12-1}} = 12.06$$

$$t = \frac{135 - 120}{12.06}$$

$$= 1.24$$

Table value of 't' at 1% level of significance and 11 d.f. = 2.718

Calculated value is less than table value.

We accept the null hypothesis i.e, $\mu = 120$

We conclude that his claim of taking dictation at the rate of more than 120 words per minute is not valid.

F-test

F-test is based on F-distribution and is used to compare the variance of the two-independent samples. This test is also used in the context of analysis of variance (ANOVA) for judging the significance of more than two sample means at one and the same time. It is also used for judging the significance of multiple correlation coefficients. Test statistic, F, is calculated and compared with its probable value (to be seen in the F-ratio tables for different degrees of freedom for greater and smaller variances at specified level of significance) for accepting or rejecting the null hypothesis.

ANALYSIS OF VARIANCE (ANOVA)

Analysis of variance (abbreviated as ANOVA) is an extremely useful technique concerning researches in the fields of economics, biology, education, psychology, sociology, business/industry and in researches of several other disciplines. This technique is used when multiple sample cases are involved. As stated earlier, the significance of the difference between the means of two samples can be judged through either z-test or the t-test, but the difficulty arises when we happen to examine the significance of the difference amongst more than two sample means at the same time. The ANOVA technique enables us to perform this simultaneous test and as such is considered to be an important tool of analysis in the hands of a researcher. Using this technique, one can draw inferences about whether the samples have been drawn from populations having the same mean.

The ANOVA technique is important in the context of all those situations where we want to compare more than two populations such as in comparing the yield of crop from several varieties of seeds, the gasoline mileage of four automobiles, the smoking habits of five groups of university students and so on. In such circumstances one generally does not want to consider all possible combinations of two populations at a time for that would require a great number of tests before we would be able to arrive at a decision. This would also consume lot of time and money, and even then certain relationships may be left unidentified (particularly the interaction effects). Therefore, one quite often utilizes the ANOVA technique and through it investigates the differences among the means of all the populations simultaneously.

Procedure:-

1.Set up null and alternative hypothesis:

H1: There is no significant difference.

H0: There is significant difference.

2. Compute sum of squares Total (SST)

SST = Sum of squares of all observations - $\frac{T^2}{N}$

3. Compute sum of squares between samples (SSC)

SSC = $\frac{(\sum X1)^2}{N1}+\frac{(\sum X2)^2}{N2}+\frac{(\sum X3)^2}{N3}+\ldots\ldots\ldots -- \frac{T^2}{N}$

4. Compute sum of squares within sample (SSE)

SSE = SST – SSC

5. Compute MSC

$$MSC = \frac{SSC}{d.f} = \frac{SSC}{C-1}$$

6. Compute MSE

MSE = $\frac{SSE}{d.f} = \frac{SSE}{C-1}$

7. Compute F – ratio:

$$F = \frac{Larger\ variance}{Smaller\ variance}$$

8. Incorporate all these in an ANOVA TABLE as flows:

ANOVA TABLE				
Source of variation	Sum of squares	Degrees of freedom	Mean square	F - ratio
Between samples	SSC	C-1	MSC = $\frac{SSC}{C-1}$	F = $\frac{\text{Larger variance}}{\text{Smaller variance}}$
Within samples	SSE	N-C	MSE = $\frac{SSE}{C-1}$	
Total	SST	N-1		

9. Obtain table value at corresponding to the level of significance and for degree of freedom of (C-1, N-C).

10. Decide whether to accept or reject the null hypothesis.

Comparison of MEANS	Degrees of Freedom	Application	Assumptions	Test Statistic
One Sample Z-Test	Not Applicable	Testing the difference of a sample mean, x-bar, with a known population mean, μ (fixed mean, historical mean, or targeted mean)	Normal distribution Known population σ.	$Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$
One Sample t-test	n-1	Testing the difference of one sample mean, x-bar, with a known population mean, μ (fixed mean, historical mean, or targeted mean)	Normal distribution Population standard deviation, σ, is unknown.	$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$
Two Sample t-test	$n_1 + n_2 - 2$	Testing difference of two sample means when population variances unknown but considered equal	Normal Distribution Requires standard pooled deviation calculation, s_p	$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$
Paired t-test	n - 1	Testing two sample means when their respective population standard deviations are unknown but considered equal. Data recorded in pairs and each pair has a difference, d.	Normal Distribution Two dependent samples Always two-tailed test S_d = standard deviation of the differences of all samples	$t = \frac{\bar{d}\sqrt{n}}{s_d}$
One-Way ANOVA	$n_1 - 1$ & $n_2 - 1$	Testing the difference of three or more population means	Normal Distribution s_1^2 and s_2^2 represent sample variances	$F = \frac{(s_1)^2}{(s_2)^2}$

Chi-square test

The chi-square test is an important test amongst the several tests of significance developed by statisticians. Chi-square, symbolically written as χ^2 (Pronounced as Ki-square), is a statistical measure used in the context of sampling analysis for comparing a variance to a theoretical variance. As a non-parametric test, it "can be used to determine if categorical data shows dependency or the two classifications are independent. It can also be used to make comparisons between theoretical populations and actual data when categories are used. Thus, the chi-square test is applicable in large number of problems. The test is, in fact, a technique through the use of which it is possible for all researchers to (i) test the goodness of fit; (ii) test the significance of association between two attributes, and (iii) test the homogeneity or the significance of population variance.

Procedure:-

1. Set up mull hypothesis that there is goodness of fit between observed and expected frequencies.

2. Find the χ^2 value using the following formula:-

$$\chi^2 = \Sigma \frac{(O - E)^2}{E}$$

Where O = Observed frequencies

E = Expected frequencies

3. Compute the degree of freedom.

d. f. = n – r – 1Where 'r' is the number of independent constraints to be satisfied by the frequencies.

4. Obtain the table value corresponding to the lord of significance and degrees of freedom.

5. Decide whether to accept or reject the null hypothesis. If the calculated value is less than the table value, we accept the null hypothesis and conclude that there is goodness of fit. If the calculated value is more than the table value we reject the null hypothesis and conclude that there is no goodness of fit.

Interpretation

Interpretation refers to the technique of drawing inference from the collected facts and explaining the significance of those inferences after an analytical and experimental study. It is a search for broader and more abstract means of the research findings. If the interpretation is not done

very carefully, misleading conclusions may be drawn. The interpreter must be creative of ideas he should be free from bias and prejudice.

Fundamental principles of interpretation

1. Sound interpretation involves willingness on the part of the interpreter to see what is in the data.
2. Sound interpretation requires that the interpreter knows something more than the mere figures.
3. Sound interpretation demands logical thinking.
4. Clear and simple language is necessary for communicating the interpretation

Need for interpretation (importance of interpretation.)

1. It is through interpretation that the interpreter is able to know the abstract principles lying in his conclusions.
2. On the basis of the principles underlying his findings, a researcher can make various predictions about the various other events which are unrelated to his area of findings.
3. Interpretation leads to the establishment of explaining concepts.
4. A researcher can appreciate only through interpretation, why his findings are and what they are.
5. The interpretation of the findings of exploratory research study usually results in to hypothesis for experimental research.

Steps involved in the technique of interpretation

1. Researcher must give reasonable explanations of the relations he have found. He must be able to see uniformity in diversified research findings so that generalization of findings is possible.
2. If any extraneous information is collected during the study, it must be considered while interpreting the final result of research study.
3. The researcher can consult with those having insight in to the study who can point out the omission and errors in logical arguments.
4. The researcher must consider all relevant factors affecting the problem at the time of interpretation.
5. The conclusions appearing correct at the beginning may prove to be inaccurate later. So researcher must not be in a hurry while interpreting.

CHAPTER V

RESEARCH REPORT

A report is a detailed description of what has been done and how it has been done with respect to a particular area or topic. The purpose of the written report is to present the results of your research, but more importantly to provide a persuasive argument to readers of what you have found. It is the end product of a research activity. It is highly skilled work it is the final stage of the research work.

Need For Research Report

- The aim of research is the search for knowledge.
- A research report is needed to evolve a theory or a principle.
- Reporting is a process through which a basic ground is prepared for exchange of ideas orthoughts.
- Reporting helps the researcher to make specific recommendation for course of action.
- The research ability of a candidate is revealed through the final report he presents.
- A research report is highly useful for policy formulators, practitioners, general public andothers.

Functions of Research Report

- Research report serves as a means for presenting the problem studied, methods and techniques used, findings, conclusions and recommendation in an organised manner.
- It serves as a reference material for future use in the same or related area.
- It serves as a means for judging the quality of the research project.
- It is a means for evaluating research ability.
- It provides systematic knowledge on problems and issues analysed.

TYPES OF REPORTS

Research reports vary greatly in length and type. In each individual case, both the length and the form are largely dictated by the problems at hand. For instance, business firms prefer reports in the letter form, just one or two pages in length. Banks, insurance organisations and financial institutions are generally fond of the short balance-sheet type of tabulation for their annual reports to their customers and shareholders. Mathematicians prefer to write the results of their investigations in the form of algebraic notations. Chemists report their results in symbols and formulae. Students of literature usually write long reports presenting the critical analysis of some writer or period or the like with a liberal use of quotations from the works of the author under discussion. In the field of

education and psychology, the favourite form is the report on the results of experimentation accompanied by the detailed statistical tabulations. Clinical psychologists and social pathologists frequently find it necessary to make use of the case-history form.

The above narration throws light on the fact that the results of a research investigation can be presented in a number of ways viz., a technical report, a popular report, an article, a monograph or at times even in the form of oral presentation. Which method(s) of presentation to be used in a particular study depends on the circumstances under which the study arose and the nature of the results. A technical report is used whenever a full written report of the study is required whether for recordkeeping or for public dissemination. A popular report is used if the research results have policy implications. We give below a few details about the said two types of reports:

(A) Technical Report

In the technical report the main emphasis is on (i) the methods employed, (it) assumptions made in the course of the study, (iii) the detailed presentation of the findings including their limitations and supporting data.

A general outline of a technical report can be as follows:

1. Summary of results: A brief review of the main findings just in two or three pages.
2. Nature of the study: Description of the general objectives of study, formulation of the problem inoperational terms, the working hypothesis, the type of analysis and data required, etc.
3. 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.
4. Data : 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.
5. 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.
6. Conclusions: A detailed summary of the findings and the policy implications drawn from the results be explained.
7. Bibliography: Bibliography of various sources consulted be prepared and attached.
8. Technical appendices: Appendices be given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular technique of analysis and the like ones.

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

(B) 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.

1. The findings and their implications: Emphasis in the report is given on the findings of most practical interest and on the implications of these findings.
2. Recommendations for action: Recommendations for action on the basis of the findings of the study is made in this section of the report.
3. Objective of the study: A general review of how the problem arise is presented along with the specific objectives of the project under study.
4. Methods employed: A brief and non-technical description of the methods and techniques used, including a short review of the data on which the study is based, is given in this part of the report.
5. Results: This section constitutes the main body of the report wherein the results of the study are presented in clear and non-technical terms with liberal use of all sorts of illustrations such as charts, diagrams and the like ones.
6. Technical appendices: More detailed information on methods used, forms, etc. is presented in the form of appendices. But the appendices are often not detailed if the report is entirely meant for general public.

ORAL PRESENTATION

At times oral presentation of the results of the study is considered effective, particularly in cases where policy recommendations are indicated by project results. The merit of this approach lies in the fact that it provides an opportunity for give-and-take decisions which generally lead to a better understanding of the findings and their implications. But the main demerit of this sort of presentation is the lack of any permanent record concerning the research details and it may be just possible that the findings may fade away from people's memory even before an action is taken. In order to overcome this difficulty, a written report may be circulated before the oral presentation and referred to frequently during the discussion. Oral presentation is effective when supplemented by various visual devices. Use of slides, wall charts and blackboards is quite helpful in contributing to clarity and in reducing the boredom, if any.

DIFFERENT STEPS IN WRITING REPORT

Research reports are the product of slow, painstaking, accurate inductive work. The usual steps involved in writing report are: (a) logical analysis of the subject-matter; (b) preparation of the final outline; (c) preparation of the rough draft; (d) rewriting and polishing; (c) preparation of the final bibliography; and (f) writing the final draft. Though all these steps are self explanatory, yet a brief mention of each one of these will be appropriate for better understanding.

1. Logical analysis of the subject matter: It is the first step which is primarily concerned with the development of a subject. There are two ways in which to develop a subject (a) logically and (b) chronologically. The logical development is made on the basis of mental connections and associations between the one thing and another by means of analysis. Logical treatment often consists in developing the material from the simple possible to the most complex structures. Chronological development is based on a connection or sequence in time or occurrence. The directions for doing or making something usually follow the chronological order.
2. Preparation of the final outline: It is the next step in writing the research report "Outlines are the framework upon which long written works are constructed. They are an aid to the logical organisation of the material and a reminder of the points to be stressed in the report."
3. Preparation of the rough draft: This follows the logical analysis of the subject and the preparation of the final outline. Such a step is of utmost importance for the researcher now sits to write down what he has done in the context of his research study. He will write down the procedure adopted by him in collecting the material for his study along with various limitations faced by him, the technique of analysis adopted by him, the broad findings and generalizations and the various suggestions he wants to offer regarding the problem concerned.
4. Rewriting and polishing of the rough draft: This step happens to be most difficult part of all formal writing. Usually this step requires more time than the writing of the rough draft. The careful revision makes the difference between a mediocre and a good piece of writing. While rewriting and polishing, one should check the report for weaknesses in logical development or presentation. The researcher should also "see whether or not the material, as it is presented, has unity and cohesion; does the report stand upright and firm and exhibit a definite pattern, like a marble arch? Or does it resemble an old wall of moldering cement and loose brick."4 In addition the researcher should give due attention to the fact that in his rough draft he has been consistent or not. He should check the mechanics of writing—grammar, spelling and usage.

5. Preparation of the final bibliography: Next in order comes the task of the preparation of the final bibliography. The bibliography, which is generally appended to the research report, is a list of books in some way pertinent to the research which has been done. It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts; the first part may contain the names of books and pamphlets, and the second part may contain the names of magazine and newspaper articles. Generally, this pattern of bibliography is considered convenient and satisfactory from the point of view of reader, though it is not the only way of presenting bibliography. The entries in bibliography should be made adopting the following order:

For books and pamphlets the order may be as under:

1. Name of author, last name first.
2. Title, underlined to indicate italics.
3. Place, publisher, and date of publication.
4. Number of volumes.

Example

Kothari, C.R., Quantitative Techniques, New Delhi, Vikas Publishing House Pvt. Ltd., 1978.

For magazines and newspapers the order may be as under:

1. Name of the author, last name first.
2. Title of article, in quotation marks.
3. Name of periodical, underlined to indicate italics.
4. The volume or volume and number.
5. The date of the issue.
6. The pagination.

Example

Robert V. Roosa, "Coping with Short-term International Money Flows", The Banker, London, September, 1971, p. 995.

Style of Listing- Reports and other Official Publications

(Name of the Agency, Title of the publication, Place and Year) - Examples.

- Government of India, Annual Reports. (Various Issues), Ministry of Health and FamilyWelfare, New Delhi
- Planning Commission, Report on General Hospital, New Delhi, 1964.

For a Newspaper

(Name of Paper, Place of edition, month, day, Year)

- Editorial, Thiruvananthapuram,The Hindu, May 16, 2010, 6.

Style of Listing – Websites/Electronic Sources

• www.ksfe.com

• www.chitfund.org

• www.gokulamchits.com

6. Writing the final draft: This constitutes the last step. The final draft should be written in a concise and objective style and in simple language, avoiding vague expressions such as "it seems", "there may be", and the like ones. While writing the final draft, the researcher must avoid abstract terminology and technical jargon. Illustrations and examples based on common experiences must be incorporated in the final draft as they happen to be most effective in communicating the research findings to others. A research report should not be dull, but must enthuse people and maintain interest and must show originality. It must be remembered that every report should be an attempt to solve some intellectual problem and must contribute to the solution of a problem and must add to the knowledge of both the researcher and the reader.

LAYOUT OF THE RESEARCH REPORT

Anybody, who is reading the research report, must necessarily be conveyed enough about the study so that he can place it in its general scientific context, judge the adequacy of its methods and thus form an opinion of how seriously the findings are to be taken. For this purpose there is the need ofproper layout of the report. The layout of the report means as to what the research report should contain. A comprehensive layout of the research report should comprise (A) preliminary pages; (B) the main text; and (C) the end matter. Let us deal with them separately.

(A) Preliminary Pages

In its preliminary pages the report should carry a title and date, followed by acknowledgements in the form of 'Preface' or 'Foreword'. Then there should be a table of contents followed by list of tables and illustrations so that the decision-maker or anybody interested in reading the report can easily locate the required information in the report.

Title Page

The contents of Title Page

• The title of the research study

• The name of the faculty/subject

• Institution to which the report is to be submitted

• The degree for which report is to be submitted

• The name of the researcher

• The name of the supervising teacher & his address

• The month & Year of submission of the Report

These items are centered between the margin of the page and no terminal punctuation is used.

Researcher's Declaration

The researcher has to declare that it is a bonafide Research work done by him/her and that no part of the Thesis/Dissertation is presented for the award of any degree, diploma, associateship, fellowship or other similar title before.

Certificate of the Research Guide

The Guide has to state that the thesis is a record of bonafide research work carried out by the researcher under his supervision and no part of the thesis is submitted for any degree, diploma, associateship, fellowship or other similar title before. He/she is permitted to submit the thesis.

Acknowledgements

• This page is largely a matter of courtesy

• The researcher acknowledges the following persons/Institutions for the assistance

- Guide
- Other academicians and Professionals who rendered assistance
- Authorities of Libraries
- Respondents of questionnaire/Schedule
- Persons from administrative assistance is received
- Any other individuals who assisted in the research work.

Contents

• This page gives the readers a bird's eye-view of the Report

• It enables the reader to locate quickly each section of it.

• It includes the chapter headings, major sub divisions of the chapters

List of Tables and Figures

In this Page a list of Tables and Figures, if any, is shown. The full titles of Tables & Figures as shown in the text are shown with corresponding Page numbers.

(B) Main Text

The main text provides the complete outline of the research report along with all details. Title of the research study is repeated at the top of the first page of the main text and then follows the other details on pages numbered consecutively, beginning with the second page. Each main section of the report should begin on a new page. The main text of the report should have the following sections: (i) Introduction; (ii) Statement of findings and recommendations; (iii) The results; (iv) The implications drawn from the results; and (v) The summary.

(i) Introduction: The purpose of introduction is to introduce the research project to the readers. It should contain a clear statement of the objectives of research i.e., enough background should be given to make clear to the reader why the problem was considered worth investigating. A brief summary of other relevant research may also be stated so that the present study can be seen in that context. The hypotheses of study, if any, and the definitions of the major concepts employed in the study should be explicitly stated in the introduction of the report.

(ii) Statement of findings and recommendations: After introduction, the research report must contain a statement of findings and recommendations in non-technical language so that it can be easily understood by all concerned. If the findings happen to be extensive, at this point they should be put in the summarised form.

(iii) Results: A detailed presentation of the findings of the study, with supporting data in the form of tables and charts together with a validation of results, is the next step in writing the main text of the report. This generally comprises the main body of the report, extending over several chapters. The result section of the report should contain statistical summaries and reductions of the data rather than the raw data. All the results should be presented in logical sequence and splitted into readily identifiable sections. All relevant results must find a place in the report. But how one is to decide about what is relevant is the basic question. Quite often guidance comes primarily from the research problem and from the hypotheses, if any, with which the study was concerned. But ultimately the researcher must rely on his own judgement in deciding the outline of his report. "Nevertheless, it is still necessary that he states clearly the problem with which he was concerned, the procedure by which he worked on the problem, the conclusions at which he arrived, and the bases for his conclusions."

(iv) Implications of the results: Toward the end of the main text, the researcher should again put down the results of his research clearly and precisely. He should, state the implications that flow from the results of the study, for the general reader is interested in the implications for understanding the human behaviour. Such implications may have three aspects as stated below:

(a) A statement of the inferences drawn from the present study which may be expected to apply in similar circumstances.

(b) The conditions of the present study which may limit the extent of legitimate generalizations of the inferences drawn from the study.

(c) Thc relevant questions that still remain unanswered or new questions raised by the study along with suggestions for the kind of research that would provide answers for them.

(v) Summary: It has become customary to conclude the research report with a very brief summary, resting in brief the research problem, the methodology, the major findings and the major conclusions drawn from the research results.

(C) End Matter

At the end of the report, appendices should be enlisted in respect of all technical data such as questionnaires, sample information, mathematical derivations and the like ones. Bibliography of sources consulted should also be given. Index (an alphabetical listing of names, places and topics along with the numbers of the pages in a book or report on which they are mentioned or discussed) should invariably be given at the end of the report. The value of index lies in the fact that it works as a guide to the reader for the contents in the report.

CHAPTERIZATION

The entire research work will run into five chapters. The first one on Introduction brings out the importance of the study, and states its objectives and hypotheses. It also includes methodology and limitations. Chapter II will contain previous reviews, history of the Problems. A Quick look on subjective well-being will also be carried out in chapter II. Chapter III will be a methodological part of the study. Analysis and Discussionsis to be done in chapter IV. Findings, Conclusions and Suggestionsfor further Research will be presented in Chapter V followed by Bibliography and References.

ROLE OF AUDIENCE

Audience analysis involves identifying the audience and adapting a speech to their interests, level of understanding, attitudes, and beliefs. Taking an audience-centered approach is important because a speaker's effectiveness will be improved if the presentation is created and delivered in an appropriate manner.

One of the first things to do when you analyze and audience is to identify its type (or types--it's rarely just one type). The common division of audiences into categories is as follows:

1. Experts: These are the people who know the theory and the product inside and out. They designed it, they tested it, they know everything about it. Often, they have advanced degrees and operate in academic settings or in research and development areas of the government and business worlds. The nonspecialist reader is least likely to understand what these people are saying-but also has the least reason to try. More often, the communication challenge faced by the expert is communicating to the technician and the executive.

2. Technicians: These are the people who build, operate, maintain, and repair the stuff that the experts design and theorize about. Theirs is a highly technical knowledge as well, but of a more practical nature.
3. Executives: These are the people who make business, economic, administrative, legal, governmental, political decisions on the stuff that the experts and technicians work with. If it's a new product, they decide whether to produce and market it. If it's a new power technology, they decide whether the city should implement it. Executives are likely to have as little technical knowledge about the subject as nonspecialists.
4. Nonspecialists: These readers have the least technical knowledge of all. Their interest may be as practical as technicians', but in a different way. They want to use the new product to accomplish their tasks; they want to understand the new power technology enough to know whether to vote for or against it in the upcoming bond election. Or, they may just be curious about a specific technical matter and want to learn about it--but for no specific, practical reason.

READABILITY

Readability is what makes some texts easier to read than others. It is often confused with legibility, which concerns typeface and layout. In natural language, the readability of text depends on its content (the complexity of its vocabulary and syntax) and its presentation (such as typographic aspects like font size, line height, and line length).

Many experts, through much research, have compiled golden rules of documentation writing. These rules apply regardless of medium:

•Use short, simple, familiar words

•Avoid jargon

.•Use culture-and-gender-neutral language.

•Use correct grammar, punctuation, and spelling.

•Use simple sentences, active voice, and present tense.

•Begin instructions in the imperative mode by starting sentences with an action verb.

•Use simple graphic elements such as bulleted lists and numbered steps to make information visually accessible.

COMPREHENSION

Comprehension is the ability to understand and get meaning from spoken and written language. Comprehension skills are based on rich language and experience with text from early in life. These experiences include learning how to decode; becoming fluent in decoding with an

extensive repertoire of sight words; increasing vocabulary to include words commonly found in texts; and learning how to get meaning from text using comprehension processes.

Causes of Reading Comprehension Failure

- Inadequate instruction
- Insufficient exposure and practice
- Deficient word recognition skills
- Deficient memory capacity and functioning
- Significant language deficiencies
- Inadequate comprehension monitoring and self-evaluation
- Unfamiliarity with text features and task demands
- Undeveloped attentional strategies
- Inadequate cognitive development and reading experiences

TONE

Tone in writing refers to the writer's attitude toward the reader and the subject of the message. The overall tone of a written message affects the reader just as one's tone of voice affects the listener in everyday exchanges".

Business writers should consider the tone of their message, whether they are writing a memo, letter, report, or any type of business document. Tone is present in all communication activities. Ultimately, the tone of a message is a reflection of the writer and it does affect how the reader will perceive the message.

The writer should consider several things when preparing to write. The following questions will help you to determine the appropriate tone for your message.

- Why am I writing this document?
- Who am I writing to and what do I want them to understand?
- What kind of tone should I use?

Here are some general guidelines to keep in mind when considering what kind of tone to use in your letters and how to present information in that tone:

- Be confident.

- Be courteous and sincere.
- Use appropriate emphasis and subordination.
- Use non-discriminatory language.
- Stress the benefits for the reader.
- Write at an appropriate level of difficulty.

FORMAT OF THE REPORT

- TITLE PAGE:- Title of project, Subtitle (where appropriate), Date, Author, Organization, Logo
- BACKGROUND:– History(if any) behind the project
- ACKNOWLEDGEMENT:- Author thanks people and organization who helped during the project
- SUMMARY(sometimes called abstract of the synopsis):- A condensed version of a report – outlines salient points, emphasizes main conclusions and (where appropriate) the main recommendations. N.B this is often difficult to write and it is suggested that you write it last.
- LIST OF CONTENTS:- An at- a – glance list that tells the reader what is in the report and what page number(s) to find it on.
- LIST OF TABLES:- As above, specifically for tables.
- LIST OF APPENDICES:- As above, specifically for appendices.
- INTRODUCTION:- Author sets the scene and states his/ her intentions.
- AIMS AND OBJECTIVES AIMS:- – general aims of the audit/ project, broad statementof intent.
- OBJECTIVES:- specific things expected to do/deliver(e.g. expected outcomes)
- METHOD:- Work steps; what was done – how, by whom, when?
- RESULT/FINDINGS:- Honest presentation of the findings, whether these were as expected or not. Give the facts, including any inconsistencies or difficulties encountered
- DISCUSSION:- Explanation of the results.(you might like to keep the SWOT analysis in mind and think about your project's strengths, weakness, opportunities and threats, as you write)
- CONCLUSIONS:- The author links the results/ findings with the points made in the introduction and strives to reach clear, simply stated and unbiased conclusions. Make sure they are fully supported by evidence and arguments of the main body of your audit/project.

- RECOMMENDATIONS:- The author states what specific actions should be taken, by whom and why. They must always be linked to the future and should always be realistic. Don't make them unless asked to.
- REFERENCES:- A section of a report, which provides full details of publications mentioned in the text, or from which extracts have been quoted.
- APPENDIX:- The purpose of an appendix is to supplement the information contained in the main body of the report.

ETHICS IN RESEARCH

Research ethics concerns the responsibility of researchers to be honest and respectful to all individuals who are affected by their research studies or their reports of the studies' results. The research ethics may be;

- To protect participants /patients /society /resources /researcher?
- To ensure accuracy of scientific knowledge
- To protect intellectual and property rights

Breach of ethics in research would amount to scientific misconduct. Scientific misconduct are;

- Fraud : invention/fabrication of data
- Plagiarism : copying data, ideas, text without acknowledgement of source
- Piracy : infringement of a copyright
- Submitting/Publishing the same paper to different journals
- Not informing a collaborator of your intent to file a patent in order to make sure that you are the sole inventor
- Overworking, neglecting, or exploiting research students
- Making derogatory comments and personal attacks in your review of author's submission
- Making significant deviations from the research protocol approved by the Review Board without informing the committee
- Not reporting an adverse event in a human research experiment
- Including a colleague as an author on a paper in return for a favour even though the colleague did not make a serious contribution to the paper
- Trimming outliers from a data set without discussing your reasons in paper
- Using an inappropriate statistical technique in order to enhance the significance of your research, etc.

SUBJECTIVITY AND OBJECTIVITY IN RESEARCH

In its purest sense, the idea of objectivity assumes that a truth or independent reality exists outside of any investigation or observation. The researcher's task in this model is to uncover this reality without contaminating it in any way. This notion - that a researcher can observe or uncover phenomena without affecting them - is increasingly rejected, especially in the social sciences but also in the natural sciences. In qualitative research, a realistic aim is for the researcher to remain impartial; that is, to be impartial to the outcome of the research, to acknowledge their own preconceptions and to operate in as unbiased and value-free way as possible.

Subjectivity refers to how someone's judgment is shaped by personal opinions and feelings instead of outside influences. Subjective research is generally referred to as phenomenological research. This is because it is concerned with the study of experiences from the perspective of an individual, and emphasises the importance of personal perspectives and interpretations. Subjective research is generally based on data derived from observations of events as they take place or from unstructured or semi-structured interviews. In unstructured interviews the questions emerged from the discussion between the interviewer and the interviewee. In semi-structured interviews the interviewer prepares an outline of the interview topics or general questions, adding more as needs emerged during the interview. Structured interviews include the full list of questions. Interviewers do not deviate from this list. Subjective research can also be based on examinations of documents. The researcher will attribute personal interpretations of the experiences and phenomena during the process of both collecting and analysing data.

BC5B08 BUSINESS RESEARCH METHODS

Lecture Hours per week : 4 Credits : 4
Internal : 20, External : 80

Objectives : > To enable students for acquiring basic knowledge in business research methods and to develop basic skills in them to conduct survey researches and case studies.

Module I

Business Research : – Definition and significance - Features of business research – The research process – Variable - Proposition - Types of research – Exploratory and causal research – Theoretical and empirical research - Basic and applied research - Descriptive research - Phases of business research – Research Hypothesis – Characteristics – Research in an evolutionary perspective – Role of theory in research - Theory building - Induction and Deduction Theory.

10 Hours

Module II

Research Design – Definition – Types of research design – Exploratory and causal research design - Descriptive and experimental design – Types of experimental design – Validity of findings – Internal and external validity – Variables in research – Measurement and scaling – Different scales – Construction of instrument - Validity and reliability of instrument -

15 Hours

Module III

Data Collection: - Types of data – Primary Vs secondary data – Methods of primary data collection – Survey Vs observation – Experiments – Construction of questionnaire and instrument – Validation of questionnaire – Sampling plan – Sample size – Sampling methods - Determinants of optimal sample size – Sampling techniques – Probability Vs non probability sampling methods.

15 Hours

Module IV

Data Processing : Processing stages - Editing - Coding and data entry – Validity of data – Qualitative Vs quantitative data analysis – Frequency table - Contingency table - Graphs - Measures of central tendency and index number – Testing of Hypothesis - Bivariate and multi variate statistical techniques – Factor analysis – Discriminant analysis- Cluster analysis – Interpretation.

15 Hours

Module V

Research Report : Different types – Contents of report – Need of executive summary – Chapterisation – Contents of chapter - Report writing stages – The role of audience – Readability – Comprehension – Tone – Final proof – Report format – Title of the report – Ethics in research – Subjectivity and objectivity in research.

15 Hours

Reference Books:

1.DonaldR.Cooper and Pamela S, Schindler: Business Research Methods. Latest Edition, Irwin McGraw- Hill International Editions, New Delhi. 2.John Adams, Hafiz T.A. Khan Robert Raeside, David white: Research Methods for Graduate Business and Social Science Students, Response Books. New Delhi - 110044.

3.Neresh K. Malhotra: Marketing Research, Latest edition. Pearson Education.

4.William G. Zikmund, Business Research Methods, Thomson 5.Wilkinson T.S. and Bhandarkar P.L.: Methodology and Techniques of Social Research, Himalaya.

6.S N Murthy &. U Bhojanna : Business Research Methods, Excel Books, New Delhi.

7.Jan Brace: Questionnaire Design, Kogan Page India

8.Michael V.P. Research Methodology in Management, Himalaya. 9.Dipakkumar Bhattacharyya. Research Methodology. Excel Books, New Delhi.

10.R. Paneerselvan : Research Methodology, Prentice-Hall of India

11.Ajai S Gaur &Sanjaya S Gaur: Statistical Methods for Practice &
Research, Response Books, New Delhi.

12.Kultar Singh: Quantitative Social Research Methods. Response Books, New Delhi.