DEPARTMENT OF MANAGEMENT STUDIES

I YEAR / II SEMESTER

BA4205: BUSINESS RESEARCH METHODS

COURSE MATERIAL

Anna University Chennai

Regulation 2021

JEPPIAAR ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

VISION

To build Jeppiaar Engineering College as an institution of academic excellence in technology and management education, leading to become a world class university..

MISSION

- To excel in teaching and learning, research and innovation by promoting the principles of scientific analysis and creative thinking.
- To participate in the production, development and dissemination of knowledge and interact with national and international communities.
- To equip students with values, ethics and life skills needed to enrich their lives and enable them to contribute for the progress of society.
- To prepare students for higher studies and lifelong learning, enrich them with the practical skills necessary to excel as future professionals and entrepreneurs for the benefit of Nation's economy.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS):

MBA programme curriculum is designed to prepare the post graduate students

- To have a thorough understanding of the core aspects of the business.
- To provide the learners with the management tools to identify, analyze and create business opportunities as well as solve business problems.
- To prepare them to have a holistic approach towards management functions.
- To inspire and make them practice ethical standards in business.

PROGRAMME OUTCOMES (POS)

On successful completion of the programme,

1. Ability to apply the business acumen gained in practice.
2. Ability to understand and solve managerial issues.
3. Ability to communicate and negotiate effectively, to achieve organizational and individual goals.
4. Ability to understand one's own ability to set achievable targets and complete them.
5. Ability to fulfill social outreach
6. Ability to take up challenging assignments

COURSE OUTCOMES (COs)

To make the students of tourism understand the principles of scientific methodology in business enquiry, develop analytical skills of business research and to prepare scientific business reports.

COURSE OUTCOMES (COs)

1. Students will understand and appreciate scientific inquiry
2. Students would know to write research proposals
3. The students would be able to undertake a systematic outlook towards business situations for the purpose of objective decision making, and the method of conducting scientific inquiry to solve organizational problems
4. Students would be able to analyze data and find solutions to the problems.
5. Students could prepare research reports

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	0	0	0	2
CO2	3	3	2	0	0	2
CO3	3	3	0	1	0	2
CO4	3	3	0	0	0	2
CO5	3	3	2	0	3	2
Average	3	3	2	1	3	2

BA4205 BUSINESS RESEARCH METHODS

UNIT I INTRODUCTION **9**

  Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross – Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

UNIT II RESEARCH DESIGN AND MEASUREMENT **9**

  Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different 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.

UNIT III DATA COLLECTION **9**

  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 – determinants optimal sample size – sampling techniques – Probability Vs Non–probability sampling methods.

UNIT IV DATA PREPARATION AND ANALYSIS **9**

  Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Bivariate and Multivariate statistical techniques – Factor analysis – Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Application of statistical software for data analysis.

UNIT V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH 9

  Research report – Different types – Contents of report – need of executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – ethics in research – ethical behaviour of research – subjectivity and objectivity in research.

TEXT BOOKS

1. Donald R. Cooper, Pamela S. Schindler and J K Sharma, Business Research methods, 11th Edition, Tata Mc Graw Hill, New Delhi, 2012.
2. Alan Bryman and Emma Bell, Business Research methods, 3rd Edition, Oxford University Press, New Delhi, 2011.
3. Uma Sekaran and Roger Bougie, Research methods for Business, 5th Edition, Wiley India, New Delhi, 2012.
4. William G Zikmund, Barry J Babin, Jon C.Carr, Atanu Adhikari,Mitch Griffin, Business Research methods, A South Asian Perspective, 8th Edition, Cengage Learning, New Delhi, 2012.
5. Panneerselvam. R, Research Methodology, 2nd Edition, PHI Learning, 2014

UNIT I

UNIT I INTRODUCTION

Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross – Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

Business Research – Definition:

The Advanced Learner's Dictionary of Current English lays down the meaning of research as "a careful investigation or inquiry especially through search for new facts in any branch of knowledge." Redman and Mory define research as a "systematized effort to gain new knowledge."

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

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.

Qualities of a good research

1. Good research is systematic: It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules. Systematic characteristic of the research does not rule out creative thinking but it certainly does reject the use of guessing and intuition in arriving at conclusions.

2. Good research is logical: This implies that research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research. Induction is the process of reasoning from a part to the whole whereas deduction is the process of reasoning from some premise to a conclusion which follows from that very premise. In fact, logical reasoning makes research more meaningful in the context of decision making.

3. Good research is empirical: It implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results.

4. Good research is replicable: This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

Motivation in research:

The possible motives for doing research may be either one or more of the following:

1. Desire to get a research degree along with its consequential benefits;
2. Desire to face the challenge in solving the unsolved problems, i.e., concern over practical problems initiates research;
3. Desire to get intellectual joy of doing some creative work;
4. Desire to be of service to society;
5. Desire to get respectability.

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

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.

Significance of research:

(a) To those students who are to write a master's or Ph.D. thesis, research may mean careerism or a way to attain a high position in the social structure;

(b) To professionals in research methodology, research may mean a source of livelihood;

(c) To philosophers and thinkers, research may mean the outlet for new ideas and insights;

(d) To literary men and women, research may mean the development of new styles and creative work;

(e) To analysts and intellectuals, research may mean the generalisations of new theories.

Thus, research is the fountain of knowledge for the sake of knowledge and an important source of providing guidelines for solving different business, governmental and social problems. It is a sort of formal training which enables one to understand the new developments in one's field in a better way.

PROBLEMS ENCOUNTERED BY RESEARCHER IN INDIA:

➢ The lack of a scientific training in the methodology of research

➢ Insufficient interaction between the university research departments on the side and business establishments, governments department, and research institution on the other side.

➢ The business unit do not have confidence that the information supplied by them to researchers will be misused and so such they are often reluctant in supplying the needed information to researchers.

➢ Research studies overlapping one another are undertaken quite often for want of adequate information.

➢ There does not exist a code of conduct for researcher

➢ The difficult of adequate and timely secretarial assistance.

➢ Library management and functioning is not satisfactory at many place.

➢ There is also the problem that many of our libraries are not able to get copies of old and new Acts/ rules, reports and other government publications in time.

➢ There is also the difficulty of timely availability of published data.

➢ There may at times take place the problem of conceptualization.

HALLMARKS OF SCIENTIFIC RESEARCH

Purposiveness
- Research must be started with a definite, clear aim, objective and purpose.
- Research findings must be beneficial for organization.
- For example an increase in employee commitment will be beneficial for Organization. It will translate into less turnover, less absenteeism, and increased performance levels

Rigor
- Rigor connotes carefulness during research.
- It also refers to degree of exactitude in research investigations.
- Chosen sample should be true representative of whole organization.
- Method adopted for collecting data should be appropriate.
- Research process should be free from personal and emotional biases.

Testability
- Testability refers that hypothesis must be testable.
- Hypotheses are tentative yet testable statements.
- They are derived from theory or theory based.
- It must be able to testify by applying certain statistical tests experimentally.

Replicability
- Results should be supported again and again when the same type of research is repeated in other similar circumstances.
- Replicability will gain confidence in the scientific nature of our research.
- Replicability brings exactitude and accuracy in research findings.

Precision and Confidence
- Precision refers to the closeness of the findings to reality.
- Precision reflects the degree of accuracy of the results .
- We ensures that our findings are close to reality.
- So that we can place reliance or confidence in the results.
- In social sciences confidence level is 95%.

Objectivity
- The conclusions drawn from information should be objective.
- The findings should be based on the facts .
- The more objective the interpretation of the data, the more scientific the research investigation becomes.

Generalizability
- Generalizability refers to the scope of applicability of the research findings in one organizational setting to other settings.
- The wider the range of applicability of the solutions generated by research, the more useful the research is to the users.

Parsimony
- Parsimony refers to simplicity in explaining the phenomena or problems that occur.
- It is Level of understanding in generating solutions for the problems.
- Economy in research models is achieved when we can build a lesser number of variables.
- Those variables would explain the variance far more efficiently than a complex set of variables.

Limitations of Research

- It is based on sample & sampling research lacks the complete accuracy.
- Long time is required in the research procedures.
- Difficult to evaluate the economic benefits derived from the research.
- Trained personnel and a lot of time are required for research.
- Lack of adequate knowledge of research.

TYPES OF RESEARCH:

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

➢ **Applied research** : is also known as decisional research, use existing knowledge as an aid to the solution of some given problem or set of problems. An attempt to find a solution to an immediate problem encountered by a firm, an industry, a business organisation, or the society is known as applied research. Researchers engaged in such researches aim at drawing certain conclusions confronting a concrete social or business problem.

➢ **Fundamental research**, frequently called basic or pure research, seeks to extend the boundaries of knowledge in a given area with no necessary immediate application to existing problems. Researches relating to pure mathematics or concerning some natural phenomenon are examples

➢ **Futuristic research**: Futures research is the systematic study of possible future conditions. It includes analysis of how those conditions might change as a result of the implementation of policies and actions, and the consequences of these policies and actions.

➢ **Descriptive research** includes surveys and fact-finding enquiries of different kinds. It tries to discover answers to the questions who, what, when and sometimes how. Here the researcher attempts to describe or define a subject, often by creating a profile of a group of problems, people, or events. The major purpose of descriptive research is description of the state of affairs as it exists at present The term 'ex post facto research' is quite often used for descriptive research studies in social sciences and business research.

➢ **Explanatory research**: Explanatory research goes beyond description and attempts to explain the reasons for the phenomenon that the descriptive research only observed. The research would use theories or at least hypothesis to account for the forces that caused a certain phenomenon to occur.

➢ **Predictive research**: If we can provide a plausible explanation for an event after it has occurred, it is desirable to be able to predict when and in what situations the event will occur. This research is just as rooted in theory as explanation. This research calls for a high order of inference making. In business research, prediction is found in studies conducted to evaluate specific courses of action or to forecast current and future values.

➢ **Analytical research**: The researcher has to use facts or information already available, and analyse these to make a critical evaluation of the material.

➢ **Quantitative research**: Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity

➢ **Cross-Sectional Design**

A cross-sectional design is used for research that collects data on relevant variables one time only from a variety of people, subjects, or phenomena. A cross-sectional designs provides a snapshot of the variables included in the study, at one particular point in time.

➢ **Longitudinal:** A longitudinal design collects data over long periods of time. Measurements are taken on each variable over two or more distinct time periods. This allows the researcher to measure change in variables over time.

➢ **Fundamental:** Mainly concerns generalizations and formulation of a theory. In other words, "Gathering knowledge for knowledge's sake is termed 'pure' or 'basic' research"
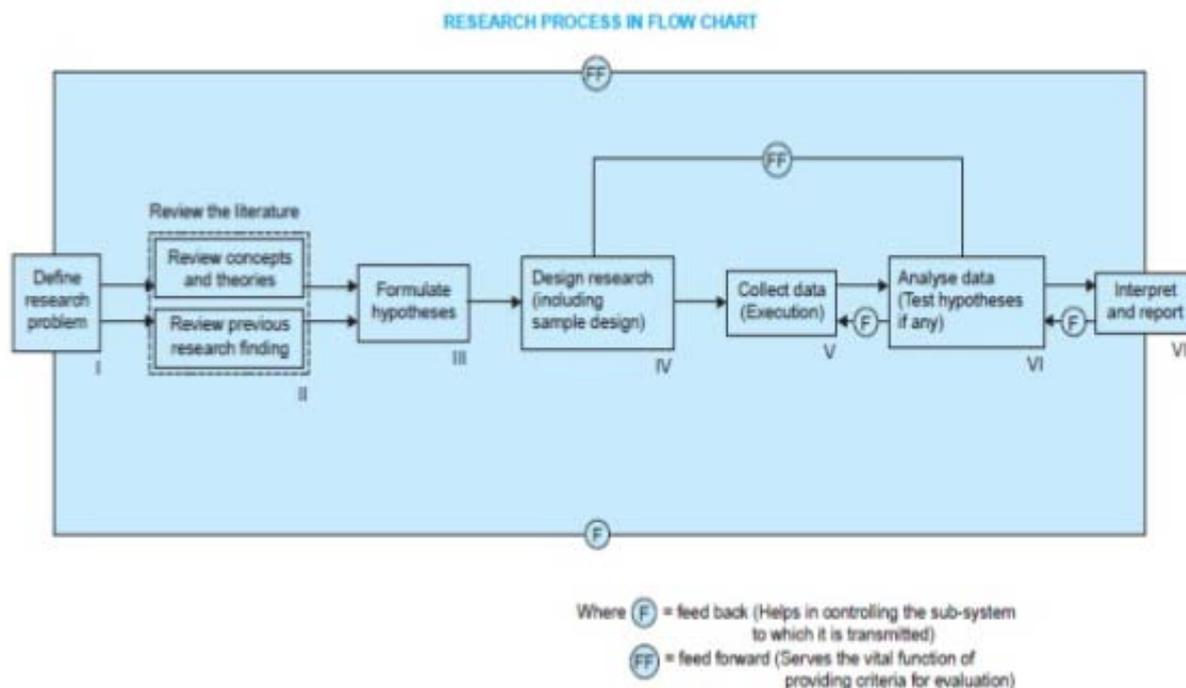
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(Young in Kothari, 1988). Researches relating to pure mathematics or concerning some natural phenomenon are instances of Fundamental Research. Likewise, studies focusing on human behaviour also fall under the category of fundamental research.

➢ **Quantitative:** Quantitative research relates to aspects that can be quantified or can be expressed in terms of quantity. It involves the measurement of quantity or amount. Various available statistical and econometric methods are adopted for analysis in such research. Which includes correlation, regressions and time series analysis etc,.

➢ **Qualitative:** Qualitative research is concerned with qualitative phenomena, or more specifically, the aspects related to or involving quality or kind. For example, an important type of qualitative research is 'Motivation Research', which investigates into the reasons for certain human behaviour. The main aim of this type of research is discovering the underlying motives and desires of human beings by using in-depth interviews. The other techniques employed in such research are story completion tests, sentence completion tests, word association tests, and other similar projective methods. Qualitative research is particularly significant in the context of behavioural sciences, which aim at discovering the underlying motives of human behaviour.

➢ **Conceptual :** The research related to some abstract idea or theory is known as Conceptual Research. Generally, philosophers and thinkers use it for developing new concepts or for reinterpreting the existing ones.

➢ **Empirical:** Empirical Research, relies on the observation or experience with hardly any regard for theory and system. Such research is data based, which often comes up with conclusions that can be verified through experiments or observation. Empirical research is also known as experimental type of research, in which it is important to first collect the facts and their sources, and actively take steps to stimulate the production of desired information.

➢ **Time Series**

A Time Series research collects data on the same variable at regular intervals in the form of aggregate measures of a population. Time series designs are useful for:

- establishing a baseline measure
- describing changes over time
- keeping track of trends
- forecasting future (short term) trends

➢ **Historical research** is research involving analysis of events that occurred in the remote or recent past. Historical research can show patterns that occurred in the past and over time which can help us to see where we came from and what kinds of solutions we have used in the past. Understanding this can add perspective on how we examine current events and educational practices.

RESEARCH PROCESS:

Research process consists of a series of steps or actions required for effectively conducting research. The following are the steps that provide useful procedural guidelines regarding the conduct of research:

Research Process Flow Chart

RESEARCH PROCESS IN FLOW CHART

Where (F) = feed back (Helps in controlling the sub-system to which it is transmitted)
(FF) = feed forward (Serves the vital function of providing criteria for evaluation)

1. Identifying, Evaluating and Formulating the Research Problems-:

After creating interest in a research work, a researcher has to think about formulating the problem related to his research work. Choosing a correct problem for study is the most important step in the entire research process. After selecting the problem, the researcher has to formulate the problem.

2. Extensive Literature Survey:-

Before formulating the research it is desirable that researcher examines all available literature, both conceptual and empirical. The conceptual literature is one which deals with concepts and theories. Empirical literature is that which contains studies made earlier and so it consists of many facts and figures observed in the earlier studies.

3. Writing a Primary Synopsis:-

After formulating the problems a brief summary of it should be written down. A research worker has to write a synopsis of the topic selected for research work mentioning the summary of what is going to be done under his research.

4. Indentifying and Labeling Variables: -

In any research the problem under study deals with relation between variables. The variables whose change has affected the other variable, is called independent variable. Therefore there is a cause and effect relation between the variables. The research problem must be formulated in such a manner that it highlights the nature, extent and implications of relation existing between the variables. It is only through this process of establishing the effective relation between variables that meaningful conclusions are derived from the study.

5. Setting Up Of Hypothesis:

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Specification of working hypothesis is a basic step in the research process. A hypothesis is a tentative conclusion logically drawn. The research work is conducted to test the truth of this hypothesis.

6. Preparing the Research Design:-

A research design is a plan that specifies the sources and types of information relevant to the research problem. It is a strategy which approach will be used for gathering and analyzing the data. It includes the time and cost budgets since most studies are done under these two constraints. A research design provides a rational approach to research enabling one to decide in advance what to do, how to do, in investigating the subjects.

7. Determining the Sample Design:-

A sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given universe. Sample design refers to the technique or the procedure which the researcher would adopt in selecting some sampling units from the universe for drawing inferences about the universe. If the proper procedure is followed to select the sample, definitely the sample will give all dependable information.

8. Collecting of Data: -

There are several ways of collecting the appropriate data. Some of the methods of collecting primary data are (1) Observation method. (2) Direct personal interview method. (3) Telephone interview method. (4) Questionnaire method. (5) Schedule method. A choice of one of these methods.

9. Execution of the Project: -

The researcher has to see that the project is executed in a systematic manner and in time. He should make necessary preparations for successful conduct of the project.

10. Processing, Analysis and Interpretation of Data by Statistical Methods: -

The processing of data consists of classification, tabulation and coding. By classification and tabulation the unwieldy data can be condense into few manageable and purposeful groups and tables so that further analysis becomes simple. Coding converts the data into symbols and small figures so that the data can be dealt with in an easy manner. Editing improves the quality of the data since it is at this stage that data which is irrelevant can be dropped. Analysis and interpretation of data results in observation, analysis, conclusion, induction and deduction. For this various statistical measures are computed.

11. Testing of Hypothesis: -

Depending upon the nature of data and conclusions to be arrived one or two of these tests can be applied. Testing of hypothesis will results in either accepting or rejecting the hypothesis. Testing of hypothesis may prove or disprove a theory and a theory facilitates formulating of a further hypothesis. Testing of hypothesis will result in contribution to existing theory or the generation of a new theory.

12. Preparation of the Report or Thesis:-

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 report should contain the preliminary section, the main body and the end matter. The preliminary section contains only titles, data, acknowledgement foreword and table of contents. The important section of a report is its

main body. It carries introduction, methodology, and statements of findings, conclusions and recommendations. The end matter includes appendix, literature selected and bibliography. The appendix includes letters, questions or other tools used. Bibliography is the list of books, journals. Reports, bulletins etc. used for reference.

RESEARCH PROBLEMS
Refers to some difficulty which a researcher experiences in the context either a theoretical or practical situation and wants to obtain solution for the same

Components of a Research Problem
- There must be an individual or a group which has some difficulty or the problem
- There must be some objectives to be attained at.
- There must be alternative means for obtaining the objectives one wishes to attain
- There must remain some doubt in the mind of a researcher with regard to the selection of alternatives
- There must be some environment to which the difficulty pertains

Steps in Research Problem
- Statement of the problem in a general way
- Understanding the nature of the problem
- Surveying the available literature
- Formulating the ideas through discussions
- Finalizing the research problem

HYPOTHESIS:
  "Hypothesis may be defined as a proposition or a set of propositions set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation in the light of established facts" (Kothari, 1988). A research hypothesis is quite often a predictive statement, which is capable of being tested using scientific methods that involve an independent and some dependent variables. For instance, the following statements may be considered:
i. "Students who take tuitions perform better than the others who do not receive tuitions" or,
ii. "The female students perform as well as the male students".

These two statements are hypotheses that can be objectively verified and tested. Thus, they indicate that a hypothesis states what one is looking for. Besides, it is a proposition that can be put to test in order to examine its validity.

Role of Hypothesis:
• It guides the direction of the study
• It identifies facts that are relevant and those that are not
• It suggests which form of research design is likely to be most appropriate
• It provides a frame work for organising the conclusions that result

Different Types of Hypothesis:

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- ➢ **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.
- ➢ **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
- ➢ **Non-Directional Hypothesis** If the hypothesis simply predicts that there will be a difference between the two groups, then it is a. It is non-directional because it predicts that there will be a difference but does not specify how the groups will differ.
- ➢ **Directional Hypothesis** If, however, the hypothesis uses so-called comparison terms, such as "greater,""less,""better," or "worse," then it is a directional hypothesis. It is directional because it predicts that there will be a difference between the two groups and it specifies how the two groups will differ

Characteristics of Hypothesis:

A hypothesis should have the following characteristic features:-

- • It should be clear and precise
- • It should be capable of being tested
- • It should be related to the body of the theory
- • It should be related to the available techniques
- • It should state relationship between variables
- • It should be stated in simple terms
- • It should be consistent with most known facts

Source of Hypothesis

Theoretical or conceptual frameworks

- • Through a deductive approach these hypotheses are drawn from theoretical or conceptual frameworks for testing them.

Previous research

- • Findings of the previous studies may be used for framing the hypotheses for another study.
- • For example, in a small sample descriptive study, a researcher found that a number of patients admitted with coronary artery disease had increased body mass index.

Real-life experiences

- ■ Real-life experiences also contribute in the formulation of hypotheses for research studies.

- For example, Newton had a life-changing experience of the falling of an apple & formulated a hypothesis that earth attracts all the mass towards its centre, through several researchers were conducted before generating a law of central gravity.

Academic literature

- Academic literature is based on formal theories, empirical evidences, experiences, observation, & conceptualizations of academicians. These literatures may serve as good sources for formulating hypotheses for research studies

HYPOTHESIS TESTING:
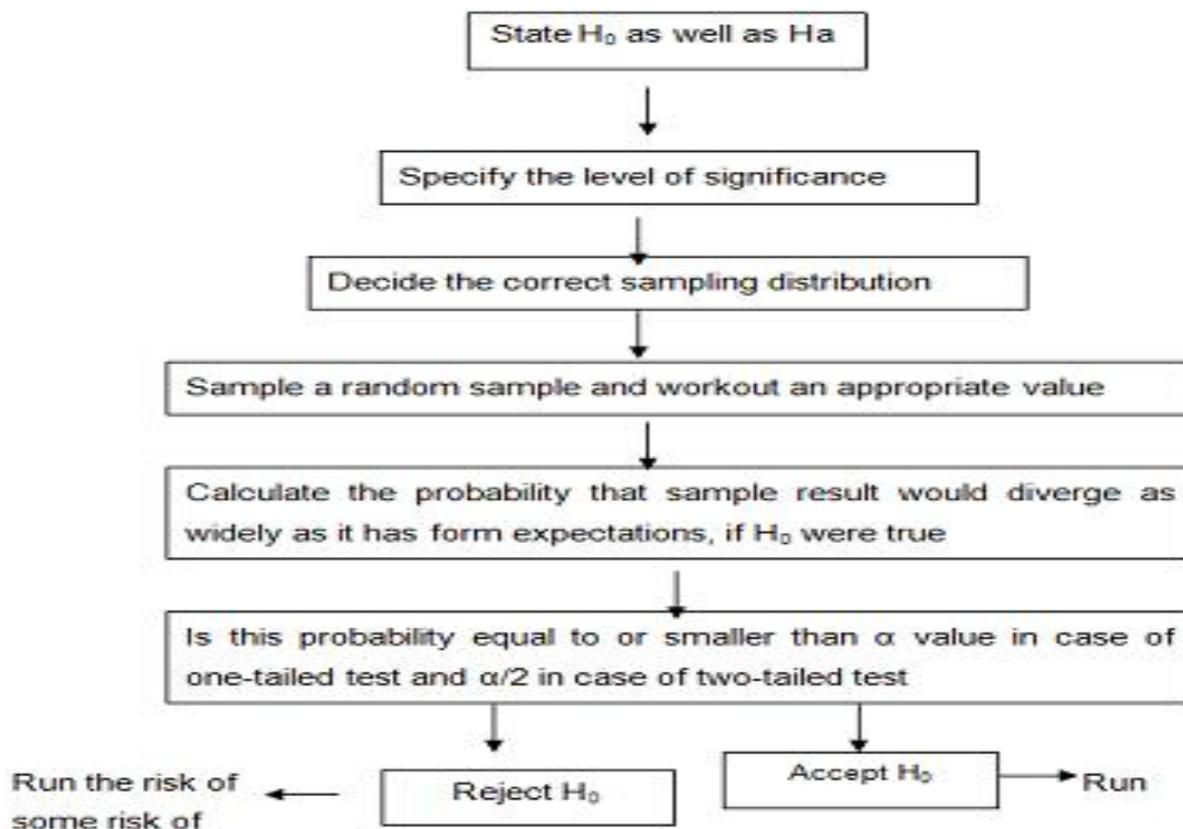
A Statistical hypothesis Statistical hypothesisis a conjecture about a population parameter. This conjecture may or may not be true. The null hypothesis null hypothesis, symbolized by H0, is a statistical hypothesis that states that there is no difference between a parameter and a specific value or that there is no difference between two parameters.

The alternative hypothesis alternative hypothesis, symbolized by H1, is a statistical hypothesis that states a specific difference between a parameter and a specific value or states that there is a difference between two parameters.

Testing Procedure:

1. The first step is to state the relevant null and alternative hypotheses. whether the alternative hypothesis can either be accepted or stays undecided as it was before the test.

2. The second step is to consider the statistical assumptions being made about the sample in doing the test; for example, assumptions about the statistical independence or about the form of the distributions of the observations.
3. Decide which test is appropriate, and stating the relevant test statistic.
4. Derive the distribution of the test statistic under the null hypothesis from the assumptions. For example, the test statistics may follow a Student's t distribution or a normal distribution.
5. The distribution of the test statistic partitions the possible values of T into those for which the null-hypothesis is rejected, the so called critical region, and those for which it is not.
6. Compute from the observations the observed value of the test statistic.
7. Decide to either fail to reject the null hypothesis or reject it in favour of the alternative. The decision rule is to reject the null hypothesis H0 if the observed value is in the critical region, and to accept or "fail to reject" the hypothesis otherwise.

Theory and Concept:

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 deduced 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:
- They must be logically consistent.
- They must be interrelated.
- The statements must be exhaustive.
- The propositions should be mutually exclusive.
- They must be capable of being tested through research.

Role of Theory in Research

Interaction between theory and research is a continuous process of science leading to consolidation of existing knowledge and additions to it.
1. Theory provides significant guidelines for the empirical research by pointing to areas in which meaningful relationships are likely to be found. Theory narrows down range of facts to be studied. Theory provides the research a definite point of view helping him enquires into relationships between certain variables selected infinite array of variables. A theory provides fruitful hypotheses and new perspectives. It also points to gaps in our knowledge.
2. Theory increases the meaning of the findings of empirical research by helping us to perceive them as special cases of a set of abstract statements of relationships. Research findings will have meaning only when they are put into a theoretical perspective. Theory summarizes relationships amongst variables in a conceptual framework.
3. Proper linkage between theory and research findings provides a more secure ground

for prediction about future events.

4. Research findings in theoretical framework provide a secure basis for drawing inferences about consequences in remote areas from the central area to which the findings relate.
5. Theory attests to the truth of research findings.
6. Theory helps in bridging the gaps in knowledge with intuition..

General Principles Regarding the Use of Theory in Research

1. Knowledge of the existing theory in one's area of research is essential for conducting research.

2. Concepts are crucial components of theory and so their clear definitions are essential to the designing of the study.

3. One should view theory as hypothetical proposition and not as conclusive fact.

4. One should pay attention to all odd and puzzling unexpected observations in one's research and enquire into them. They may be a source for new theoretical approaches.

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UNIT II

UNIT II RESEARCH DESIGN AND MEASUREMENT

Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of `– Validity and Reliability of instrument.

MEANING OF RESEARCH DESIGN:

"A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure." In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data.

- o What is the study about?
- o Why is the study being made?
- o Where will the study be carried out?
- o What type of data is required?
- o Where can the required data be found?
- o What periods of time will the study include?
- o What will be the sample design?
- o What techniques of data collection will be used?
- o How will the data be analysed?
- o 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:

- The sampling design which deals with the method of selecting items to be observed for the given study
- The observational design which relates to the conditions under which the observations are to be made;
- 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
- 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 as under:

- o It is a plan that specifies the sources and types of information relevant to the research problem.
- o It is a strategy specifying which approach will be used for gathering and analysing the data.
- o It also includes the time and cost budgets since most studies are done under these two constraints.
- The observational design which relates to the conditions under which the observations are to be made;

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

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.

Types of Research Design:

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

(1) Exploratory Research Design;

(2) Descriptive and Diagnostic Research Design; and

(3) Hypothesis-Testing Research Design.

1. Exploratory Research Design:

The Exploratory Research Design is known as formulative research design. The main objective of using such a research design is to formulate a research problem for an in-depth or more precise investigation, or for developing a working hypothesis from an operational aspect. The major purpose of such studies is the discovery of ideas and insights. Therefore, such a research design suitable for such a study should be flexible enough to provide opportunity for considering different dimensions of the problem under study. The in-built flexibility in research design is required as the initial research problem would be transformed into a more precise one in the exploratory study, which in turn may necessitate changes in the research procedure for collecting relevant data. Usually, the following three methods are considered in the context of a research design for such studies. They are (a) a survey of related literature; (b) experience survey; and (c) analysis of 'insight-stimulating' instances.

2. Descriptive and Diagnostic Research Design:

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

a) Formulation of the objectives of the study,

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b) Proper designing of the methods of data collection,

c) Sample selection,

d) Data collection,

e) Processing and analysis of the collected data, and

f) Reporting the findings.

3. Hypothesis-Testing Research Design:

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

EXPERIMENTAL RESEARCH DESIGN

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

All experiment involve three basic component.

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

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

Advantage:

1. The researcher can manipulates the independent variable
2. Control group serves as a comparison to assess the existence and potency of the manipulation.
3. The contamination from extraneous variable can be controlled more effectively.
4. The convenience and cost of experimentation are superior to other methods.
5. The experimenter can assemble combination of variables for testing .
6. Repeating an experiment with different subject group and condition is possible.
7. Researcher can use naturally occurring events.

Disadvantages:

1. The laboratory experiment is artificial
2. Generalisation from non-probability samples can poses problems.
3. The experimentation can outrun the budget.
4. It is mostly effectively targeted at present or immediate future problems.
5. It is concerned with the study of people.
6. There is limits to the types of manipulation and control that are ethical.

CONDUCTING AN EXPERIMENT:

1. **Select relevant Variable**

In this step researcher will a) Select variable that are the best operational concepts. b) Determine how many variables to test c) Select or design appropriate measures for them.

2. **Specify the level of the treatment**:
The treatment levels of the independent variables are the distinctions the researcher makes between different aspects of the treatment condition.

3. **Control the experimental Environment:**
At this research concerned with environment control, holding constant the physical environment of the experiment. The introduction of the experiment to the subjects and the instruction would likely be videotaped for consistency. The arrangement of the room , the time of administration the experimenter's contract with the subjects and so forth must all be consistent across each administration of the experiment.

4. **Choose the experimental design:**
The experimental design are unique to the experimental. They serve as positional and statistical plans to designate relationships between experimental treatment and the experimenter's observations or measurement points in the temporal   scheme of the study. The design strengthen the generalizability of results beyond the experimental setting

5. **Select and assign the subjects:**
The subject selected for the experiment should be representative of the population to which the researcher wishes to generalize. The researcher first prepares a sampling frame and then assigns the subject for the experiment to groups using a randomization technique. If randomization is used those assigned to the experimental group are likely to be similar to those assigned to the control group. Random assignment to the group is required to make the group as comparable as possible with respect to the dependent variable.

6. **Pilot test –revise and test**:
Pilot testing is intended to reveal errors in the design and improper control of extraneous or environmental conditions. Pretesting the instrument permits the researcher to revise scripts ,look for control problems with laboratory conditions and scan the environmental for factor that might confound the results.

7. **Analyse the data**:
If adequate planning and pretesting have occurred the experimental data will take an order and structure uncommon to surveys and unstructured observational studies. Researcher has several measurement and instrument options with experiment. Among them are
   1) Observational technique and coding schemes
   2) Paper and pencil tests
   3) Self report instrument with open or dosed questions
   4) Scaling technique
   5) Physiological measure

VALIDITY IN EXPERIMENTATION:
Validity refers to the extent to which the conclusions drawn from the are true experiment

I- <u>**Internal validity**</u> :

Refers to the extend to which the research design accurately identifies casual relationship.

a) History

When extraneous factors that enter the experiment process between the first and later manipulation affect measure of the dependent variable.

b) Maturation :

Changes in the dependent variable based on the natural function of time and not attributed to any specific event.

c) Testing

When learned understanding gained from the first treatment and measure of the dependent variable distort future treatment and measurement activities.

d) Instrumentation :

Contamination from changes in measurement processes observation technique and measuring instruments

e) Selection Bias:

Contamination created by inappropriate selection or assignment process of test subject to experimental treatment groups

f) Statistical Regression:

Contamination created when experiment group are selected on the basis of their extreme response or scores.

g) Mortality :

Contamination due to changing the composition of the test subjects in the experiment.

h) Ambiguity :

Contamination from unclear determination of cause effect relationship

II - <u>**External Validity**</u> :

Refer to the extent to which a casual relationship found in a study can be expected to be true for the entire target population.

a) Treatment Vs Treatment

When test subject in different treatment groups are exposed to different amount of manipulations.

b) Treatment Vs Testing

When the premeasurement process sensitizes test subject to respond in an abnormal manner to treatment manipulation.

c) Treatment Vs Selection

Generalising the results to other categories of people beyond those used in the experiment

d) Treatment Vs Setting

Generalising the results to other environment beyond the one used in the experiment.

e) Treatment Vs History

Using the existing functional relationship to predict future phenomenon outcomes.

III - <u>**Construct Validity**</u>

Refers to the extent to which the variables under investigation are completely and accurately identified prior to hypothesizing any functional relationships.

a) Inadequate pre-operationalization of variable

Contamination due to inadequate understanding of the complete make-up of the independent and dependent variable included in the experimental design.

b) **Mano operation bias**

Contamination created by using only one method to measure the outcome of the dependent variable.

c) **Mano-method bias**

Contamination due to assessing multi-attribute treatment manipulation using single item measuring instrument.

d) **Hypothesis –guessing**

Contamination by test subject believing they know the desired functional relationship relationship prior to the manipulation treatment.

e) **Evaluation Apprehension**:

Contamination caused by test subjects being fearful that their actions or response will become known to others.

f) **Demand Characteristic**:

Contamination created by test subjects trying behind the experiment thus abnormal socially acceptable responses or behaviour.

g) **Diffusion Of treatment**

Contamination due to test subject discussing the treatment and measurement activities with individual yet to receive the treatment.

IMPROVING THE VALIDITY OF EXPERIMENT DESIGN:

a) Inclusion of control group

When designing an experiment the researcher must determine who will be assigned to the group that will be exposed to the manipulation and who will be assigned to the control that does not receive the manipulation. Control group represent the greatest strength of the experiment and the best way to ensure internal validity.

b) Time order of the manipulation exposure:

The researcher also must determine which variables, independent or dependent will occur first. This can be accomplished by using pre-experimental measure of the variables prior to manipulation or by establishing experimental treatment and control group that do not differ in terms of influencing the dependent variable before the manipulation takes place.

c) Exclusion of Non similar test subject

To increase internal validity the researcher can select only those test subject who have similar and controllable characteristics.

d) Matching extraneous variable

Through the process of matching, the researcher measure certain extraneous variable on a individual by individual basis Those who respond similarly to the variables are then allocated to the experimental and control groups. Again this process can control for both selection and statistical regression threats and enhances internal validity.

e) Randomisation Of Test subjects to treatment groups

Randomization of the assignment of test subjects to the experimental and control groups can help make the groups equivalent . To enhance external validity the researcher should also randomly select setting and times for the experiment based on the population or event under investigation.

PRINCIPLES OF EXPERIMENTAL DESIGN

a) Principle of Replication :

According to this principle the experiment should be repeated more than once. So each treatment is applied in many experimental units instead of one. By this statistical accuracy of the experiment can be increased. This aims for increase in accuracy with which effects and interactions can be estimated.

b) Principle of Randomisation

It provides protection, against the effect of extraneous factors in experiment. This principle indicates that we should design or plan the experiment in such a way that the variations caused by extraneous factors can all be combined under the general heading of chance.

c) Principal Of local control

Under this method we first divide the whole unit into several homogenous parts , known as blocks and then each such block is divided into parts equal to the number of treatment. Then the treatment are randomly assigned to these parts of the block.

TYPES OF EXPERIMENTAL DESIGN

I - Informal experimental design

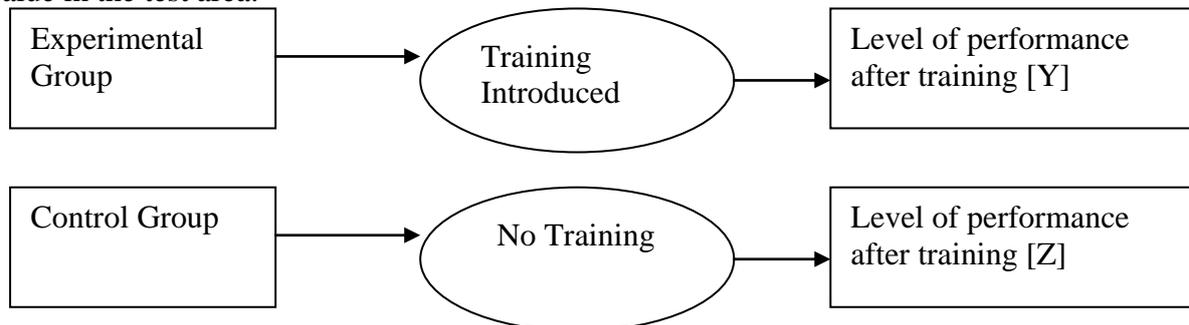#### 1) Before and after without control design

In this design a single test group or area is selected and the dependent variable is measured before the introduction of the treatment. The treatment is then introduced and the dependent variable is measured again after the treatment has been introduced.
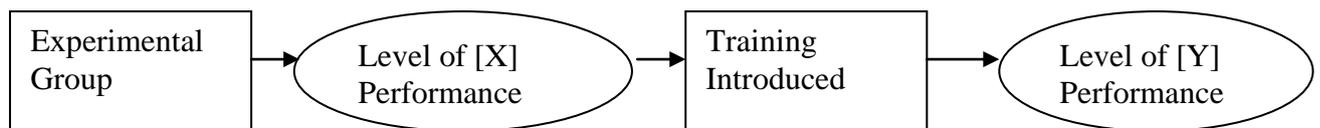
Training Effect = Y- X

2) After – Only with control design

In this design two group or areas are selected and the treatment is introduced into the test area only. The dependent variable is then measured in both the areas at the same time. Treatment impact is assessed by subtracting the value of the dependent variable is then measured in both the areas at the same time. Treatment impact is assessed by subtracting the value in the test area.

Training Effect = Y- Z

#### 3) Before and After with control design

In this design two areas are selected and the dependent variable is measured in both the areas for an identical time period before the treatment. The treatment is then introduced into the test area only, and the dependent variable is measured in both for an identical time period after the introduction of the treatment. The treatment effect is determined by

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subtracting the change in the dependent variable in the control area from the change in the dependent variable in the test area.

Time Period – I		**Time Period - II**	
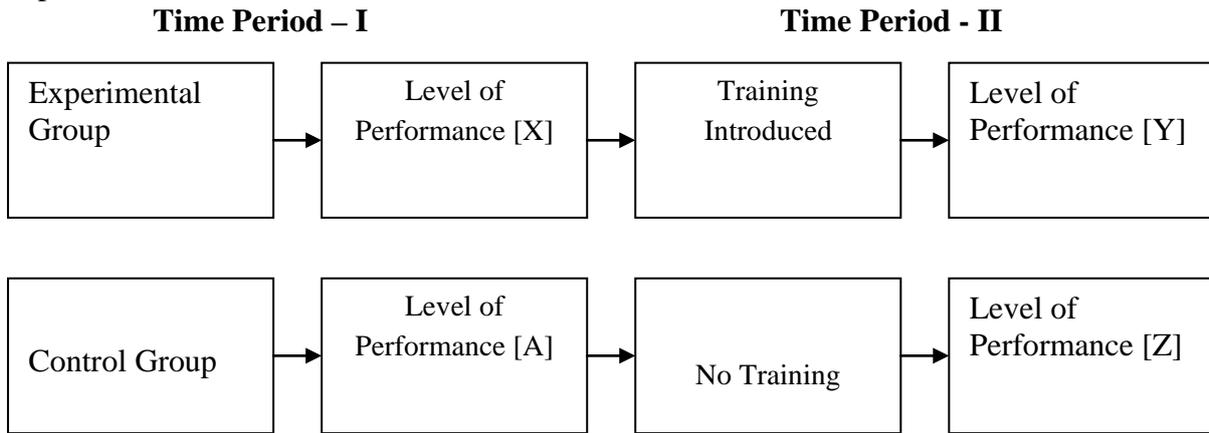
Training Effect [Y-X] – [Z-A]

II Formal Experimental Design
4) Completely Randomized design

In this design the subjects are randomly assigned to experimental treatments. It involves two basic principle , ie principle of replication and principle of randomization of experimental designs.

a) Two group simple randomization design

In this design all the population is defined and then from population a sample is selected randomly. Then the samples are randomly assigned to the experimental and control groups. The two groups ie experimental & control , of such a design are given different treatments of the independent variable. This design is common in behavioural sciences.
It is simple & randomize the differences among the sample items. But this does not control extraneous variable.
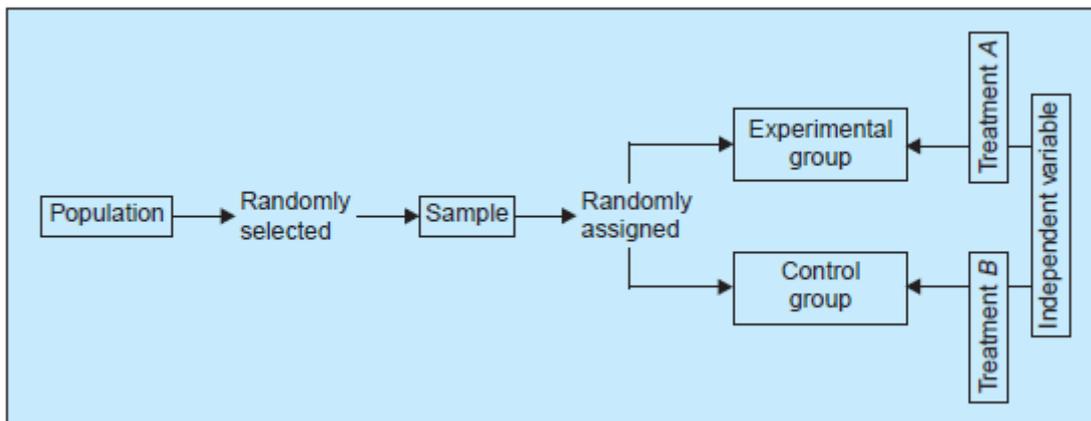
b) Random replication design :

In previous design extraneous variable was not controlled . But in this method the effect of such variable are minimized by providing a number of repetitions for each treatment. Each repetition is technically called a replications. In this design sample is taken randomly from the population available to conduct experiments and randomly assigned to four experimental & four control groups. Generally equal number of items are put in each

group so that the size of the group is not likely to affect the results of the study. Due to repetitions the results are more reliable and population differences is also reduced as it is randomized.
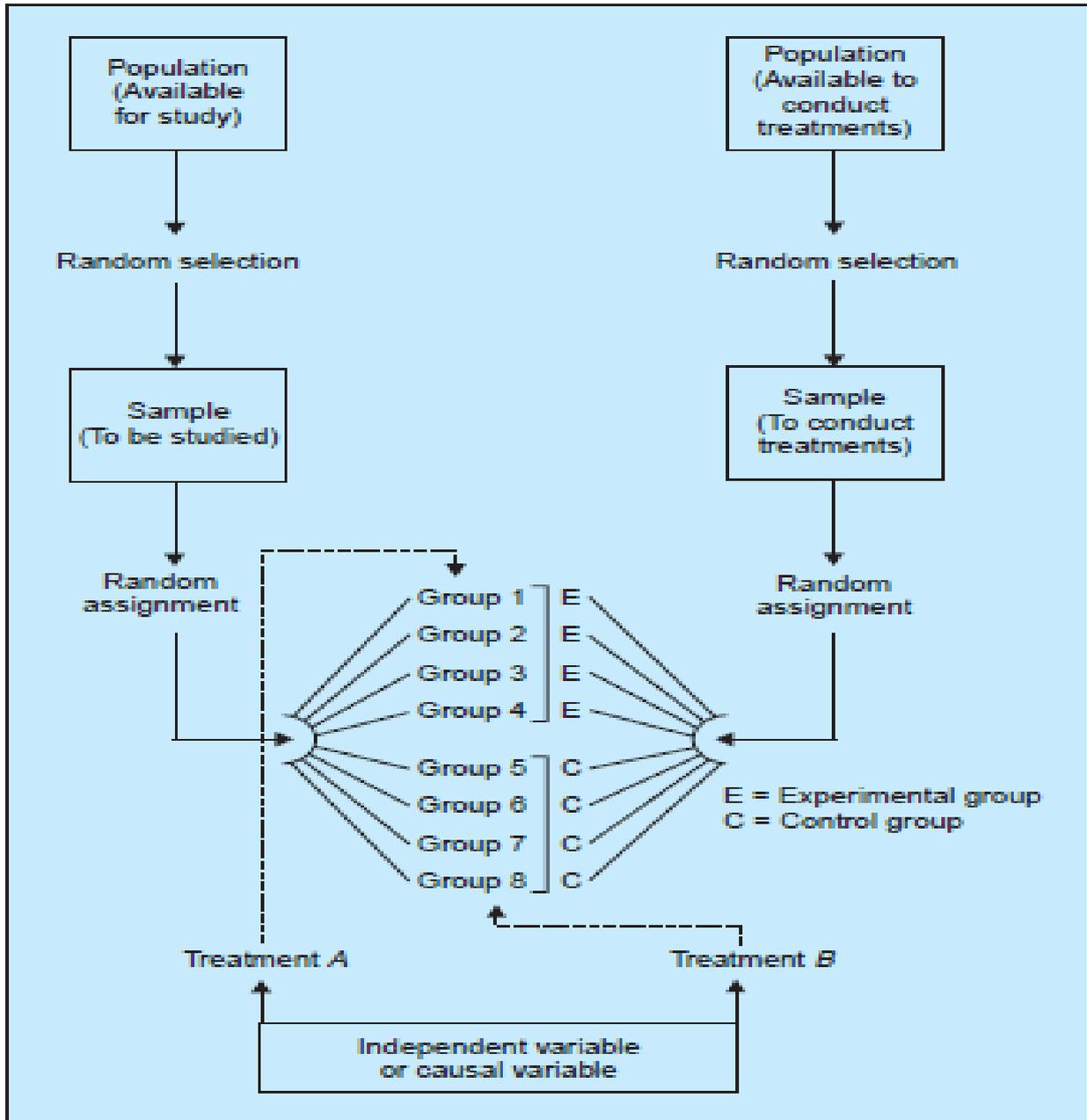
5) Randomized Block design

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

that its contribution to the total variability of data can be measured. The main feature of the R.B. design is that in this each treatment appears the same number of times in each block.

Randomized Block Design:

Student	Very Low I.Q A	Very Low I.Q B	Very Low I.Q C	Very Low I.Q D	Very Low I.Q E
Form 1					
Form 2					
Form 3					
Form 4					
Form 5					

6) Latin Squares design

It is used in agricultural research. For eg an experiment has to be made through which the effects of five different varieties of fertilizers on the yield of a certain crop say wheat is to be judged. In such case the varying fertility of the soil in different blocks in which the experiment has to be performed must be taken into consideration otherwise the results obtained may not be very dependable because the output happens to be the effect not only of fertilizers, but it may also be the effect of fertility of soil , varying seeds. To overcome such difficulties the L.S design is used when there are two major extraneous factors such as the varying soil fertility & varying seeds.

The merit of this design is it enables differences in fertility gradients in the field to be eliminated in comparision to the effects of different varieties of fertilizers on the yield of the crop. But it has a limitation , that there is no interation between treatments and blocking factors and it requires rows & columns to be equal

	I	II	III	IV	V
X1					
X2					
X3					
X4					
X5					

Fertility Level

7) Factorial Design

It is used in experiment where the effects of varying than one factor be determined.
a) Simple factorial Designs;

It is also termed as a two –factor factorial design. In this design the extraneous variable to be controlled by homogeneity is called the control variable and the independent variable , which is manipulated is called the experimental variable. Then there are two experimental variable and two levels of the control variable. Subjects are assigned at random to each treatment just

like Random design. Means of different cells represent the mean scores for the dependent variable. The column means represent the effect for treatments without taking in account of control variable. The row means represent the effect for levels without regard to treatment. Thus we can study the main effect of treatments as well as the main effect of levels. It is also possible to examine the interactions between treatment and levels, whether they are independent of each other nor they are not so.

Training

Control Intelligence	Treatment A	Treatment B	Row Mean
Level I	155	23.3	19.4
Level II	35.8	30.2	33.0
Column Mean	256	26.7	

Training

Control Intelligence	Treatment A	Treatment B	Row Mean
Level I	10.4	20.6	15.5
Level II	30.6	40.4	35.5
Column Mean	20.5	80.5	

b) Complex Factorial design:

Experiment with more than two factors at a time involve the use of complex factorial design. A design which considers three or more independent variables simultaneously is called a complex factorial design. When three factors with one experimental variable having two treatments and two control variable each one of which having two levels , the design used will be termed complex factorial design. In this method it is possible to determine the main effect for three variables ie one experimental and two control variables. The researcher can also determine the interactions between each possible pair of variables.

		Experimental Variable			
		Treatment A		Treatment B	
		C.V. 2 Level 1	C.V. 2 Level 2	C.V. 2 Level 1	C.V. 2 Level 2
Control Variable	Level I				
	Level II				

VALIDITY

"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 ... Practicality is concerned with a wide range of factors of economy, convenience, and interpretability ..." We briefly take up the relevant details concerning these tests of sound measurement.

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 the question arises: how can one determine validity without direct confirming knowledge? The answer may be that we seek other relevant evidence that confirms the answers we have found with our measuring tool. What is relevant, evidence often depends upon the nature of the research problem and the judgement of the researcher. But one can certainly consider three types of validity in this connection: (i) Content validity; (ii) Criterion-related validity and (iii) Construct validity.

(i) Content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. If the instrument contains a representative sample of the universe, the content validity is good. Its determination is primarily judgemental and intuitive. It can also be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards, but there is no numerical way to express it.

(ii) Criterion-related validity relates to our ability to predict some outcome or estimate the existence of some current condition. This form of validity reflects the success of measures used for some empirical estimating purpose. The concerned criterion must possess the following qualities:

- Relevance: (A criterion is relevant if it is defined in terms we judge to be the proper measure.)
- Freedom from bias: (Freedom from bias is attained when the criterion gives each subject an equal Opportunity to score well.)
- Reliability: (A reliable criterion is stable or reproducible.)
- Availability: (The information specified by the criterion must be available.)

In fact, a Criterion-related validity is a broad term that actually refers to

(i) Predictive validity and

(ii) Concurrent validity.

The former refers to the usefulness of a test in predicting some future performance whereas the latter refers to the usefulness of a test in closely relating to other measures of known validity. Criterion-related validity is expressed as the coefficient of correlation between test scores and some measure of future performance or between test scores and scores on another measure of known validity.

(iii) Construct validity is the most complex and abstract. A measure is said to possess construct validity to the degree that it confirms to predicted correlations with other theoretical propositions. Construct validity is the degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory. For determining construct validity, we associate a set of other propositions with the results received from using our measurement instrument. If measurements on our devised scale correlate in a predicted way with these other propositions, we can conclude that there is some construct validity. If the above stated criteria and tests are met with, we may state that our measuring instrument is valid and will result in correct measurement; otherwise we shall have to look for more information and/or resort to exercise of judgement.

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 overweighs 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. If the quality of reliability is satisfied by an instrument, then while using it we can be confident that the transient and situational factors are not interfering.

Two aspects of reliability viz., stability and equivalence deserve special mention. The stability aspect is concerned with securing consistent results with repeated measurements of the same person and with the same instrument. We usually determine the degree of stability by comparing the results of repeated measurements. The equivalence aspect considers how much error may get introduced by different investigators or different samples of the items being studied. A good way to test for the equivalence of measurements by two investigators is to compare their observations of the same events. Reliability can be improved in the following two ways:

(i) By standardising the conditions under which the measurement takes place i.e., we must ensure that external sources of variation such as boredom, fatigue, etc., are minimised to the extent possible. That will improve stability aspect.

(ii) By carefully designed directions for measurement with no variation from group to group, by using trained and motivated persons to conduct the research and also by broadening the sample of items used. This will improve equivalence aspect.

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. Although more items give greater reliability as stated earlier, but in the interest of limiting the interview or observation time, we have to take only few items for our study purpose. Similarly, data-collection methods to be used are also dependent at times upon economic factors. Convenience test suggests that the measuring instrument should be easy to administer. For this purpose one should give due attention to the proper layout of the measuring instrument. For instance, a questionnaire, with clear instructions (illustrated by examples), is certainly more effective and easier to complete than one which lacks these features. Interpretability consideration is especially important when persons other than the designers of the test are to interpret the results. The measuring instrument, in order to be interpretable, must be supplemented by

(a) detailed instructions for administering the test;

(b) scoring keys;

(c) evidence about the reliability and

(d) guides for using the test and for interpreting results.

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 six common variable types:

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

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

. . . refer to abtract 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.

MODERATOR 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.

CONTROL VARIABLES

Language learning and teaching are very complex processes. It is not possible to consider every variable in a single study. Therefore, the variables that are not measured in a particular study must be held constant, neutralized/balanced, or eliminated, so they will not have a biasing effect on the other variables. Variables that have been controlled in this way are called control variables.

EXTRANEOUS VARIABLES

. . . are those factors in the research environment which may have an effect on the dependent variable(s) but which are not controlled. Extraneous variables are dangerous. They may damage a study's validity, making it impossible to know

whether the effects were caused by the independent and moderator variables or some extraneous factor. If they cannot be controlled, extraneous variables must at least be taken into consideration when interpreting results.

MEASUREMENT AND SCALING

The word scale or scaling is generally used for indicating measurements or measuring something. Many aspects of social phenomena like emotion, attitude, faiths etc. are not measurable directly. They are not quantitative in nature. In social phenomena there are two types of variables quantitative and qualitative. Measurement or scaling implies conversion of qualitative data into quantitative data and then measuring them. Various kinds of statistical measurements are used for this purpose. Scaling is an attempt to bring about greater accuracy which is desired in both physical and social sciences.

Essentials of Scaling (Criteria for Good Scaling)

- Continuum means judging the scalability of the phenomenon under study.
- Reliability means that it should consistently produce the same result when applied to the same design.
- Validity implies correct measurement. A scale is valid if it measures correctly what is expected to measure.
- weighting items means proper weights are to be provided to the attributes involved in the study because they are not of equal importance.
- Equality of units is a desirable characteristic but not essential for sound scientific procedure. In order to make the units equal, sometimes subtraction or addition can be made.

MEASUREMENT SCALES:

The most widely used classification of measurement scales are: (a) nominal scale; (b) ordinal scale; (c) interval scale; and (d) ratio scale.

(a) Nominal scale: Nominal scale is simply a system of assigning number symbols to events in order to label them. The usual example of this is the assignment of numbers of basketball players in order to identify them. Such numbers cannot be considered to be associated with an ordered scale for their order is of no consequence; the numbers are just convenient labels for the particular class of events and as such have no quantitative value. Nominal scales provide convenient ways of keeping track of people, objects and events. The scale indicates no order or distance relationship and has no arithmetic origin. A nominal scale simply describes differences between things by assigning them to categories. Nominal data are, thus, counted data.

(b) Ordinal scale: The ordinal scale places events in order, but there is no attempt to make the intervals of the scale equal in terms of some rule. Rank orders represent ordinal scales and are frequently used in research relating to qualitative phenomena. A student's rank in his graduation class involves the use of an ordinal scale. For instance, if Ram's position in his class is 10 and Mohan's position is 40, it cannot be said that Ram's position is four times as good as that of Mohan. Ordinal scales only permit the ranking of items from highest to lowest. Ordinal measures have no absolute values, and the real differences between adjacent

ranks may not be equal. Thus, the use of an ordinal scale implies a statement of 'greater than' or 'less than' (an equality statement is also acceptable) without our being able to state how much greater or less. A percentile or quartile measure is used for measuring dispersion. Correlations are restricted to various rank order methods. Measures of statistical significance are restricted to the non-parametric methods.

(c) Interval scale: Interval scales can have an arbitrary zero, but it is not possible to determine for them what may be called an absolute zero or the unique origin. The primary limitation of the interval scale is the lack of a true zero; it does not have the capacity to measure the complete absence of a trait or characteristic. The Fahrenheit scale is an example of an interval scale and shows similarities in what one can and cannot do with it. One can say that an increase in temperature from 30° to 40° involves the same increase in temperature as an increase from 60° to 70°, but one cannot say that the temperature of 60° is twice as warm as the temperature of 30° because both numbers are dependent on the fact that the zero on the scale is set arbitrarily at the temperature of the freezing point of water. The ratio of the two temperatures, 30° and 60°, means nothing because zero is an arbitrary point..

(d) Ratio scale: Ratio scales have an absolute or true zero of measurement. The term 'absolute zero' is not as precise as it was once believed to be. We can conceive of an absolute zero of length and similarly we can conceive of an absolute zero of time. For example, the zero point on a centimetre scale indicates the complete absence of length or height. But an absolute zero of temperature is theoretically unobtainable and it remains a concept existing only in the scientist's mind. The number of minor traffic-rule violations and the number of incorrect letters in a page of type script represent scores on ratio scales. Both these scales have absolute zeros and as such all minor traffic violations and all typing errors can be assumed to be equal in significance. With ratio scales involved one can make statements like "Jyoti's" typing performance was twice as good as that of "Reetu."

The ratio involved does have significance and facilitates a kind of comparison which is not possible in case of an interval scale. Ratio scale represents the actual amounts of variables. Measures of physical dimensions such as weight, height, distance, etc. are examples. Multiplication and division can be used with this scale but not with other scales mentioned above. Geometric and harmonic means can be used as measures of central tendency and coefficients of variation may also be calculated

What is the Validity of a Study?
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

Scaling Techniques :

I - Rating scale:

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

a) Simple category scale :

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

b) Multiple Choice – Single

When there are multiple options for the respondent and only one answer is sought this scale is preferred.

c) Multiple Choice – Multiple response scale

It allows the respondent to select one or more alternatives from multiple choices.

e) Likert Scale –

It is a mostly used summated rating scale. It consists of statements that express either a favorable or unfavorable attitude toward the object of interest. The respondent is asked to agree or disagree with each statement. Each response is given a numerical score to reflect its degree of attitude favorableness and the scores may be totaled to measure the respondent's attitude. This data provides interval data.

f) Semantic differential

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

g) Numerical Scale

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

h) Multiple rating scale:

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

i) Fixed sum scale

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

j) Graphic rating scale:

It was created to enable researcher to discern fine differences. It uses pictures , icons or other visuals to communicate with the respondents.

II Ranking Scales

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

a) **Paired –comparison**

In this respondent can express attitudes clearly by choosing between two objects.

b) **Forced Ranking Scale**:

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

c) **Comparative Scales**

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

SCALE CONSTRUCTION TECHNIQUES

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

1) That the statement must elicit responses which are psychologically related to the attitude being measured.
2) That the statements need be such that they discriminate not merely between extremes of attitude but also among individual who differ slightly.

DIFFERENT SCALES FOR MEASURING ATTITUDES OF PEOPLE

Name of the scale construction approach	Name of the scales developed
1. Arbitrary approach	Arbitrary scales
2. Consensus scale approach	Differential scales (Thurstone Differential scale)
3. Item analysis approach	Summated (Likert Scale)
4. Cumulative scale approach	Cumulative Scale (Guttman's Scalogram)
5. Factor analysis approach	Factor scales (Semantic differential, Multi-dimensional scaling)

1. Arbitrary Scale;

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

Merits:
1. It is easy to develop quickly with less expense.
2. It can be designed highly specific and adequate
3.

Demerits ;
1. It is not reliable

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

2. Differential scale (Thustone –type scale)

It is associated with differential scale which have been developed using consensus scale approach. In this selection is made by panel of judges
The procedure is

1. The researcher gather a large number of statements
2. The statements are submitted to panel of judges.
3. Each judge is request to arrange in position according to opinion.
4. Each judge is request to place the statement in first, second groups etc according to his favorableness.
5. In case of disagreement between the judges in assigning a position to an item that item is discarded.
6. A final selection of statements is then made .
7. The position of statements on the scale is determined by judges.

Merits

1. It appropriate when we measure single attitude.
2. It is very reliable method

Demerits

1. It is costly method
2. Judge own attitude may reflect in arrangement

3. Summated Scale (Likert Scale)

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

1. Researcher collect a number of statements relevant to the attitude being studied.
2. A trial test should be made with small group of people
3. The response to various statements are scored in such a way that a response of most favorable attitude is given the highest score of 5, and the most unfavorable attitude is given the lowest score of 1.
4. Then the total score of each respondent is obtained by adding his scores for separate statements.
5. Then arrange these scores & find out with those statements which have a high discriminating power. This way we determine which statement consistently co relate with high favorability & which with low favorability.
6. Only those statements that correlate with total test, should be retained in the final statement. And others must be removed.

Merits:

1. It is easy to construct in comparison to differential scale.
2. It is more reliable.
3. Each statement in this is given a test for discriminating ability, so it permits the use of only those statements that have direct relationship to the attitude being studied.
4. We can study how responses differ between people & how response differ between stimuli.
5. It takes less time to construct.

Demerits:
1. In this method we can examine whether respondents are more or less favorable to the topic, but we can't tell how much or less they are.
2. The interval between strongly agree & agree may not be equal to the interval between agree & undecided.
3. Often the total score of an individual respondent has little clear meaning since the given score can be secured by a variety of answer pattern.

4. Cumulative scale or scalogram:

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

Procedure;
1. The layout in clear terms the issue we want to deal in our study.
2. Develop a number of items relating the issue and to eliminate by inspection the items that are irrelevant or those that happen to be extreme items.
3. Pre-test the items whether the issue at hand is scalable. The respondent are asked to record their opinion on all items ranging from 'strongly agree to strongly disagree. The score like 5 -1 was assigned. If there is 5 items in all , total, score can be from 75- 15.
4. Respondent opinionnaires are then arrayed according to total score for analysis and evaluation. If the responses of an item form a cumulative scale, its response category scores should decrease in an orderly fashion. After analyzing the preset results , a few items may be chosen.
5. Then total scores for the various opininnoires and to rearray them to reflect any shift in order resulting from reducing the items.

Merits;
1. It assures that only a single dimension of attitude is measured.
2. Researcher's subjective judgment is not allowed to creep in the development of scale since the scale is determined by the replies of respondent.
3. It can be appropriately be used for personal ,telephone or mail surveys.

Demerits:
1. It is very tedious & complex in preparation.
2. Conceptually is more difficult in comparison to other scaling methods.
3. It very a reliable source for assessing attitudes of persons towards complex objects.

5. Factor Scales:

It is developed on the basis of intercorrelations of items which indicate the degree of interdependence. It include a variety of technique that have been developed for two problem.
1) How to deal with the universe of content that is multidimensional.
2) How to uncover underlying dimension that have not been identified.
An important factor scale is semantic differential and multidimensional scaling.

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

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

Merits:
1. It is used in psychological survey.
2. It is used to measure the perceptual structure of a set of stimuli and cognitive processes underlying the development of this structure.
3. It is an important measurement tool for attitude.

Demerits:
1. It is complicated in calculation.
It is laborious in collection of data & analysis.

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UNIT III
UNIT 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 – determinants optimal sample size – sampling techniques – Probability Vs Non–probability sampling methods.

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

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

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

METHODS OF COLLECTING PRIMARY DATA

1. **Questionnaire** :-

    In this method to pre-printed list of questions arranged in sequence is used to elicit response from the informant.

2. **Interview** :

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

3. **Observation:**

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

4. **Feedback**   In

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

5. **Sales force opinion**

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

6. **Schedule**

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

7. **Warranty Card**

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

8. **Distributor or store Audit**

    Distributors get the retail stores audited through salesman and use such information to estimate market size, market share, seasonal purchasing pattern & so on.

9. **Pantry Audit**

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

10. **Consumer Panel**   It

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

11. **Collection through mechanical devices**   The

    use ofmechanical devices has been widely made to collect information by way of indirect means. Eye camera, pupilometric camera, psychgalvanameter, motion picture camera and audiometer etc are principal devices, commonly used for the purpose for collecting the required information.

12. **Projective technique**

    This technique is adopted to study the consumers through various methods like recalling advertisement theme, story completion tests, quizzes, thematic appreciation tests etc. Through

this technique it is possible to compile information to be used as the basis for projecting the demand for the product at different points of time.

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

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

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

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

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

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

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

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

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

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

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

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

13. **In-depth Interview**
    These are those interview that are designed to discover underlying motives and desires and are often used in motivational research. Such interview are held to explore needs, desires and feelings of respondents.

14. **Content Analysis**

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

OBSERVATION METHOD

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

Types

1. **Structured Observation**

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

2. **Unstructured Observation**

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

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

4. **Non Participant Observation**

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

5. **Controlled Observation**

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

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

MERITS:-

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

LIMITATION:

1. This is a relatively costly method of data collection, because the observer has to be present on the spot to observer whatever is happening.
2. Training an observer is the additional cost to be incurred.]
3. The scope for the biases of the observe interfering in what is observed and understood is high.
4. It could be noticed that what is observed may bring out only part of the facts.
5. It may not be possible to observe what is targeted.
6. There is a lot of scope for the observer to get distracted by function.
7. The observer can effectively establish link among whatever he has observed to give a meaningful interpretation.

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

TYPES OF INTERVIEW

1. **Direct Interview**

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

   a. **Structured Interview**

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

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

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

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

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

   f. **Telephonic Interview**

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

Merits :

1. Interview enables personal contact with which factual information could be obtained.
2. The interviewer can guide the respondent to understand the question and suitably rephrase or modify the question.
3. The non response in this category of data collection is low
4. Spontaneous reply of the respondent can be obtained which would truly reflect their opinion.
5. Interviewer has the flexibility to handle the interview to collect relevant information.
6. The interviewer can combine observation with interview so that a lot of additional information about the environment, nature, behavior and attitude of the respondent could also be noted.
7. The interviewer can be persuasive to obtain the response of the respndent while this may not be possible in the case of questionnaire method of data collection.
8. The interviewer can adopt himself better by using the language with which he can reach the respondents better and the educational level of the respondent.
9. it is also possible to obtain personal information which will not be revealed through questionnaire.

Demerits:

1. This method presupposes the existence of rapport between the respondent and the interviewer.
2. It is costly method of data collection, as the interviewer should be trained, oriented and supported.
3. The time taken for covering a large sample of respondents is more than what it is under questionnaire method.

4. It is possible for a respondent to conceal his real opinion or views and so genuine data may not be available.
5. The interviewer may also be biased and thereby his bias may influence the interview outcome.
6. Interview method requires an elaborate organizational arrangement.
7. Sometimes this method cannot be followed as it would require fixing up appointment, specifying the questions that are to be answered duration of interview, the person interviewing the organizational background, the purpose of interview etc.   Inspite of providing all these information it may not be possible to get an appointment to conduct the interview.

HOW TO MAKE INTERVIEW SUCCESSFUL?
1. The interviewer should be carefully selected.
2. The interviewer should be trained properly.
3. Different methods of obtaining the response from the informants have to be explored and the interviewer should be trained in all these aspects.
4. Unless the interviewer is experienced he would not be able to conduct the interview properly. But without conducting interview he cannot be experience co care, should be taken while selecting this method of data collection.
5. Honesty and integrity of the interviewer determine the outcomes of the interview so the qualities of the interviewer should be objectively studied.
6. The interviewer should be fully equipped to clarify any questions raised by the informant.
7. The interviewer must first create a report with the respondent and ensures presence of cordial atmosphere to conduct the interview.
8. Qualities like courteousness , politeness, friendliness, conversational, unbiased are all necessary to make the interview successful.
9. The interviewer should avoid showing his reaction to the response of the respondent as otherwise the replies given may be biased.
10. The interviewer should be alert and intelligent with presence of mind to keep the interview focused on the subject matter.

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

Merits:
1. It involves lesser cost as questionnaire could be send by post to a wide area.
2. It does not interfere with the respondent while answering the question.
3. The bias of the investigator is completely eliminated.
4. Respondents are given sufficient time to fill up the questionnaire.
5. If respondents cannot be reached personally, questionnaire is the alternative method available.
6. This method is useful when the sample size is very large.
7. if the questionnaire is designed properly with instructions then the training, supervising and controlling the investigators is saved.
8. Confidentiality is ensured as the respondents directly send the filled up questionnaire to the researcher.

Demerits:
1. It is always found that the response rate in questionnaire is very poor compared to using schedules.
2. Bias of the respondent cannot be determined easily.
3. Only if the respondent is educated questionnaire could be used for collecting information.
4. Follow up of non-response or unfilled questionnaire only adds to the cost and time.
5. There is no scope for giving any clarification to the respondent in case of need.
6. Accuracy of response cannot be ensured.

7. A lot of care is required to design and structure a questionnaire. Hence unless a scholar is good at drafting a questionnaire, this method cannot be adopted for data collection.

TYPES OF QUESTIONNAIRES

1. **Structured Questionnaire**

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

2. **Closed Form Questionnaire**

    Questions are set in such a manner that leaves only a few alternatives answers.
3. **Open Ended Questionnaire**

    Here the respondent has the choice of using his own style. Diction, expression of language, length and perception. The respondent are not restricted, his replies to the questions, and his answers may be free and spontaneous
4. **Unstructured Questionnaire**

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

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

GUIDELINES OF QUESTIONNAIRE

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

1. **General Form**

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

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

3. **Question formulation and Wording**:

    Questions should be constructed with a view to their forming a logical plan. The questions can be of any forms like :-
    i. **Multiple Choice**

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

        It refers to one which offers the respondent a choice between only two alternatives, and reduces the issue to its simplest terms.
    iii. **Close End Question**:

        It refers to those questions in which the respondent is given a limited number of

alternative responses from which he is to select the one that most closely matches his/ her opinion or attitude.

iv. **Open Ended Question**

It refers to a quesdtion that has no fixed alternatives to which the answer must conform.

v. **Direct Question**

They explicitly ask for the desired data.

vi. **Indirect Data**

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

vii. **Checklists**

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

ESSENTIALS OF A GOOD QUESTIONNAIRE:

1. It should be comparatively short and simple.
2. Questions should proceed in logical sequence moving from easy to more difficult questions.
3. Personal and intimate questions should be left to the end.
4. Technical terms and vague expressions capable of different interpretations should be avoided in a questionnaire.
5. Questions affecting the sentiments should be avoided.
6. Adequate space for answers should be provided in the questionnaire to help editing and tabulation.
7. It should be attractive looking.
8. The quality of the paper, along with its colour, must be good so that is may attract the attention of recipients.
9. The first part of the questionnaire should specify the object or purpose for which the information is required.
10. It should not force the respondent to recall from his memory anything to answer.
11. If there I is instruction, it should be given separately specifying the question number and the related instructions.
12. It should not require any referencing before replying.
13. Repetition of questions should be eliminated.
14. Questions which cross check the response, could be built in to the questionnaire.

Construction of questionnaire:

1. The researcher must keep in view the problem he is to study for it provides the starting point for developing the Questionnaire/Schedule. He must be clear about the various aspects of his research problem to be dealt with in the course of his research project.

2. Appropriate form of questions depends on the nature of information sought, the sampled respondents and the kind of analysis intended. The researcher must decide whether to use closed or open-ended question. Questions should be simple and must be constructed with a view to their forming a logical part of a well thought out tabulation plan. The units of enumeration should also be defined precisely so that they can ensure accurate and full information.

3. Rough draft of the Questionnaire/Schedule is prepared, giving due thought to the appropriate sequence of putting questions. Questionnaires or schedules previously drafted (if available) may as well be looked into at this stage.

4. Researcher must invariably re-examine, and in case of need may revise the rough draft for a better one. Technical defects must be minutely scrutinised and removed.

5. Pilot study should be undertaken for pre-testing the questionnaire. The questionnaire may be edited in the light of the results of the pilot study.

6. Questionnaire must contain simple but straight forward directions for the respondents so that they may not feel any difficulty in answering the questions.

Validation of questionnaire:

Validation is "The process of establishing that a method is sound." Validation involves establishing that the instrument produces data that are reliable and true. There are a number of ways to define this, some of which outlined below.

Reliability: the degree to which a questionnaire will produce the same result if administered again, or the "test-retest" concept. It is also a measure of the degree to which a questionnaire can reflect a true change.

Validity: the degree to which a questionnaire reflects reality. There are a number of different facets to validity. Internal validity: the degree to which questions within an instrument agree with each other, i.e., that a subject will respond to similar questions in a similar way. It also affects the likelihood of producing false positives and false negatives.

External validity: the ability to make generalizations about a population beyond that of the sample tested.

Sensitivity: The degrees to which the instrument can identify a true positive, e.g., accurately identify a person who does have the condition.

Specificity: similar to sensitivity, this is the degree, to which the instrument can identify a true negative, e.g., correctly identify the people who do not have the disease. Sensitivity and specificity are another side of the coin from internal validity.

Statistical validity: this is related to internal validity, and assesses whether the differences in the questionnaire results between patient groups can appropriately be subjected to statistical tests of significance.

Longitudinal validity: whether a questionnaire returns the same results in a given population over time, assuming all else remains equal Linguistic validity: whether the wording of the questionnaire is understood in the same way by everyone who completes it.

Discriminant validity: the ability of the questionnaire to detect true differences between groups, and detect no difference when there isn't one.

Construct validity: the ability of a measure to assess correctly a particular cause and effect relationship between the measure and some other factor.

Questionnaire Vs Schedule

Basis	Questionnaire	Schedule
Usage	Respondent himself records the answers obtained.	Researcher/ enumerator records the answers obtained.
Cost	Relatively cheaper as it is sent by mail to the targeted respondent.	Costlier, as the investigator has to be appointed, trained and meet every informant at the latter's place.
Coverage	Wide coverage possible as it can be sent to any place by post	Relatively limited coverage as the investigator cannot be sent to every place.
Degree of Freedom	Less all the respondents, do not respondent	Relatively better as the investigator guides the respondents in understanding the questions in right context.
Quality of	Not good, as the respondent answers the	Relatively better as the investigator

response	questions the way it understood.	guides the respondents in understanding the questions in right context
Identify of respondent	It is not known clearly who answered the questionnaire and this in turn might affect accuracy information obtained.	It is clearly known, as the enumerator himself elicits the information so the accuracy of information is more.
Time Taken for reply	It cannot be established as the respondent may reply at his convenience.	It is possible to plan the enquiry & depute the investigators accordingly & collect information within a targeted time
Personal contact	It is completely absent and to that extent there is to no scope for giving any clarification to respondents.	It is absolutely possible and so the quality of response is better. The investigator can understand the questions clearly.
Sample Coverage	It is possible to cover a wide range of sample elements as the questionnaire is only sent by post.	This is not possible as the investigator has to personally contact each respondent.
Pre-condition for use	The respondent should be a literate and co-operative	The literacy status of the respondent is not a limitation. The investigator can explain the question & obtain the response.
Accuracy of Information	It is not likely to be high, as it depends on the structure of the questionnaire itself	Relatively accuracy is better in this method as the investigator can determine the accuracy on the field and adopt appropriate methods to ensure accuracy.
Presentation requirement	Questionnaire should be designed properly and made attractive to encourage the respondent to fill it.	No such requirements is a condition
Scope for application of other methods of data collection.	This is not possible as the questionnaire is sent to the respondent.	There is a lot of scope for the investigator to apply observation method or interview method of data collection along with the use of schedules.
Field control & testing.	This is not possible as the questionnaire is filled by the respondent himself	There is good scope for controlling editing and monitoring information on the field itself
Bias in information collected	There is no way to test the extent of bias of the information given by the respondent.	If the investigator is trained and experienced then there is very little scope for bias in information content.

Survey Vs Observation:

Observational Study - In an observational study, the sample population being studied is measured, or surveyed, as it is. The researcher observes the subjects and measures variables, but does not influence the population in any way or attempt to intervene in the study.   There is no manipulation by the researcher. Instead, data is simply gathered and correlations are investigated. Since observational studies do not control any variable, the results can only allow the researcher to claim association, not causation (not a cause-and-effect conclusion).

Surveys - Surveys are one form of an observational study, since the researchers do not influence the outcomes. Statistical surveys collect information from a sample group to learn about the entire population. A survey may focus on opinions or factual information depending upon the purpose of

the study. Surveys may involve answering a questionnaire or being interviewed by a researcher. The U.S. Census is a type of survey.

Survey Vs Experiment

BASIS FOR COMPARISON	SURVEY	EXPERIMENT
Meaning	Survey refers to a technique of gathering information regarding a variable under study, from the respondents of the population.	Experiment implies a scientific procedure wherein the factor under study is isolated to test hypothesis.
Used in	Descriptive Research	Experimental Research
Samples	Large	Relatively small
Suitable for	Social and Behavioral sciences	Physical and natural sciences
Example of	Field research	Laboratory research
Data collection	Observation, interview, questionnaire, case study etc.	Through several readings of experiment.

2**. Secondary data**

The secondary data means which have already been collected by someone else and which have already been passed through the statistical process. The researcher would have to decide which sort of data he would be using (thus collecting) for his study and accordingly he will have to select one or the other method of data collection.

Sources

I. **Internal Sources**

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

    B. **Sales force Report**
- ✓ Marketing information
- ✓ Customers opinion
- ✓ Competitor information
- ✓ AreaWise Sales

    C. **Internal Expert**

      Experts working in the company like product manager, marketing research managers, public relation personnel and advertising personnel etc.

    C. **Miscellaneous**
- ✓ Company history
- ✓ Company background
- ✓ Market share
- ✓ Pamplet
- ✓ Prospectus

- ✓ Annual General Body Meeting Report.
- ✓ Organization manual, chart.
- ✓ Organisation report.

External Sources

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

ii) Non-government Publication
- f. Private agencies
- g. Stock –exchange directories
- h. Chamber of commerce
- i. Federation of Indian Chamber of Commerce
- j. Associate Chamber of commerce & Industry Of India
- k. Indo- Amercian Chamber of Commerce etc
- l. Promotion
- m. Market Research & Statistical Bureau

iii) Syndicated Services

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

iv) Technical and trade journals

v) Books, magazines & newspapers

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

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

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

CHARACTERISTCS OF SECONDARY DATA

1. **Reliability of Data** :

The reliability can be treated by finding out such things about the said data
- a. Who collected the data?
- b. What were the sources of data ?
- c. Were they collected by using proper methods?
- d. At what time were they collected?
- e. Was there any bias of the compiler ?
- f. What level of accuracy was desired ?

2. **Suitability of Data**

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

3. **Adequacy of Data**

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

4. **Continuity of Data**

This is another problem in using secondary data. For eg, the format used for providing some date may not be consistently followed by the source. Depending upon the page constraints or availability of material the data presentaion ina format is decided. So frequent change in the format would only add to confusion to the people using the data from such sources.

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

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

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

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

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

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

PRIMARY vs SECONDARY DATA

Criteria	Primary data	Secondary data
Accuracy	• A direct approach that starts from scratch. Data is highly accurate and zooms in on your research problem.	• An indirect approach that hinges on existing data. May not be specific to your research problem.
Control	• Researchers have a high degree of control.	• Less control over data.
Relevancy	• Very relevant to your research.	• Negligible or less relevant to a new research.
Ownership	• Researcher has ownership of the data.	• No ownership of the data.
Cost and time	• Expensive and time consuming task.	• Saves you money and time.
Accessibility	• Not freely or easily available to the public.	• Available to the public and your competitors.
Bias	• The data does not favor the researcher who collected the data.	• The data may lean toward the researcher who collected the data.
Sampling errors	• Errors in sampling arise by selecting the wrong sample size.	• Errors arise by selecting outdated, irrelevant data that is no longer pertinent to the research problem.
Sources	• Websites, journals, dissertations, literature reviews, balance sheets, and more	• Case studies, surveys, interviews, questionnaires, field observations, experiments, etc.

SELECTION OF APPROPRIATE METHOD OF DATA COLLECTION: -

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

1. **Nature, Scope and Object of enquiry**: This constituted the most important factory affecting the choice of a particular method. The method selected should be such that it suits the type of enquiry that is to be conducted by the researcher.
2. **Availability of Funds**: Availability of funds for the research project determines to a large extent the method to be used for the collection of data. When funds at the disposal of the researcher are very limited, he will have to select a comparatively cheaper method, which may not be as efficient and efficient as some other costly method.
3. **Time Factor**: Availability of time has also to be taken into account in deciding a particular method of data collection. Some method, take relatively more time whereas with others the data can be collected in a comparatively shorter duration.
4. **Precision Required**: The very important condition is the level of accuracy of the data collected. In cases of compilation of data regarding the deviation from the standard measurements in a workshop, the data should be cent % accurate. Similarly the data regarding the patient condition explained through various parameters should be very accurate.
5. **Period of Study**: A study based on historical data requires secondary data source while the study on the patient status in a hospital require primary data.

PILOT STUDY:

It is a process of testing the questionnaire before it is finalized, the questionnaire before it is finalized, that is after the questionnaire is drafted, to decide whether it is comprehensive or not, it is used with a few respondents.

Their responses are studied to determine the need for restructuring the questionnaire, re-sequencing the questions, addition or deletion of questions, giving more instructions for filing up etc can also be decided. It will bring to light the weaknesses of the questionnaire.

SAMPLING
Sampling Plan:

A sampling plan is a term widely used in research studies that provide an outline on the basis of which research is conducted. It tells which category is to be surveyed, what should be the sample size and how the respondents should be chosen out of the population.

Sampling plan is a base from which the research starts and includes the following three major decisions:

1. What should be the Sampling unit i.e. choosing the category of the population to be surveyed is the first and the foremost decision in a sampling plan that initiates the research? e.g. In the case of Banking industry, should the sampling unit consist of current account holders, saving account holders, or both? Should it include male or female account holders? These decisions once made the then sampling frame is designed to give everyone in the target population equal chance of being sampled.

2. The second decision in sampling plan is determining the size of the sample i.e. how many objects in the sample is to be surveyed. Generally, "the larger the sample size, the more is the reliability" and therefore, researchers try to cover as many samples as possible.

3. The final decision that completes the sampling plan is selecting the sampling procedure i.e. which method can be used such that every object in the population has an equal chance of being selected. Generally, the researchers use the probability sampling to determine the objects to be chosen as these represents the sample more accurately.

Population :

Is defined as the aggregate of units from which a sample is chosen. If a forest area is divided into a number of compartments and the compartments are the units of sampling, these compartments will form the population of sampling units.

Sampling units: The population is thus sub-divided into suitable units for the purpose of sampling andthese are called sampling units. They are administrative units or natural units like topographical sections and subcompartment.

Sampling Frame : A list of sampling units will be called a 'frame'. A population of units is said to be finite if the number units in it is finite.

Sample : One or more sampling units selected from a population according to some specified procedure will constitute a sample.

Sampling Intensity :Intensity of sampling is defined as the ratio of the number of units in the sample to the number of units in the population.

Parameter :A function of the values of the units in the population will be called a parameter. The population mean, variance, coefficient of variation, etc., are examples of population Parameters

Sampling variance : The difference between a sample estimate and the population value is called the sampling error of the estimate, but this is naturally unknown since the population value is unknown.

Standard error of an estimator :The square root of the sampling variance of an estimator is known as the standard error of the estimator. The standard error of an estimate divided by the value of the estimate is called relative standard error which is usually expressed in percentage.

Accuracy usually refers to the size of the deviations of the sample estimate from the mean m= E (t) obtained by repeated application of the sampling procedure, the bias being thus measured by m-q .

TYPES OF SAMPLING Techniques

Sampling techniques are classified into two broad categories of Probability samples or Non- Probability samples.

I   Probability Sampling Technique

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

Probability sampling techniques differ in terms of sampling efficiency which is a concept that refers to trade off between sampling cost and precision. Precision refers to the level of uncertainty about the characteristics being measured. Precision is inversely related to sampling errors but directly related to cost. The greater the precision, the greater the cost and there should be a tradeoff between sampling cost and precision. The researcher is required to design the most efficient sampling design in order to increase the efficiency of the sampling. Probability sampling techniques are broadly classified as simple random sampling, systematic sampling, and stratified sampling.

- **Simple Random Sampling**

This is the most important and widely used probability sampling technique. They gain much significance because of their characteristic of being used to frame the concepts and arguments in statistics. Another important feature is that it allows each element in the population to have a known and equal probability of selection. This means that every element is selected independently of every other element. This method resembles lottery method where a in a system names are placed in a box, the box is shuffled, and the names of the winners are then drawn out in an unbiased manner. Simple random sampling has a definite process, though not, so rigid. It involves compilation of a sampling frame in which each element is assigned a unique identification number. Random numbers are generated either using random number table or a computer to determine which elements to include in the sample. For example, a researcher is interested in investigating the behavioural pattern of customers while making a decision on purchasing a computer. Accordingly, the researcher is interested in taking 5 samples from a sampling frame containing 100 elements. The required sample may be chosen using simple random sampling technique by arranging the 100 elements in an order and starting with row 1 and column 1 of random table, and going down the column until 5 numbers between 1 and 100 are selected. Numbers outside this range are ignored. Random number tables are found in every statistics book. It consists of a randomly generated series of digits from 0 – 9. To enhance the readability of the numbers, a space between every 4 digit between every 10 row is given.

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

- **Systematic sampling**

Employs a simple rule of selecting every kth unit starting with a number chosen at random from 1 tokas the random start. Let us assume that Nsampling units in the population are numbered 1 toN. To select a systematic sample of nunits, we take a unit at random from the first kunits and then every kth sampling unit is selected to form the sample. The constant kis known as the sampling intervaland is taken as the integer nearest to N / n, the inverse of the sampling fraction.

- **Stratified Sampling**

Stratified sampling is a two-way process. It is distinguished from the simple random

sampling and systematic sampling, in that:
a) It requires division of the parent population into mutually exclusively and exhaustive subsets;
b) A simple random sample of elements is chosen independently from each group or subset.

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

Strata are created by a divider called the stratification variable. This variable divides the population into strata based on homogeneity, heterogeneity, relatedness or cost. Sometimes, more than one variable is used for stratification purpose. This type of sampling is done in order to get homogenous elements within each strata and, the elements between each strata should have a higher degree of heterogeneity. The number of strata to be formed for the research is left to the discretion of the researcher, though, researchers agree that the optimum number of strata may be 6.

The reasons for using stratified sampling are as follows:
a) It ensures representation of all important sub-populations in the sample;
b) The cost per observation in the survey may be reduced;
c) It combines the use of simple random sampling with potential gains in precision
d) Estimates of the population parameters may be wanted for each sub-population and;
e) Increased accuracy at given cost.

- **Multistage sampling**
  Multi-stage sampling (also known as multi-stage cluster sampling) is a more complex form of cluster sampling which contains two or more stages in sample selection. In simple terms, in multi-stage sampling large clusters of population are divided into smaller clusters in several stages in order to make primary data collection more manageable. It has to be acknowledged that multi-stage sampling is not as effective as true random sampling; however, it addresses certain disadvantages associated with true random sampling such as being overly expensive and time-consuming.
- **Cluster Sampling:**
cluster sampling is a sampling method in which the entire population of the study is divided into externally homogeneous, but internally heterogeneous, groups called clusters. Essentially, each cluster is a mini-representation of the entire population.

Use of the Probability Sampling Method
There are multiple uses of the probability sampling method. They are:
- **Reduce Sample Bias:** Using the probability sampling method, the bias in the sample derived from a population is negligible to non-existent. The selection of the sample largely depicts the understanding and the inference of the researcher. Probability sampling leads to higher quality data collection as the population is appropriately represented by the sample.
- **Diverse Population:** When the population is large and diverse, it is important to have adequate representation so that the data is not skewed towards one demographic. For example, if Square would like to understand the people that could their point-of-sale devices, a survey conducted from a sample of people across US from different industries and socio-economic backgrounds, helps.
- **Create an Accurate Sample:** Probability sampling helps the researchers plan and create an accurate sample. This helps to obtain well-defined data.

II Non-probability Sampling Methods
Non-probability sampling does not involve random selection. It involves personal judgement of the researcher rather than chance to select sample elements. Sometimes this

judgement is imposed by the researcher, while in other cases the selection of population elements to be includes is left to the individual field workers. The decision maker may also contribute to including a particular individual in the sampling frame. Evidently, non probability sampling does not include elements selected probabilistically and hence, leaves an degree of „sampling error" associated with the sample.

Sampling error is the degree to which a sample might differ from the population. Therefore, while inferring to the population, results could not be reported plus or minus the sampling error. In non-probability sampling, the degree to which the sample differs from the population remains unknown However, we cannot come to a conclusion that sampling error is an inherent of non probability sample.

Non-probability samples also yield good estimates of the population characteristics. Since, inclusion of the elements in the sample are not determined in a probabilistic way, the estimates obtained are not statistically projectable to the population.

The most commonly used non-probability sampling methods are convenience sampling, judgment sampling, quota sampling, and snowball sampling.

- **Convenience Sampling**

Convenience samples are sometimes called accidental samples because the elements included in the sample enter by accident". It is a sampling technique where samples are obtained from convenient elements. This refers to happening of the element at the right place at the right time, that is, where and when the information for the study is being collected. The selection of the respondents is left to the discretion of the interviewer. The popular examples of convenience sampling include (a) respondents who gather in a church (b) students in a class room (c) mall intercept interviews without qualifying the respondents for the study (d) tear-out questionnaire included in magazines and (e) people on the street. In the above examples, the people may not be qualified respondents, however, form part of the sample by virtue of assembling in the place where the researcher is conveniently placed. Convenience sampling is the least expensive and least time consuming of all sampling techniques. The disadvantage with convenience sampling is that the researcher would have no way of knowing if the sample chosen is representative of the target population.

- **Judgment Sampling**

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

- **Quota Sampling**

Quota sampling is another non-probability sampling. It attempts to ensure that the sample chosen by the researcher is a representative by selecting elements in such a way that the proportion of the sample elements possessing a certain characteristic is approximately the same as the proportion of the elements with the characteristic in the population. Quota sampling is viewed as two-staged restricted judgemental sampling technique. The first stage consists of developing control categories, or quotas, of population elements. Control characteristics involve age, sex, and race identified on the basis of judgement. Then the distribution of these characteristics in the target population is determined. For example, the researcher may use control categories in that, he/she intends to study 40% of men and 60% of women in a

population. Sex is the control group and the percentages fixed are the quotas. In the second stage, sample elements are selected based on convenience or judgement. Once the quotas have been determined, there is considerable freedom to select the elements to be included in the sample. For example, the researcher may not choose more than 40% of men and 60% of women in the study. Even if the researcher comes across qualified men after reaching the 40% mark, he/she would still restrict entry of men into the sample and keep searching for women till the quota is fulfilled.

- **Snowball sampling**

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

Use of the Non-Probability Sampling Method

There are multiple uses of the non-probability sampling method. They are:

- **Create a hypothesis:** The non-probability sampling method is used to create a hypothesis when limited to no prior information is available. This method helps with immediate return of data and helps to build a base for any further research.
- **Exploratory research:** This sampling technique is widely used when researchers aim at conducting qualitative research, pilot studies or exploratory research.
- **Budget and time constraints:** The non-probability method when there are budget and time constraints and some preliminary data has to be collected. Since the survey design is not rigid, it is easier to pick respondents at random and have them take the survey or questionnaire.

	Probability Sampling Methods	**Non-Probability Sampling Methods**
Definition	Probability Sampling is a sampling technique in which sample from a larger population are chosen using a method based on the theory of probability.	Non-probability sampling is a sampling technique in which the researcher selects samples based on the subjective judgment of the researcher rather than random selection.
Alternatively Known as	Random sampling method.	Non-random sampling method
Population selection	The population is selected randomly.	The population is selected arbitrarily.
Market Research	The research is conclusive in nature.	The research is exploratory in nature.
Sample	Since there is method to deciding the sample, the population demographics is conclusively represented.	Since the sampling method is arbitrary, the population demographics representation is almost always skewed.
Time Taken	Take a longer time to conduct since the research design defines the selection parameters before the market research study begins.	This type of sampling method is quick since neither the sample or selection criteria of the sample is undefined.
Results	This type of sampling is entirely	This type of sampling is entirely biased

	unbiased and hence the results are unbiased too and conclusive.	and hence the results are biased too rendering the research speculative.
Hypothesis	In probability sampling, there is an underlying hypothesis before the study begins and the objective of this method is to prove the hypothesis.	In non-probability sampling, the hypothesis is derived after conducting the research study.

Determinants optimal sample size:

(i) Nature of universe: Universe may be either homogenous or heterogeneous in nature. If the items of the universe are homogenous, a small sample can serve the purpose. But if the items are heterogeneous, a large sample would be required. Technically, this can be termed as the dispersion factor.

(ii) Number of classes proposed: If many class-groups (groups and sub-groups) are to be formed, a large sample would be required because a small sample might not be able to give a reasonable number of items in each class-group.

(iii) Nature of study: If items are to be intensively and continuously studied, the sample should be small. For a general survey the size of the sample should be large, but a small sample is considered appropriate in technical surveys.

(iv) Type of sampling: Sampling technique plays an important part in determining the size of the sample. A small random sample is apt to be much superior to a larger but badly selected sample.

(v) Standard of accuracy and acceptable confidence level: If the standard of accuracy or the level of precision is to be kept high, we shall require relatively larger sample. For doubling the accuracy for a fixed significance level, the sample size has to be increased fourfold.

(vi) Availability of finance: In practice, size of the sample depends upon the amount of money available for the study purposes. This factor should be kept in view while determining the size of sample for large samples result in increasing the cost of sampling estimates.

(vii) Other considerations: Nature of units, size of the population, size of questionnaire, availability of trained investigators, the conditions under which the sample is being conducted, the time available for completion of the study are a few other considerations to which a researcher must pay attention while selecting the size of the sample.

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UNIT IV

UNIT IV DATA PREPARATION AND ANALYSIS

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Bivariate and Multivariate statistical techniques – Factor analysis –

Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Application of statistical software for data analysis.

Data Preparation:

The data, after collection, has to be processed and analysed in accordance with the outline laid down for the purpose at the time of developing the research plan. This is essential for a scientific study and for ensuring that we have all relevant data for making contemplated comparisons and analysis. Technically speaking, processing implies editing, coding, classification and tabulation of collected data so that they are amenable to analysis. The term analysis refers to the computation of certain measures along with searching for patterns of relationship that exist among data-groups. Thus, "in the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions".

Processing stages

There are four important stages in the processing of data. They are;

1. Editing

As soon as the researcher receives the data, he should screen it for accuracy. Editing is the process of examining the data collected through various methods to detect errors and omissions and correct them for further analysis. Though editing, it is ensured that the collected data are accurate, consistent with other facts gathered, uniformly entered and well arranged so that further analysis is made easier.

Practical guidelines for editing

While editing care has to be taken to see that the data are as accurate and complete as possible.

The following points are to be noted;

1. The editor should familiarize with the copy of instructions given to the interviewers.

2. The original entry, if found incorrect, should not be destroyed or erased. On the other hand, it should be crossed out in such a manner that it is still eligible.

3. Any, modification to the original entry by the editor must be specifically indicated.

4. All completed schedules must bear signature of the editor and the date.

5. Incorrect answer to the questions can be corrected only if the editor is absolutely sure of the answer, otherwise leave it as such.

6. Inconsistent, incomplete or missing answers should not be used.

7. Sere that all numerical answers are converted to same units.

2. Coding

Coding is the process by which r response categories are summarized by numerals or other symbols to carry out subsequent operations of data analysis. This process of assigning numerals or symbols to the responses is called coding. It facilitates efficient analysis of the collected data and helps in reducing several replies to a small number of classes which contain the critical information required for analysis. In general it reduces the huge amount of information collected in to a form that is amenable to analysis.

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.

3. 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.

Objectives of classification

1. To organize data in to concise, logical and intelligible form.
2. To take the similarities and dissimilarities s between various classes clear.
3. To facilitate comparison between various classes of data.
4. To help the researcher in understanding the significance of various classes of data.
5. To facilitate analysis and formulate generalizations.

Types of classification

A. Classification according to external characteristics

In this classification, data may be classified either on geographical basis or periodical basis.

Classification on geographical basis

In this type of classification, the data that are collected from different places are placed in different classes.

Classification on periodical basis (chronological classification)

In this type of classification, the data belonging to a particular time or period are put under one class. This type of classification is based on period.

B. Classification according to internal characteristics

Data may be classified either according to attributes or according to the magnitude of variables

Classification according to Attributes

In this type data are classified on the basis of some attributes an characteristics.

Simple Classification

If the classification is based on one particular attribute only it is called simple classification. Eg; classification on the basis of sex.

Manifold Classification

If the classification is based on more than one or several attributes it is called manifold or multiple classifications. In this data are classified in several groups.

C. Classification according variables

Here the data are classified to some characteristics that can be measured. Data are classified on the basis of quantitative characteristics such as age, height; weight etc. quantitative variables are grouped in to two:

a) Discrete variable

If the variables can take only exact value, it is called discrete variable.

b) Continuous variable

The variables that can take any numerical value within a specified range are called continuous variable.

Characteristics of an ideal classification

1. Unambiguity- Classification should be unambiguous. The various classes should be defined properly.
2. Stable- it should not change from enquiry to enquiry
3. Flexibility- classification should have the capacity of adjustment to new situations and circumstances.
4. Homogeneity- each class should contain homogenous items.

5. Suitability- it should be suitable to objects of any statistical enquiry.
6. Exhaustiveness- there should be no item which does not find a class.

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.

Types of Tables

☐ **Simple Table**

Here the data are presented only for one variable or characteristic. Any frequency distribution of a single variable is simple table

☐ **Complex table**

In complex table, two or more characteristics are shown. If the study is related to more than two variables, it is called multivariate analysis. They may be of the following tables.

(a) One- way table

In this type of table, data of only one characteristic will be shown. It means that when one type of information is secured about different groups or individuals, it can be displayed with the help of one- way table

(b) **Two- way table**

When mutually related attributes of a phenomenon are to be displayed, two way tables are used. In other words, this table shows two types of characteristics.

(c) Three-way table

It displays three types of attributes. It is used when three inter- related or mutually related attributes or characteristics of a phenomenon are to be displayed,.

(d) Manifold tables

When information about different mutually attributes or characteristics of a phenomenon are to be displayed, manifold table is used. Such tables display information about various characteristics or attributes.

Parts of a statistical table

Following are the important parts of a statistical table.

1. Title of the table

The title of the table is placed above the table. If there are more than one table in a research, each should bear a number for easy reference.

2. Caption or title of the column

It is also termed as "box head". There may be sub- captions under the main caption.

3. Stub (row heading)

Stub refers to the title given to rows

4. Body (main data)

This is the main body of information needed for the research work.

5. End note (foot note)

This is placed below the table to convey the expansions of abbreviations to caption, stub or main body.

6. Source note

If the table is based on outside information, it should be mentioned in the source note below.

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 ... Practicality is concerned with a wide range of factors of economy, convenience, and interpretability ..."1 We briefly take up the relevant details concerning these tests of sound measurement.

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 the question arises: how can one determine validity without direct confirming knowledge? The answer may be that we seek other relevant evidence that confirms the answers we have found with our measuring tool. What is relevant, evidence often depends upon the nature of the research problem and the judgement of the researcher. But one can certainly consider three types of validity in this connection: (i) Content validity; (ii) Criterion-related validity and (iii) Construct validity.

(i) Content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. If the instrument contains a representative sample of the universe, the content validity is good. Its determination is primarily judgemental and intuitive. It can also be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards, but there is no numerical way to express it.

(ii) Criterion-related validity relates to our ability to predict some outcome or estimate the existence of some current condition. This form of validity reflects the success of measures used for some empirical estimating purpose. The concerned criterion must possess the following qualities:

Relevance: (A criterion is relevant if it is defined in terms we judge to be the proper measure.)

Freedom from bias: (Freedom from bias is attained when the criterion gives each subject an equal opportunity to score well.)

Reliability: (A reliable criterion is stable or reproducible.)

Availability: (The information specified by the criterion must be available.)

In fact, a Criterion-related validity is a broad term that actually refers to (i) Predictive validity and (ii) Concurrent validity. The former refers to the usefulness of a test in predicting some future performance whereas the latter refers to the usefulness of a test in closely relating to other measures of known validity. Criterion-related validity is expressed as the coefficient of correlation between test scores and some measure of future performance or between test scores and scores on another measure of known validity.

(iii) Construct validity is the most complex and abstract. A measure is said to possess construct validity to the degree that it confirms to predicted correlations with other theoretical propositions. Construct validity is the degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory. For determining construct validity, we associate a set of other propositions with the results received from using our measurement instrument. If measurements on our devised scale correlate in a predicted way with these other propositions, we can conclude that there is some construct validity. If the above stated criteria and tests are met with, we may state that our measuring instrument is valid and will result in correct measurement; otherwise we shall have to look for more information and/or resort to exercise of judgement.

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 overweighs 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. If the quality of reliability is satisfied by an instrument, then while using it we can be confident that the transient and situational factors are not interfering.

Two aspects of reliability viz., stability and equivalence deserve special mention. The stability aspect is concerned with securing consistent results with repeated measurements of the same person and with the same instrument. We usually determine the degree of stability by comparing the results of repeated measurements. The equivalence aspect considers how much error may get introduced by different investigators or different samples of the items being studied. A good way to test for the equivalence of measurements by two investigators is to compare their observations of the same events. Reliability can be improved in the following two ways:

(i) By standardising the conditions under which the measurement takes place i.e., we must ensure that external sources of variation such as boredom, fatigue, etc., are minimised to the extent possible. That will improve stability aspect.

(ii) By carefully designed directions for measurement with no variation from group to group, by using trained and motivated persons to conduct the research and also by broadening the sample of items used. This will improve equivalence aspect.

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. Although more items give greater reliability as stated earlier, but in the interest of limiting the interview or observation time, we have to take only few items for our study purpose. Similarly, data-collection methods to be used are also dependent at times upon economic factors. Convenience test suggests that the measuring instrument should be easy to administer. For this purpose one should give due attention to the proper layout of the measuring instrument. For instance, a questionnaire, with clear instructions (illustrated by examples), is certainly more effective and easier to complete than one which lacks these features. Interpretability consideration is especially important when persons other than the designers of the test are to interpret the results. The measuring instrument, in order to be interpretable, must be supplemented by (a) detailed instructions for administering the test; (b) scoring keys; (c) evidence about the reliability and (d) guides for using the test and for interpreting results.

Qualitative Vs Quantitative Data:

Qualitative Data refers to the data that provides insights and understanding about a particular problem. It can be approximated but cannot be computed. Hence, the researcher should possess complete knowledge about the type of characteristic, prior to the collection of data.

The nature of data is descriptive and so it is a bit difficult to analyze it. This type of data can be classified into categories, on the basis of physical attributes and properties of the object. The data is interpreted as spoken or written narratives rather than numbers. It is concerned with the data that is observable in terms of smell, appearance, taste, feel, texture, gender, nationality and so on. The methods of collecting qualitative data are:

Focus Group
Observation
Interviews
Archival Materials like newspapers.
Definition of Quantitative Data

Quantitative Data, as the name suggests is one which deals with quantity or numbers. It refers to the data which computes the values and counts and can be expressed in numerical terms is called quantitative data. In statistics, most of the analyses are conducted using this data.

Quantitative data may be used in computation and statistical test. It is concerned with measurements like height, weight, volume, length, size, humidity, speed, age etc. The tabular and diagrammatic presentation of data is also possible, in the form of charts, graphs, tables, etc. Further, the quantitative data can be classified as discrete or continuous data. The methods used for the collection of data are:

Surveys

Experiments

Observations and Interviews

Differences between qualitative and quantitative data are discussed below:
1. The data type, in which the classification of objects is based on attributes (quality), is called qualitative data. The type of data which can be counted and expressed in numbers and values is called quantitative data.
2. The research methodology is exploratory in qualitative data, i.e. to provide insights and understanding. On the other hand, quantitative data is conclusive in nature which aims at testing a specific hypothesis and examines the relationships.
3. The approach to inquiry in the case of qualitative data is subjective and holistic whereas quantitative data has an objective and focused approach.
4. When the data type is qualitative the analysis is non-statistical. As opposed to quantitative data which uses statistical analysis.
5. In qualitative data, there is an unstructured gathering of data. As against this, data collection is structured in quantitative data.
6. While qualitative data determines the depth of understanding, quantitative data ascertains the level of occurrence.
7. Quantitative data is all about 'How much or how many'. On the contrary, qualitative data asks 'Why?'
8. In qualitative data the sample size is small and that too is drawn from non-representative samples. Conversely, the sample size is large in quantitative data drawn from the representative sample.
9. Qualitative data develops initial understanding, i.e. it defines the problem. Unlike quantitative data, this recommends the final course of action.

Bivariate and Multivariate statistical techniques:
There are several methods of applying the two techniques, but the important ones are as under: In case of bivariate population: Correlation can be studied through (a) cross tabulation; (b) Charles Spearman's coefficient of correlation; (c) Karl Pearson's coefficient of correlation; whereas cause and effect relationship can be studied through simple regression equations.

In case of multivariate population: Correlation can be studied through (a) coefficient of multiple correlation; (b) coefficient of partial correlation; whereas cause and effect relationship can be studied through multiple regression equations.

Factor analysis:
Basic concepts in factor analysis
The following are the key concepts on which factor analysis is based.
Factor:
A factor plays a fundamental role among a set of attributes or variables. These variables can be filtered down to the factor. A factor represents the combined effect of a set of attributes. Either there may be one such factor or several such factors in a real life problem based on the complexity of the situation and the number of variables operating.
Factor loading:
A factor loading is a value that explains how closely the variables are related to the factor. It is the correlation between the factor and the variable. While interpreting a factor, the absolute value of the factor is taken into account.
Communality:

It is a measure of how much each variable is accounted for by the underlying factors together. It is the sum of the squares of the loadings of the variable on the common factors. If A,B,C,… are the factors, then the communality of a variable is computed using the relation

h2 = (The factor loading of the variable with respect to factor A) 2 +

(The factor loading of the variable with respect to factor B) 2 +

(The factor loading of the variable with respect to factor C) 2 + …..

Eigen value:

The sum of the squared values of factor loadings pertaining to a factor is called an eigen value. It is a measure of the relative importance of each factor under consideration.

Total Sum of Squares (TSS)

It is the sum of the Eigen values of all the factors.

Application of Factor Analysis:

1. Model Building for New Product Development:

As pointed out earlier, a real life situation is highly complex and it consists of several variables. A model for the real life situation can be built by incorporating as many features of the situation as possible. But then, with a multitude of features, it is very difficult to build such a highly idealistic model. A practical way is to identify the important variables and incorporate them in the model. Factor analysis seeks to identify those variables which are highly correlated among themselves and find a common factor which can be taken as a representative of those variables. Based on the factor loading, some of variables can be merged together to give a common factor and then a model can be built by incorporating such factors. Identification of the most common features of a product preferred by the consumers will be helpful in the development of new products.

2. Model Building for Consumers:

Another application of factor analysis is to carry out a similar exercise for the respondents instead of the variables themselves. Using the factor loading, the respondents in a research survey can be sorted out into various groups in such a way that the respondents in a group have more or less homogeneous opinions on the topics of the survey. Thus a model can be constructed on the groups of consumers. The results emanating from such an exercise will guide the management in evolving appropriate strategies towards market segmentation.

Merits: The main merits of factor analysis can be stated thus:

(i) The technique of factor analysis is quite useful when we want to condense and simplify the multivariate data.

(ii) The technique is helpful in pointing out important and interesting, relationships among observed data that were there all the time, but not easy to see from the data alone.

(iii) The technique can reveal the latent factors (i.e., underlying factors not directly observed) that determine relationships among several variables concerning a research study. For example, if people are asked to rate different cold drinks (say, Limca, Nova-cola, Gold Spot and so on) according to preference, a factor analysis may reveal some salient characteristics of cold drinks that underlie the relative preferences.

(iv) The technique may be used in the context of empirical clustering of products, media or people i.e., for providing a classification scheme when data scored on various rating scales have to be grouped together.

Limitations: One should also be aware of several limitations of factor analysis. Important ones are as follows:

(i) Factor analysis, like all multivariate techniques, involves laborious computations involving heavy cost burden. With computer facility available these days, there is no doubt that factor analysis has become relatively faster and easier, but the cost factor continues to be the same i.e., large factor analyses are still bound to be quite expensive.

(ii) The results of a single factor analysis are considered generally less reliable and dependable for very often a factor analysis starts with a set of imperfect data. "The factors are nothing but blurred averages, difficult to be identified."4 To overcome this difficulty, it has been realised that analysis

should at least be done twice. If we get more or less similar results from all rounds of analyses, our confidence concerning such results increases.

(iii) Factor-analysis is a complicated decision tool that can be used only when one has thorough knowledge and enough experience of handling this tool. Even then, at times it may not work well and may even disappoint the user.

Cluster Analysis:

Cluster analysis consists of methods of classifying variables into clusters. Technically, a cluster consists of variables that correlate highly with one another and have comparatively low correlations with variables in other clusters. The basic objective of cluster analysis is to determine how many mutually and exhaustive groups or clusters, based on the similarities of profiles among entities, really exist in the population and then to state the composition of such groups. Various groups to be determined in cluster analysis are not predefined as happens to be the case in discriminant analysis.

Steps: In general, cluster analysis contains the following steps to be performed:

(i) First of all, if some variables have a negative sum of correlations in the correlation matrix, one must reflect variables so as to obtain a maximum sum of positive correlations for the matrix as a whole.

(ii) The second step consists in finding out the highest correlation in the correlation matrix and the two variables involved (i.e., having the highest correlation in the matrix) form the nucleus of the first cluster.

(iii) Then one looks for those variables that correlate highly with the said two variables and includes them in the cluster. This is how the first cluster is formed.

(iv) To obtain the nucleus of the second cluster, we find two variables that correlate highly but have low correlations with members of the first cluster. Variables that correlate highly with the said two variables are then found. Such variables along the said two variables thus constitute the second cluster.

(v) One proceeds on similar lines to search for a third cluster and so on.

From the above description we find that clustering methods in general are judgemental and are devoid of statistical inferences. For problems concerning large number of variables, various cut-and try methods have been proposed for locating clusters. McQuitty has specially developed a number of rather elaborate computational routines* for that purpose. In spite of the above stated limitation, cluster analysis has been found useful in context of market research studies. Through the use of this technique we can make segments of market of a product on the basis of several characteristics of the customers such as personality, socio-economic considerations, psychological factors, purchasing habits and like ones.

Multidimensional Scaling:

Multidimensional scaling (MDS) allows a researcher to measure an item in more than one dimension at a time. The basic assumption is that people perceive a set of objects as being more or less similar to one another on a number of dimensions (usually uncorrelated with one another) instead of only one.

There are several MDS techniques (also known as techniques for dimensional reduction) often used for the purpose of revealing patterns of one sort or another in interdependent data structures. If data happen to be non-metric, MDS involves rank ordering each pair of objects in terms of similarity. Then the judged similarities are transformed into distances through statistical manipulations and are consequently shown in n-dimensional space in a way that the interpoint distances best preserve the original interpoint proximities. After this sort of mapping is performed, the dimensions are usually interpreted and labeled by the researcher.

The significance of MDS lies in the fact that it enables the researcher to study "The perceptual structure of a set of stimuli and the cognitive processes underlying the development of this structure.... MDS provides a mechanism for determining the truly salient attributes without forcing the judge to appear irrational."6 With MDS, one can scale objects, individuals or both with a minimum of

information. The MDS analysis will reveal the most salient attributes which happen to be the primary determinants for making a specific decision.

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UNIT V

UNIT V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH
Research report – Different types – Contents of report – need of executive summary – chapterisation – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final

proof – report format – title of the report – ethics in research – ethical behaviour of research – subjectivity and objectivity in research.

RESEARCH REPORT:

Research report is considered a major component of the research study for the research task remains incomplete till the report has been presented and/or written. As a matter of fact even the most brilliant hypothesis, highly well designed and conducted research study, and the most striking generalizations and findings are of little value unless they are effectively communicated to others. The purpose of research is not well served unless the findings are made known to others. Research results must invariably enter the general store of knowledge. All this explains the significance of writing research report. There are people who do not consider writing of report as an integral part of the research process. But the general opinion is in favour of treating the presentation of research results or the writing of report as part and parcel of the research project. Writing of report is the last step in a research study and requires a set of skills somewhat different from those called for in respect of the earlier stages of research. This task should be accomplished by the researcher with utmost care; he may seek the assistance and guidance of experts for the purpose.

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.

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.

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.

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.

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.

The above examples are just the samples for bibliography entries and may be used, but one should also remember that they are not the only acceptable forms. The only thing important is that, whatever method one selects, it must remain consistent.

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 of proper 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.
(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. The methodology adopted in conducting the study must be fully explained. The scientific reader would like to know in detail about such thing: How was the study carried out? What was its basic design? If the study was an experimental one, then what were the experimental manipulations? If the data were collected by means of questionnaires or interviews, then exactly what questions were asked (The questionnaire or interview schedule is usually given in an appendix)? If measurements were based on observation, then what instructions were given to the observers? Regarding the sample used in the study the reader should be told: Who were the subjects? How many were there? How were they selected? All these questions are crucial for estimating the probable limits of generalizability of the findings. The statistical analysis adopted must also be clearly stated. In addition to all this, the scope of the study should be stated and the boundary lines be demarcated. The various limitations, under which the research project was completed, must also be narrated.

(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."5

(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) The 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. It is considered a good practice to finish the report with a short conclusion which summarises and recapitulates the main points of the study. The conclusion drawn from the study should be clearly related to the hypotheses that were stated in the introductory section. At the same time, a forecast of the probable future of the subject and an indication of the kind of research which needs to be done in that particular field is useful and desirable.

(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.

Types of reports

Reports may be categorized broadly as Technical Reports and General Reports based on the nature of methods, terms of reference and the extent of in-depth enquiry made etc. On the basis of usage pattern, the reports may also be classified as information oriented reports, decision oriented reports and research based reports. Further, reports may also differ based on the communication situation. For example, the reports may be in the form of Memo, which is appropriate for informal situations or for short periods. On the other hand, the projects that extend over a period of time, often call for project reports. Thus, there is no standard format of reports. The most important thing that helps in classifying the reports is the outline of its purpose and answers for the following questions:

What did you do?

Why did you choose the particular research method that you used?

What did you learn and what are the implications of what you learned?

If you are writing a recommendation report, what action are you recommending in response to what you learned?

Two types of report formats are described below:

I Technical Report

A technical report mainly focuses on methods employed, assumptions made while conducting a study, detailed presentation of findings and drawing inferences and comparisons with earlier findings based on the type of data drawn from the empirical work.

An outline of a Technical Report mostly consists of the following:

Title and nature of the study:

Brief title and the nature of work sometimes followed by subtitle indicate more appropriately either the method or tools used. Description of objectives of the study, research design, operational terms, working hypothesis, type of analysis and data required should be present.

Abstract of Findings:

A brief review of the main findings just can be made either in a paragraph or in one/two pages.

Review of current status:

A quick review of past observations and contradictions reported, applications observed and reported are reviewed based on the in-house resources or based on published observations.

Sampling and Methods employed

Specific methods used in the study and their limitations. In the case of experimental methods, the nature of subjects and control conditions are to be specified. In the case of sample studies, details of the sample design i.e., sample size, sample selection etc are given.

Data sources and experiment conducted

Sources of data, their characteristics and limitations should be specified. In the case of primary survey, the manner in which data has been collected should be described.

Analysis of data and tools used.

The analysis of data and presentation of findings of the study with supporting data in the form of tables and charts are to be narrated. This constitutes the major component of the research report.

Summary of findings

A detailed summary of findings of the study and major observations should be stated. Decision inputs if any, policy implications from the observations should be specified.

References

A brief list of studies conducted on similar lines, either preceding the present study or conducted under different experimental conditions is listed.

Technical appendices

These appendices include the design of experiments or questionnaires used in conducting the study, mathematical derivations, elaboration on particular techniques of analysis etc.

II General Reports

General reports often relate popular policy issues mostly related to social issues. These reports are generally simple, less technical, good use of tables and charts. Most often they reflect the journalistic style. Example for this type of report is the "Best B-Schools Survey in Business Magazines". The outline of these reports is as follows:

1. Major Findings and their Implications
2. Recommendations for Action
3. Objectives of the Study
4. Method Employed for Collecting Data
5. Results

Writing Styles

There are atleast 3 distinct report writing styles that can be applied by students of Business Studies. They are called:

1. Conservative
2. Key points
3. Holistic

1. Conservative Style

Essentially, the conservative approach takes the best structural elements from essay writing and integrates these with appropriate report writing tools. Thus, headings are used to deliberate upon different sections of the answer. In addition, the space is well utilized by ensuring that each paragraph is distinct (perhaps separated from other paragraphs by leaving two blank lines in between).

2. Key Point Style

This style utilizes all of the report writing tools and is thus more overtly 'report-looking'. Use of headings, underlining, margins, diagrams and tables are common. Occasionally reporting might even use indentation and dot points. The important thing to remember is that the tools should be applied in a way that adds to the report. The question must be addressed and the tools applied should assist in doing that. An advantage of this style is the enormous amount of information that can be delivered relatively quickly.

3. Holistic Style

The most complex and unusual of the styles, holistic report writing aims to answer the question from a thematic and integrative perspective. This style of report writing requires the researcher to have a strong understanding of the course and is able to see which outcomes are being targeted by the question.

RESEARCH ETHICS

In doing any research there is an ethical responsibility to do the work honestly and with integrity. If you do not conduct your work in an ethical manner you will fail. This will apply to all stages of the research cycle. Fraud must be avoided in research and this can come in several forms:

_ Being selective in sampling.

_ Not reporting survey response/participation rates.

_ Deliberately biasing the data collection instruments—for example, asking leading questions in surveys.

_ Making up data—because you can't be bothered doing the data collection.

_ Falsifying results—to make them fit your conclusion.

_ Trimming—removing data that does not fit in with your analysis. This may be a legitimate thing to do but you must make it clear what has been done and why.

_ Biased or inappropriate analysis. The choice of techniques for doing analysis can lead to widely varying conclusions.

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