

DEPARTMENT OF MANAGEMENT STUDIES
RESEARCH METHODOLOGY

Business Research – Meaning, types, process of research- management problem, defining the research problem, formulating the research Hypothesis, developing the research proposals, research design formulation, sampling design, planning and collecting the data for research, data analysis and interpretation. Research Application in business decisions, Features of good research study.

DEFINITION OF RESEARCH:

“Research is the formal structured, systematic application of scientific method to the study of problems’ (Gay, Mills & Airasian; 2009)

- **Research is a structured systematic study which uses scientific method aimed at learning new facts, testing ideas, and to solve managerial problem.**

- **It is the systematic collection, analysis and interpretation of data to generate new knowledge and answer a certain question or solve a problem.**
 - A systematic Inquiry whose objective is to provide information to solve managerial problems.
 - Research provides you with the knowledge and skills needed for the fast-paced decision making environment
 - Research in common parlance refers to a search for knowledge. One can also define research as a scientific and systematic search for pertinent information on a specific topic. In fact, research is an art of scientific investigation
 - According to Clifford Woody research comprises defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis
 - Research is an art of scientific investigation, it is also systematic design, collection, analysis and reporting the findings and solution for marketing problem of a company

RESEARCH METHODS: All those methods/techniques that are used for conduction of research. Research methods or techniques, thus, refer to the methods the researchers use in performing research operations.

- Observations
- Recording data
- Processing data

RESEARCH METHODOLOGY:

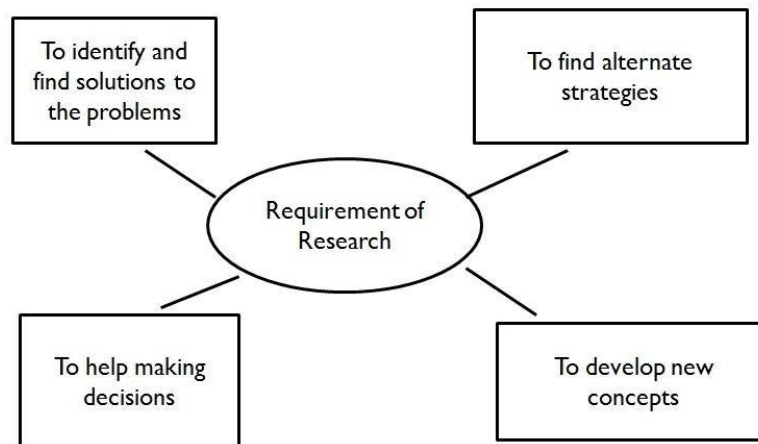
It is a systematically way to solve the research problem. It may be understood as a science of studying how research is done scientifically.

Research Methodology: It Involves solving research problem systematically (Blue print)

- Gathering data
- Use of statistical techniques for analysis
- Interpretation
- Drawing Conclusion about the research data

OBJECTIVES OF RESEARCH

- To know accurately characteristics of particular individual, group or situation
- To discover new facts e.g. Related to employee behaviour
- To verify the old facts. E.g: why people think negatively when they are sad
- To develop new concepts, theories E.G: Motivation theory by a student
- To identify research problem and provide solution E.G: Problem with quality of product
- To define policies and strategies E.G: Flexi time policy
- To know the association between variables E.G: BCOM students scores well in ACCOUNTS
- To assess the problem area in the organization E.G: Employees Performance
- It is a basis for Innovation E.G: New Product design



TYPES OF RESEARCH:

Research is a systematic search for information and new knowledge. It covers topics in every field of science and perceptions of its scope and activities are unlimited.

RESEARCH APPROACHES:

Quantitative vs. Qualitative:

- **Quantitative research** is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. E.G: Number of students who visit college canteen every day.
- **Qualitative research**, on the other hand, is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind. For instance, when we are interested in investigating the reasons for human behaviour (i.e., why people think or do certain things), we

quite often talk of „Motivation Research“, an important type of qualitative research. This type of research aims at discovering the underlying motives and desires, using in depth interviews for the purpose.

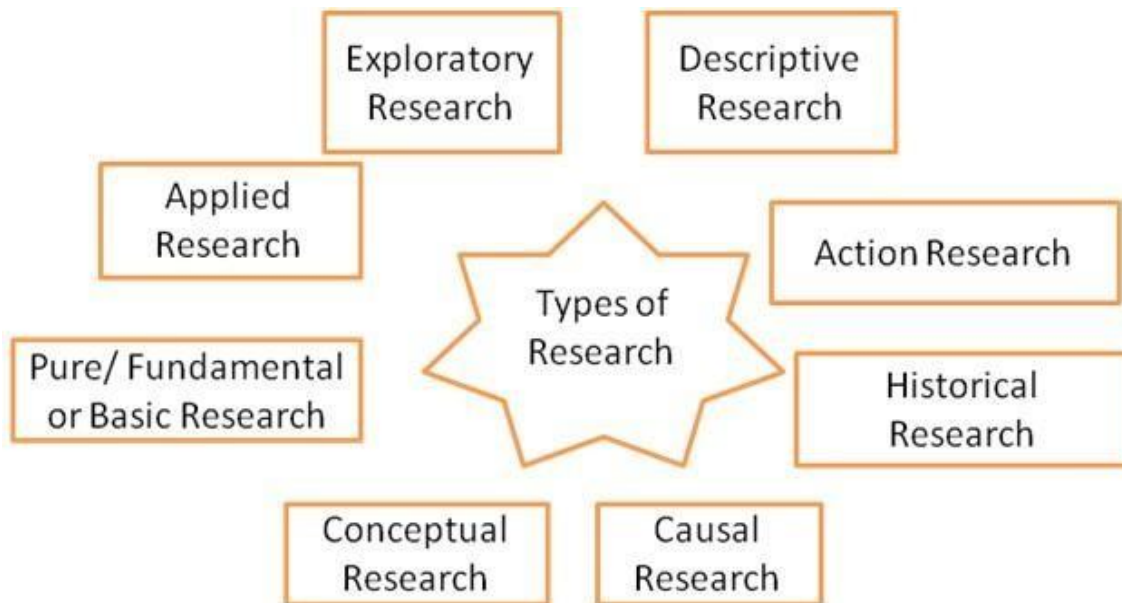
- **Attitude or opinion research** i.e., research designed to find out how people feel or what they think about a particular subject or institution is also qualitative research.
- **Qualitative research** is especially important in the behavioral sciences where the aim is to discover the underlying motives of human behaviour. Through such research we can analyze the various factors which motivate people to behave in a particular manner or which make people like or dislike a particular thing.

E.G : why people behave differently in different situation.

Differences between Qualitative and Quantitative:

	Qualitative	Quantitative
Aim/Purpose	To gain understanding of the concepts, To provide insight for the problem- individual interpretation of events	To Quantify data and generalize the results- precise measurement and analysis
Sample	Usually a small number as data will be gathered through observation	Usually a large number of cases representing the population.
Data Collection	Unstructured or semi structured	Structured techniques or methods such as questionnaire
Data analysis	Non statistical – In the form of pictures, words, or objects	Statistical data is usually in the forms of tabulations
Outcome	Findings are not conclusive as it relies on the opinions	Findings are Conclusive and recommendation can be made.

TYPES OF RESEARCH:



1. **Descriptive Research:** Researcher wants to know something about a group of people, and then descriptive research can be used. Descriptive research is to describe the characteristics of population I. e targeted respondents. The major purpose of descriptive research is description of

the state of affairs as it exists at present.

- Describes the characteristics of the respondent in relation to a particular product. Deals with demographic characteristics of the consumer.
- Used to find the association between two or more variables.
- Example: Degree of viewing TV Channels, its variation with age, income level, profession of respondent as well as time of viewing.
- **Ex-Post Facto Research:** the research examines the relationship between the dependent variable and independent variable but the researcher will not have control over the Independent variable
- E.G: Purchase Decision depends upon the **Income** of Individual, Here Income is independent variable but researcher will not have control on INCOME of Respondents/Customers.

2. **Exploratory Research (Formulative Research):** Exploratory research studies are also termed as **formulative research** studies. The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the working hypotheses

- The major emphasis in such studies is on the discovery of ideas and insights
- Often relies on secondary research such as reviewing available literature and/or data, or qualitative approaches such as informal discussions with consumers, employees, management or competitors and more formal approaches through in-depth interviews, focus groups, case studies or pilot studies.
- Carried out at the very beginning when the problem is not clear or is vague.
- In depth understanding of the topic.
- Example: Exploring the reasons for sales decline of a product in a company.

3. **Applied Research:** Applied research aims at finding a solution for an immediate problem facing a society or an industrial/business organization

- Undertaken to find solutions for **real-life problem** requiring an action or policy decision.
- It may incidentally contribute to the development of theoretical knowledge.
- Research aimed at certain conclusions (say, a solution) facing a concrete social or business problem is an example of applied research.
- Thus, the central aim of applied research is to discover a solution for some pressing practical problem
- Applied research is used to solve a specific, practical problem of an individual or group. The study and research is used in business, medicine and education in order to find solutions that may cure diseases, solve scientific problems or develop technology.
- Example: To develop a new product which will solve the problem of common man?

4. **Pure/Fundamental or Basic Research:** fundamental research is mainly concerned with generalizations and with the formulation of a theory. “Gathering knowledge for knowledge’s sake is termed „pure“ or „basic“ research.” Research concerning some natural phenomenon or relating to pure mathematics are examples of fundamental research. Similarly, research studies, concerning human behaviour carried on with a view to make generalizations about human

behaviour, are also examples of fundamental research □ Undertaken for the sake of knowledge

- Not directly involved with practical problems. □ Example : Theory of Relativity (by Einstein)

5. **Conceptual Research:** Conceptual research is that related to some abstract idea(s) or concepts. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. Conceptual research focuses on the concept or theory that explains or describes the phenomenon being studied. E.G. What causes disease? How to prevent it?

6. **Empirical research (Experimental Research):** data collection is done through observation and experimentation. On the other hand, **empirical research** relies on experiment or observation alone. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. We can also call it as experimental type of research. In such a research it is necessary to get at facts firsthand, at their source, and actively to go about doing certain things to stimulate the production of desired information. Experimental research (Manipulate the variable) changes in one variable and then study its effect on the variable E.G: Change the color of the product, assess the impact on sales.

7. **Causal Research (Explanatory):** Research attempt to reveal a cause and effect relationship between two variables. E.G: Impact of training method on training effectiveness.

- Conducted to determine the cause and effect relationship between the two variables.
- Way of seeing how actions now will affect a business in the future.
- Example: A clothing company selling blue denim jeans, causal research can measure the impact of the company changing the product design to the color white. The company bosses will be able to decide whether changing the color would be profitable.

8. **Historical Research:** Inquiry into the past events, where researcher describes and interprets those events. Historical research is that which utilizes historical sources like documents, reports, etc. Historical research is a process of searching information using scientific method and systematically examine an event which had occurred in past.

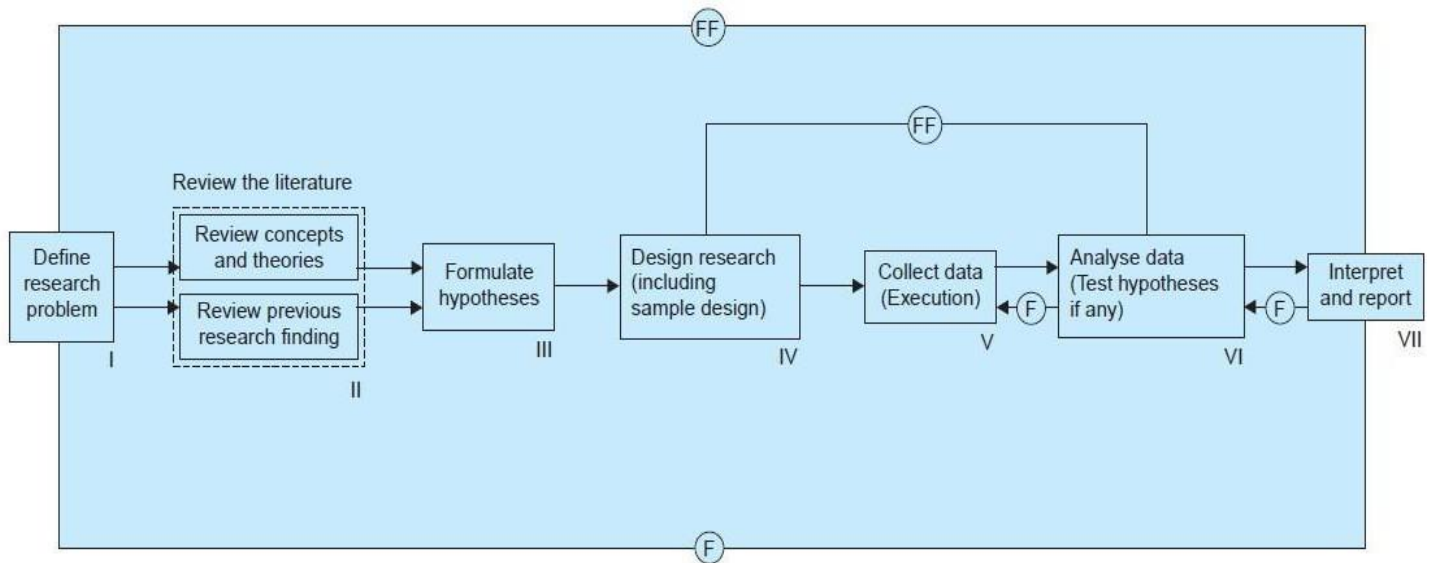
- Historical study is a study of past records and data in order to understand the future trends and development of the organization or market. E.G: Sales Trend at Big Bazaar.
- There is no direct observation involved in this research, based on past data itself, research will be carry out.
- Research has to depend on the conclusions or inferences drawn in the past.
- Main objective is to derive explanation and generalization from the past trends in order to understand the present and anticipate the future.
- **Example:** Investors in the share market study the past records or prices of shares which he/she intends to buy. Studying the share prices of a particular company enables the investor to take decision whether to invest in the shares of a company.

9. **Action Research:** the researcher is a practitioner; hence action research is being undertaken by a researcher to improve upon his own practices at workplace.

- Research is undertaken by direct action.

- Action Research is conducted to solve a problem.
- Example: Test marketing a product is an example of action research. Initially, the geographical location is identified. A target sample is selected from among the population. Samples are distributed to selected samples and feedback is obtained from the respondent.
- Example: School Teacher conducts research to find out the reasons for poor performance in the test.

PROCESS OF RESEARCH:



1. **Formulating the research problem: Formulating the Problem** – Problem formulation is the key to research process. For a researcher, the problem formulation means converting the management problem to a research problem.
 - **Example: Management Problem:** Want to increase the sale of product A. **Research Problem:** What is the current standing of the product A?
 - If the problem is not stated properly, the objectives will not be clear. If the objective is not clearly defined, the data collection becomes meaningless.
2. **Extensive literature survey:** It involves a comprehensive review of published and unpublished work for the secondary source of data. The researcher should undertake extensive literature survey connected with the problem. For this purpose, the abstracting and indexing journals and published or unpublished bibliographies are the first place to go to. Academic journals, conference proceedings, government reports, books etc., must be tapped depending on the nature of the problem. In this process, it should be remembered that one source will lead to another. The earlier studies, if any, which are similar to the study in hand, should be carefully studied. A good library will be a great help to the researcher at this stage.
 - > Identify the problem of the study
 - > Monitor the repetition of work
 - > Helps in avoiding mistakes

- 3. Development of working hypotheses:** A prediction about the relationship between two or more variables. After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses. Working hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. A hypothesis is a tentative assumption regarding the solution to the problem under study. The kind of data to be collected, the tools of analysis are influenced by the hypothesis. The hypothesis is a predictive statement which is made in the light of the available facts relating to the problem under study.

Null Hypothesis (H_0)

- *There is no relationship between two measured phenomena.*
Eg. H_0 : *There is no link between smoking and cancer.*
- Null Hypothesis can never be proven. It can either be rejected or fail to reject.

Alternative Hypothesis (H_1)

- *A hypothesis to be adopted if the Null hypothesis implied to be highly implausible. ie. The hypothesis to be accepted if the Null hypothesis is rejected.*
eg. H_1 : *There is significant link between smoking and cancer.*

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

- a) Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution;
 - b) Examination of data and records, if available, concerning the problem for possible trends, peculiarities and other clues;
 - c) Review of similar studies in the area or of the studies on similar problems; and (d) To secure greater insight into the practical aspects of the problem.
- 4 Preparing the research design:** The research problem having been formulated in clear cut terms, the researcher will be required to prepare a research design, i.e., he will have to state the conceptual structure within which research would be conducted.

> **Types of research should be selected and sample unit should be determined.**

Determining sample design: All the items under consideration in any field of inquiry constitute a „universe“ or „population“.

- Samples can be either probability samples or non-probability samples.
- With probability samples each element has a known probability of being included in the sample but the non-probability samples do not allow the researcher to determine this probability.
- Probability samples are those based on simple random sampling, systematic sampling, stratified sampling, cluster/area sampling. Whereas non-probability samples are those based on convenience sampling, judgment sampling and quota sampling techniques.

Sampling Design – Include a decision on the sampling unit, the sample size and the sampling method.

- **Sampling unit** is the most elementary unit which would be a part of the study e.g. in a survey on newspaper readership pattern, a single household comprising of all the members of the household can be regarded as a sampling unit.

- **The size of the sample** depends on factors like the availability of time and funds to the researcher, the ability of the researcher, the size of the population and the nature of the population.
- **Method of drawing a sample** – Probability method of sampling involves giving every member a known and unbiased chance of being a part of the sample. In non-probability method, an element of bias is involved. The probability of a unit being a part of the sample is not known. The sample design to be used must be decided by the researcher taking into consideration the nature of the inquiry and other related factors.

5. Collecting the data:

- **Data Collection** – The search for answers to research questions is called data collection. The sources of data may be classified as a) primary data b) secondary data.

1 **Primary data** can be collected either through experiment or through survey. If the researcher conducts an experiment, he observes some quantitative measurements, or the data, with the help of which he examines the truth contained in his hypothesis. But in the case of a survey, few data collection techniques are Questionnaire, Interview, Survey and Observation.

- 2 **Secondary data:** The secondary data has been collected from different books and company files and website. The secondary data has been collected by an individual from different sources.
- Text book
 - Internet
 - Magazines

The researcher should select one of these methods of collecting the data taking into consideration the nature of investigation, objective and scope of the inquiry, financial resources, available time and the desired degree of accuracy.

6. **Analysis of data:** After the data have been collected, the researcher turns to the task of analyzing them. The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding, tabulation and then drawing statistical inferences.

- **Data Analysis** –

Editing – The data collected should be scanned to make sure that it is complete and that all the instructions are followed. This process is called editing.

Coding – Coding means assigning numbers to each of the answers, so that they can be tabulated and analyzed easily.

Tabulation – The process of orderly arrangement of data in a tabular form.

Statistical Analysis – In the last stage, the tabulated data is analyzed using various statistical techniques like averages, percentages, trend analysis, co-relation and regression techniques etc. **Hypothesis-testing:** After analyzing the data as stated above, the researcher is in a position to test the hypotheses, if any, he had formulated earlier. Do the facts support the hypotheses or they happen to be contrary? This is the usual question which should be answered while testing hypotheses.

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

researches in times to come.

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

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

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

Case Study – A STUDY ON CUSTOMER SATISFACTION IN A PUBLIC SECTOR BANK

A bank is interested in knowing the level of satisfaction of its customers. For this purpose it decided to conduct a survey and designed a framework for conducting the same. It included the research objectives and the methodology for carrying out the survey.

Problem – What is the current level of customer satisfaction in a public sector bank at branch XYZ?

Research objectives:

The study is being conducted to find out the satisfaction level of customers on the following counts:

- I. The work efficiency of the bank
- II. The customer care service in the bank
- III. The value added services provided by the bank

Population:
All the customers of the public sector bank at branch XYZ

Design:

Sampling Unit: The existing customers of the bank (customer database)

Sample Size: 200 respondents

Sampling Technique: Systematic sampling technique i.e. probability sampling technique

Sources of data:

Secondary data on the meaning and methods of conducting customer satisfaction is studied through books and earlier researches done on customer satisfaction. Information about the working of the bank, the value added services being provided and customer care facilities and its customers is taken from the bank records.

Primary data will be collected through questionnaires.

DEFINING THE RESEARCH PROBLEM:

A research problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same.

We can, thus, state the components of a research problem as under:

- (i) There must be an individual or a group which has some difficulty or the problem.

- (ii) There must be some objective(s) to be attained at. If one wants nothing, one cannot have a problem.
- (iii) There must be alternative means (or the courses of action) for obtaining the objective(s) one wishes to attain. This means that there must be at least two means available to a researcher for if he has no choice of means, he cannot have a problem.
- (iv) There must remain some doubt in the mind of a researcher with regard to the selection of alternatives. This means that research must answer the question concerning the relative efficiency of the possible alternatives.

While formulating the problem, clearly define:

- Who is the focus?
- What is the subject matter of research?
- To which geographical territory/area the problem refers to?
- To which period does the study pertains to?
- **Example:** Why does the upper-middle class of Bangalore shop at Lifestyle during the Diwali season?

PROCESS/TECHNIQUES INVOLVED IN DEFINING THE PROBLEM:

1. **Statement of the problem in a general way:** broad general way, the researchers must have in depth knowledge about the concept, researcher may undertake some sort of preliminary survey, called as pilot survey, then problem can be defined
2. **Understand the nature of the problem:** understand its origin and nature clearly, best way to understand is to discuss with experts and define the problem.
 - **Discussions with Decision Makers-** The Decision Makers needs to understand the capabilities and limitations of research. Research provides information relevant to management decisions, but it cannot provide solutions because solutions require managerial judgment.
 - Eg. McDonalds, when losing market share to Subway, discussed with decision makers to introduce new menu varieties or reduce price to increase sales.
 - **Interviews with Industry Experts-**Interviews with industry experts, individuals knowledgeable about the firm and the industry, may help formulate the marketing research problem. These experts may be found both inside and outside the firm.
3. **Management Decision Problem (MDP)/Management Problem–** The problem confronting the decision maker. It asks what the decision maker needs to do.
Example: Decision problem: Sales reductions for a specific product group
4. **Marketing Research Problem/Research Problem –** A problem that entails determining what information is needed and how it can be obtained in the most feasible way.
Example: Research problem: Introduction of a new product because sales are below the target

(Revise the target, withdraw the product?) Management needs to make a decision about something (a problem) for example "Should we launch a new product?" "Would it be profitable" and "bring in new customers". Research Problem is the information that the market research needs to provide in order to solve the problem.

Sl No	Basis of comparison	Management Decision problem	Research Problem
1	Nature	Ask what decision makers need to do	Ask what information is needed and how can the information be obtained
2	Orientation	Action Oriented	Information Oriented
3	Focus	Focuses on Symptoms	Focuses on underlying causes
4	Common errors	Problem definition is too broad	Problem definition is too narrow
5	Example	Advertisement	Conduct an investigation to determine suitable media for Ad

DEVELOPING THE RESEARCH PROPOSAL:

A written proposal is often required when a study is being suggested. This is especially true if an outside research supplier will be contracted to conduct the research. The written proposal ensures that the parties concur on the project's purpose, the proposed methods of investigation, the extent of analysis, and the timing of each phase as well as of delivery of results. Budgets are spelled out, as are other responsibilities and obligations. The proposal may serve the purpose of a legally binding contract.

A research proposal also may be oral, wherein all aspects of the research are discussed but not codified in writing. This is more likely when a manager directs his or her own research or the research activities of subordinates.

- **Research Proposal** – A research proposal is a brief summary outlining the research objectives, the proposed methodology of research, benefits of study along with a detailed bibliography. The research proposal is like a road map to the researcher showing where he has to start and where to go and how to get there.

STEPS INVOLVED IN PREPARING BUSINESS RESEARCH PLAN/PROPOSAL:

A Research proposal is an outline, a draft plan of the research work proposed by the researcher. A research proposal is also termed as synopsis. It contains a statement of the problem, the proposed methodology, the benefits of the research and the resources required to conduct the research. It also informs the decision maker, the time taken to complete the investigation and also the cost to be incurred.

Contents of Research Proposal

1. Purpose of proposed research:

- a. Goals and objectives to be stated.
- b. Scope of the study (what will be included and what will not be included).
- c. Limitations if any due to time and money constraints, etc.
- d. What questions will the investigation answer?

2. Type of study:

- a. Is the study exploratory, descriptive or causal?
- b. Explain how secondary data will be used?
- c. Describe the method of gathering primary data.

3. Target population/group to be defined: From whom is the data collected.

4. **Sample size** – Sample size is to be determined. At research proposal stage, this will be approximate, since the response rate and accuracy required cannot be predicted. If accuracy required is more, one has to choose bigger sample size and vice versa. This would mean more cost and time.

5. **Sample design** – Is the sample probabilistic or non probabilistic? If probabilistic, what kind of sample? Is it random sampling or systematic random sampling?

6. **Data Collection** – Will questionnaire be used? If yes, is it structured or unstructured. Is the study descriptive or causal or exploratory?

Will the questionnaire be filled in presence of researcher or to be filled by respondent at their home without the presence of interviewer? If the data collection is by mail questionnaire, what incentive is

being given in order to ensure response. Data collection may include qualitative phase and could involve focus group, depth interview etc.

7. **Research instrument** – Questionnaire or any other tool used to collect data and suitable scales used as tools to analyze the data.
8. **Benefits: what benefits researcher will get, funding agents will get and organization will get.** Description / explanation of cost-benefit analysis. How the value of information is going to help the decision makers.
9. **Estimation of the cost of the project** – Total cost of the project (proposed budget) and likely payoff. Also how long will it take to complete the project.
9. **Profile of the research firm** – Background of the firm, overview and skill of the researcher such as qualification, experience etc.

Presentation should include the methodology used by the research firm and all the above contents. It should be designed in such way, to answer all the possible doubts of the clients about the research. Researcher should also convince the client about the validity and reliability of the research to be undertaken and its methodology.

SAMPLE – RESEARCH PROPOSAL:

A leading private sector bank has recently issued a platinum card to its card holders, who have membership with the bank for more than 15 years and have sound credit history. In addition to the facilities available on the existing credit card, platinum card provides additional facilities such as free health check up, free membership to golf club, cash back of 20% of any purchase, 20% discount in any 5 star hotel and host of other facilities.

Now company wants to understand the customer behavior and usage pattern of this card. M/S XYZ is appointed as a research agent to conduct the research. M/S XYZ submits the research proposal.

A study on customer usage pattern of platinum card

1. **Purpose:** It is proposed to collect information regarding attitude, behavior and other demographic information of platinum card holders. Management of the bank has a host of questions regarding the popularity of the card and usage pattern. Towards this management wants answers to the following questions:
 - i. Is the card being used by the existing card holder to whom it has been issued?
 - ii. How do the card holders view the facilities provided under this card?
 - iii. How often the card holders use this card?
 - iv. For what privileges the card has been used?
 - v. What other benefits do the card holders expect from this card?
2. **Type of study:** The study to be done will be in two stages:
 - i. Exploratory
 - ii. Descriptive

It will be exploratory with respect to

- a) Shortcomings of the card
- b) Annual fee to be charged
- c) Privileges provided under this card

It will be descriptive with respect to

- a) Usage pattern

- b) Awareness of privileges
 - c) How often it is used
3. **Target population:** Current platinum card holders of the bank.
 4. **Sample size:** To be chosen based on the level of accuracy required.
 5. **Sample design:** Probability sampling will be adopted for the study. Respondents will be drawn from among the platinum card holders, based on random sampling technique.
 6. **Data collection:** A structured, non-disguised questionnaire to be administered by skilled field force. A gift is proposed to encourage participation by the respondent.
 7. **Research instrument/techniques:** Scales will be used to measure attitude and behavioral components of respondents. Suitable statistical techniques to be used to analyze the data.
- 8. Benefits:**
- i. Profile of platinum card holders will be known.
 - ii. Knowing the profile, customers can be segmented and appropriate promotion strategy can be developed for each segment.
 - iii. Usage pattern can be tracked.
 - iv. Any new privileges to be introduced will be known.
- 9. Cost estimation of the project:**

Sl.no.	Item	Cost in Rs
1.	Questionnaire design	Rs. 1200
2.	Administrative cost	Rs. 300
3.	Data collection	Rs. 860
4.	Data coding	Rs. 900
5.	Report Preparation cost	Rs. 400
6.	Total cost	Rs. 3660

10. **Profile of the research firm:** Research will be conducted by M/S XYZ. The company is located in Mumbai. The company has experience in conducting MR studies for many multinational and public sector enterprises. Mr. X the chief of marketing research coordinator is an engineer from IIT with PG from IIM-C. He has over 20 years of experience and has conducted several studies in various sectors like retailing, banking, insurance, consumer goods.

RESEARCH APPLICATION IN BUSINESS DECISION:

- Businesses conduct research for many reasons, such as gathering crucial information about consumers and business customers.
- The key function of management is take decisions and without help of the research and analysis of present situation and future forecasting, decisions may not be effective. So research helps to take right decisions.
- Based on research, management can make intelligent and well informed decisions.
- Businesses use research to ascertain **the success of their advertising**. For instance, a dairy manufacturer may want to find out what percentage of the people saw its latest TV commercial.
- A business can make well-informed decisions due to research. In the research process, the business will be able to **acquire details about key business areas, analyze it, create a strategy and distribute business information**. Reports, presented to the top management, often contain details on consumer and employee preferences and all the available channels for

sales, marketing, finance and production. Management makes use of these details to **determine the best strategy.**

- Regarding the staff, a correctly carried out research can **uncover important details on their satisfaction quotient**, the difficulties experienced by them and how the problems related to relationships at the workplace could be handled. An analysis into the results would allow the management to bring about changes for the all round effective functioning of the organization and its employees.
- The workers **can be trained and coached in line with the needs.** This would help personal as well as professional development improving overall organizational performance.
- Research is important for **managerial decision making.** All strategic business areas are analyzed and evaluated; then techniques for more efficient procedures are created. Through proper research, the organization will be able to pick the most effective, productive and profitable one.
- Research could possibly be applied to marketing, production, finance, IT and Human resources.
- Research can answer questions for **various problems**, from getting a grip on industry trends, identifying new products to produce and deliver to the market, or deciding on which site to locate an outlet, to better understanding what it needs to fulfill customer demands. Research can also help evaluate if a product is accepted in the market. Research aids expansion into new markets.
- Research helps in **testing the potential success of new products.** Businesses have to understand what kinds of products consumers would like before they market them.
- **New Knowledge:** The fascination and desire for new knowledge, new facts for business cycles, environment analysis and technological up gradation are the primary reasons of research.
- **Research assists** the company to find the right supplier at the right price and at the right time. An appropriate supplier choice makes it possible for the company to obtain or acquire top quality raw materials which result into production of good quality items which are consumed by the end user.

CRITERIA OF 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.

Other Criteria are:

5. **Purpose clearly defined** – The purpose of the business research-the problem involved or the decision to be made-should be clearly defined and sharply delineated in terms as unambiguous as possible. The statement of the decision problem should include its scope, its limitations, and the precise meanings of all words and terms significant to the research.
6. **Research process detailed** – The research procedures used should be described in sufficient detail to permit another researcher to repeat the research. Except when secrecy is imposed, research reports should reveal the sources of data and the means by which they were obtained.
7. **Research design thoroughly planned** – The procedural design of the research should be carefully planned to yield results that are as objective as possible. A survey of opinions or recollections ought not to be used when more reliable evidence is available from documentary sources or by direct observation.
8. **High ethical standards applied** – Ethical issues in research reflect important moral concerns about the practice of responsible behavior in society. A research design that includes safeguards against causing mental or physical harm to participants and makes data integrity a first priority should be highly valued.
9. **Limitations frankly revealed** – The researcher should report, with complete frankness, flaws in procedural design and estimate their effect on the findings.
10. **Analysis adequate for decision maker's needs-** Analysis of the data should be extensive enough to reveal its significance, what managers call “insights”. The methods of analysis used should be appropriate.
11. **Findings presented unambiguously** – Language that is restrained, clear, and precise; assertions that are carefully drawn and hedged with appropriate reservations; and an apparent effort to achieve maximum objectivity tend to leave a favorable impression of the researcher with the decision maker.
12. **Conclusions justified** – Conclusions should be limited to those for which the data provide an adequate basis. Good researchers always specify the conditions under which their conclusions seem to be valid.

RESEARCH METHODS

Unit 2:

Business Research Design: Meaning and significance - **Types:** Exploratory and Conclusive Research Design.

Exploratory Research: Meaning, purpose, methods- Literature search, experience survey, focus groups and comprehensive case methods.

Conclusive Research Design - Descriptive Research - Meaning, Types – Cross sectional studies and longitudinal studies.

Experimental Research Design – Meaning and classification of experimental designs- formal and informal, Pre experimental design, Quasi-experimental design, True experimental design, statistical experimental design.

IMPORTANT CONCEPTS RELATING TO RESEARCH DESIGN:

1. Dependent and independent variables:

- A concept which can take on different quantitative values is called a variable. As such the concepts like weight, height, income are all examples of variables.
- Phenomena which can take on quantitatively different values even in decimal points are called „continuous variables“.
- But all variables are not continuous. If they can only be expressed in integer values, they are non-continuous variables or in statistical language „discrete variables“. Age is an example of continuous variable, but the number of children is an example of non-continuous variable.
- If one variable depends upon or is a consequence of the other variable, it is termed as a dependent variable, and the variable that influences the dependent variable is termed as an independent variable. For instance, if we say that height depends upon age, then height is a dependent variable and age is an independent variable.
- Commercial movies influence the behaviour of the people. Then behaviour of the people (Dependent Variable) is depending on Commercial Movies (Independent Variable)
- A continuous variable is that which can assume any numerical value within a specific range.
- A variable for which the individual values fall on the scale only with distinct gaps is called a discrete variable.

2. Extraneous variable: Independent variables that are not related to the purpose of the study, but may affect the dependent variable are termed as extraneous variables.

- Suppose the researcher wants to test the hypothesis that there is a relationship between commercial Movies and behaviour of the people. In this case commercial Movies is an independent variable and behaviour of the people is a dependent variable. Actors may as affect the Behaviour of the people, but since it is not related to the purpose of the study undertaken by the researcher, it will be termed as an extraneous variable. Whatever effect is noticed on dependent variable as a result of extraneous variable(s) is technically described as an „experimental error“.

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

DEFINITION OF RESEARCH DESIGN:

A research design is a framework or blueprint for conducting the marketing research project. It details the procedures necessary for obtaining the information needed to structure and/or solve marketing research problems. A research design lays the foundation for conducting the project. A good research design will ensure that the marketing research project is conducted effectively and efficiently.

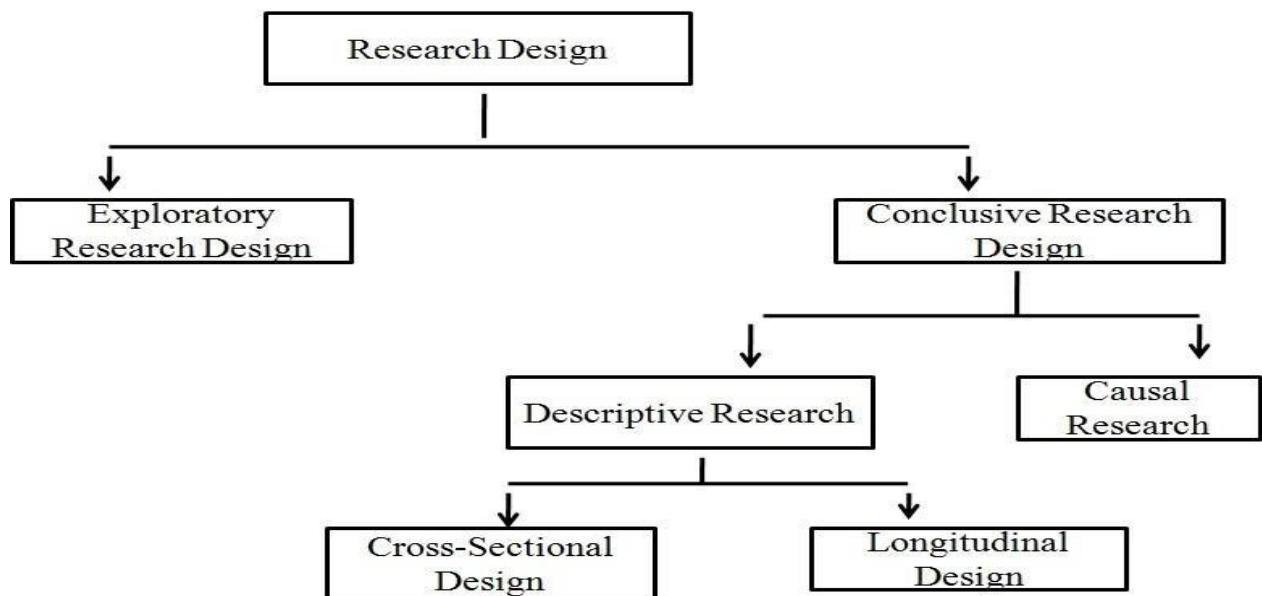
There are many definitions of research design, but no single definition imparts the full range of important aspects.

- Research design constitutes the blueprint for the collection, measurement, and analysis of data.

Research Design will answer following questions:

- What is the study about?
- Where is the study being made?
- What types of data are required?
- Where can the required data are found?
- What will be sample design?
- How will the data be gathered?
- How will the data be analyzed?

TYPES OF BUSINESS RESEARCH DESIGN:



Comparison between Basic Research Designs:

Research project components	Exploratory research	Conclusive research
<i>Research purpose</i>	General: to generate insights about a situation	Specific: to verify insights and aid in selecting a course of action
<i>Data needs</i>	Vague	Clear
<i>Data sources</i>	Ill defined	Well defined
<i>Data collection form</i>	Open-ended, rough	Usually structured
<i>Sample</i>	Relatively small; subjectively selected to maximize generalization of insights	Relatively large; objectively selected to permit generalization of findings
<i>Data collection</i>	Flexible; no set procedure	Rigid; well-laid-out procedure
<i>Data analysis</i>	Informal; typically non-quantitative	Formal; typically quantitative
<i>Inferences/recommendations</i>	More tentative than final	More final than tentative

Parameters	Exploratory	Descriptive	Causal
Objective	Discover ideas and insights.	Describe market characteristics or functions.	Determine cause and effect relationships.
Characteristics	Flexible, Versatile Often the front end of total research design	Marked by the prior formulation of specific hypotheses. Preplanned and structured design.	Manipulation of one or more independent variables. Control of other mediating variables.
Methods	Uses non-probability sampling. No preplanned analysis techniques. Uses method of expert survey, Secondary data, Case Studies, Qualitative Research	Probability sampling design. Data collected through Surveys, Panels and Secondary data	Well-defined sampling plan and data is collected through experiments under controlled or natural conditions.

EXPLORATORY RESEARCH: E.G: Consumers attitude towards Online Grocery shops. Exploratory research studies are also termed as formulative research studies. The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the

working hypotheses from an operational. Exploration is particularly useful when researchers lack a clear idea of the problems they will meet during the study. Through exploration researchers develop concepts more clearly, establish priorities, develop operational definitions, and improve the final research design. Exploration serves other purposes as well. The area of investigation may be so new or so vague that a researcher needs to do an exploration just to learn something about the dilemma facing the manager. Important variables may not be known or thoroughly defined. Hypotheses for the research may be needed. Also, the researcher may explore to be sure it is practical to do a formal study in the area.

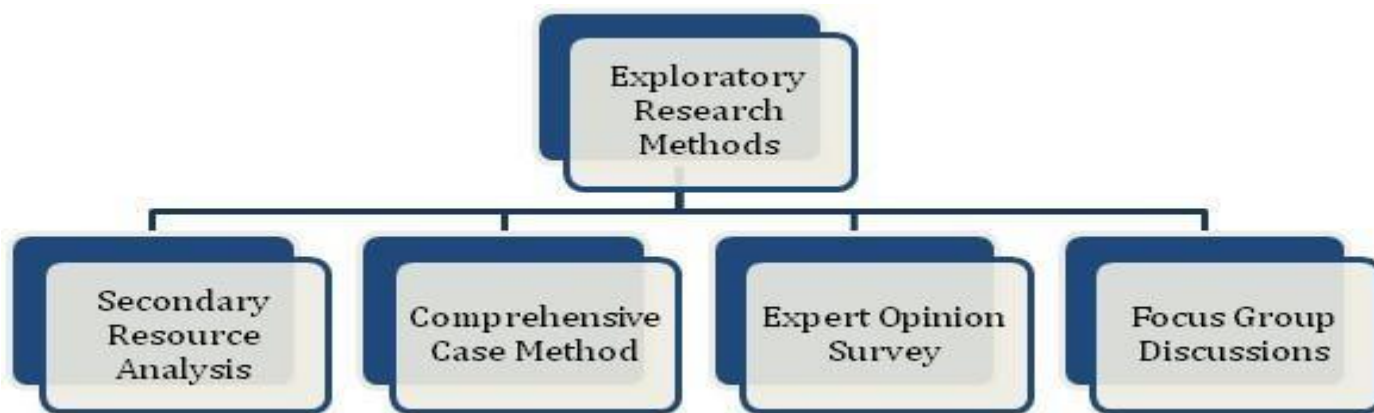
Characteristics of Exploratory Research:

- Exploratory research is flexible and very versatile.
- For data collection structured forms are not used.
- Experimentation is not a requirement.
- Cost incurred to conduct study is low.
- This type of research allows very wide exploration of views.
- Research is interactive in nature and also it is open ended.

Purpose of Exploratory Research:

- Formulate a problem or define a problem more precisely.
- Identify alternative courses of action.
- Develop hypotheses.
- Identify and separate key variables and relationships for further examination.
- Gain insights for developing an approach to the problem.
- Establish priorities for further research.
- Appropriate to any problem about which very little is known. This research is the foundation for any future study.

EXPLORATORY RESEARCH METHODS:



1. **Secondary Data Analysis** – Secondary data refers to literature, published or unpublished, available as a result of studies made by others for their own purposes. A researcher may review the literature with the purpose of framing a hypothesis, or he may review hypothesis already developed for further study by others to see their applicability. The sources of data can be bibliographies available on the topic, journals, magazines, newspapers, reports and books, special catalogues, subject guides, online on the

internet, digital libraries, e-databases maintained by the organization, guides, directories, indexes, Statistical data, Census data and other government publications.

2. **Comprehensive Case- Study Analysis/ Case methods** – Analyzing a selected case sometimes gives an insight into the problem which is being researched. Case histories of companies which have undergone a similar situation may be available. These cases are well suited to carry out exploratory research. For e.g., A Case Study on Mumbai Dabbawalas gives an insight into the problem of Supply Chain. A company implementing the practice of Supply Chain can take useful inputs from the case.
3. **Expert Opinion Surveys** – In expert surveys, it is desirable to talk to persons who are well informed in the area being investigated. These people may be company executives or persons outside the organization. Here, no questionnaire is required. The approach adopted in an experience survey should be highly unstructured, so that the respondent can give divergent views.
Example: 1. A group of housewives, Bachelors may be approached for their choice for a “Ready to Eat” product. 2. A publisher might want to find out the reason for poor circulation of newspaper introduced recently. He might meet a) Newspaper sellers b) Public reading room c) General Public d) Business community etc.
4. **Focus Group** – Another widely used technique in exploratory research is the focus group. In a focus group, a small number of individuals are brought together to study and talk about some topic of interest. The discussion is coordinated by a moderator. The group usually is of 10-12 persons. While selecting these persons, care has to be taken to see that they should have a common background and have similar experiences in buying. This is required because there should not be a conflict among the group members on the common issues that are being discussed.

CONCLUSIVE RESEARCH:

“Conclusive research is more likely to use statistical tests, advanced analytical techniques, and larger sample sizes, compared with exploratory studies. Conclusive research is more likely to use quantitative, rather than qualitative techniques”

Conclusive research can be sub-divided into two major categories:

- Descriptive or statistical research, (used to describe some functions or characteristics)
- Causal research (used to research cause and effect relationships).

Descriptive Research: Descriptive Research is to describe something – usually market characteristics or functions.

- It can describe the characteristics of a group such as, customers, organizations, markets etc. It provides association between two variables, like income and place of shopping, age and preferences.
- Inform us about the proportions of high and low income customers in a particular territory
- Requires a clear specification of “Who, what, when, where, why and how of the research.

Reasons for conducting Research:

- To describe the characteristics of relevant groups, such as consumers, salespeople, organizations or market areas.
- To estimate the percentage of units in a specified population exhibiting a certain behavior.
- To determine the perceptions of product characteristics.
- To determine the degree to which marketing variables are associated.
- To make specific predictions.

Types of descriptive Studies:

- **Cross-Sectional Designs/studies (One Time Research)** – A type of research design involving the collection of information from any given sample of population elements only once.
- E.G: In our study, we would simply measure the cholesterol levels of daily walkers and non-walkers. We would not influence non-walkers to take up that activity, or advise daily walkers to modify their behaviour. In short, we'd try not to interfere.
- **Longitudinal Designs/studies** – A type of research design involving a fixed sample of population elements that is measured repeatedly at different time periods. The sample remains the same over time, thus providing a series of pictures which, when viewed together, portray a vivid illustration of the situation and the changes that are taking place over time.
For e.g., To conduct a longitudinal design, we start with 20-year-olds, and then check in with them every 5 years to see how they've changed.

There are mainly two methods of data collection In Descriptive Research:

- **Survey Method** – A survey is defined as a brief interview or discussion with individuals about a specific topic, it includes:
 - **Questionnaires** - a series of written questions a participant answers. This method gathers responses to questions that are essay or agree/neutral/disagree style.
 - **Interviews** - questions posed to an individual to obtain information about him or her. This type of survey is like a job interview, with one person asking another a load of questions.
- **Observation Method** – The recording of behavioral patterns of people, objects and events in a systematic manner to obtain information about the phenomenon of interest.

It can be human/physical and mechanical observation

- **Personal Observation** – A researcher observes actual behavior as it occurs. The observer does not attempt to control or manipulate the phenomenon being observed.
- **Mechanical Observation** – Mechanical devices, rather than human observers, record the phenomenon being observed.
- E.G: How can an observational study can be conducted to determine which two brand of soda is more popular in college campus?
- By developing a research questions, identifying variables, and population of interest and developing an appropriate study
- So Hypothesis is: Soda B is more popular on this college campus
- Variables: Soda A and B
- Population: All the students on the campus

TYPES OF SURVEY:

- **True Survey** – This involves repeat measurement of the same variables. E.g. Perception towards frozen peas. Each member of the panel is examined at a different time to arrive at a conclusion on the above subject.
- **Omnibus Survey** – A sample of elements is being selected and maintained, but the information collected from the member varies. At a certain point of time, the attitude of panel members “towards an advertisement” may be measured. At some other point of time the same panel member may be questioned about the “product performance”.
- Omnibus surveys provide those seeking information about markets and opinions with a means to get quick, relatively low cost answers to their questions. The research company conducts a number of

interviews with the target group on a regular basis

- 'Have you ever owned a four-wheeler vehicle? (2 answers possible - Yes/No)
- If No: 'Have you ever considered purchasing a 4 wheeler vehicle?' (Yes / No).

CLASSIFICATION OF SURVEY METHODS:

- **Traditional Telephone Interviews** – Phoning a sample of respondents and asking them a series of questions.
- **Computer-Assisted Telephonic Interviewing** – Uses a computerized questionnaire administered to respondents over the telephone. The interviewer sits in front of a computer terminal and wears a mini headset. When contact is made, the interviewer reads questions posed on the computer screen and records the respondent's answers directly into the computer memory bank.
- **Personal In-Home Interviews** – Respondents are interviewed face-to-face in their home.
- **Mall Intercept Personal Interviews** – Respondents are intercepted while they are shopping in malls and brought to test facilities in the malls.
- **Computer-Assisted Personal Interviewing** – The respondent sits in front of a computer terminal and answers a questionnaire on the computer screen by using the keyboard or a mouse.
- **Mail Interviews** – Questionnaires are mailed to preselected potential respondents. A typical mail interview package consists of the outgoing envelope, cover letter, questionnaire, return envelope and possibly an incentive. The respondents complete and return the questionnaires.
- **Mail Panels** – a typical mail interview package consist of the outgoing envelop, cover letter, questionnaire, return envelop and an incentive. A mail panel consists of a large, nationally representative sample of households that have agreed to participate in periodic mail questionnaires and product tests.
- **E-mail Interviews** –To conduct an e-mail survey, a list of e-mail addresses is obtained. The survey is written within the body of the e-mail message. The e-mails are sent out over the internet. Respondents type the answers to either closed-ended or open-ended questions at designated places, and click on reply.
- **Internet Interviews** – Internet or Web surveys use hypertext markup language and are posted on a Website. Respondents are asked to go to a particular Web location to complete the survey.

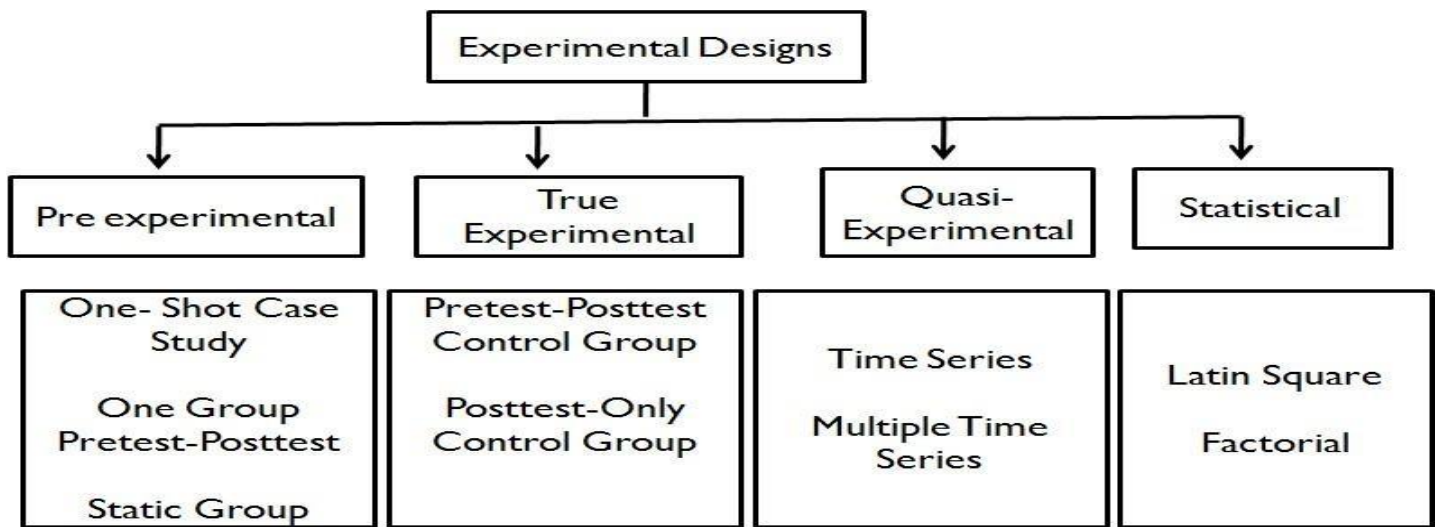
CAUSAL RESEARCH/EXPERIMENTAL:

Causal research is used to obtain evidence of cause and effect relationships. It is appropriate for the following purposes:

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

For e.g. in the context of department store project, a researcher wishes to determine whether the presence and helpfulness of sales people (causal variable) will influence the sales of house wares (effect variable). A causal design could be formulated in which two groups of otherwise comparable house wares departments of a particular chain are selected. For four weeks, trained salespeople are stationed in one group of house wares departments but not in the other. Sales are monitored for both groups, while controlling for other variables. A comparison of sales for the two groups will reveal the effect of salespeople on house wares sales in department stores.

CLASSIFICATION OF EXPERIMENTAL DESIGNS/CAUSAL RESEARCH DESIGN:



Experiment Group: while conducting an experiment, those units which are subject to the treatment under study.

E.G : Effectiveness of new teaching method on student performance, students which are subjected to new teaching methods will be experimental group

Control Group: the group of units which are exposed to usual condition is termed as control group. E.G: Group of students which is subject to usual teaching methods

Principles of Experimental Design:

1. **Replication:** According to this Principle, the experiment should be conducted more than once i.e it should be repeated again and again
E.G: in the experiment being conducted to test the effectiveness of teaching methods, there should be more than one experiment group and control group
2. **Randomization:** Randomization is used to control the effect of extraneous variables. The units and treatment are randomly assigned so that the variation caused by Extraneous variable can be controlled.
E.g: Randomly choosing and assigning the students to both experiment and control group
3. **Local control:** Identify, Measure and eliminate the effect of extraneous variables E.G: IQ is extraneous variable, after identifying the Extraneous variable, club similar IQ in one group, difference in performance among group caused due to IQ can be extracted and eliminated from the study using statistical tools like ANOVA

DEFINITION OF SYMBOLS:

- X = the exposure of a group to an independent variable, treatment or event, the effects of which are to be determined. (Treatment)
- O = the process of observation or measurement of the dependent variable on the test units or group of units. (Observation)
- R = the random assignment of test units or groups to separate treatments. (Randomization) □ EG = Experiment group.
- CG = Control Group.
- TE = Treatment Effect.
- R = Randomization.

Types of Experimentation:

1. **Pre experimental designs** do not employ **randomization** procedures to control for extraneous factors.

a. **One-Shot Case Study** – Also known as the after-only design, it is represented as

$$X \rightarrow O_2$$

- A single group of test units is exposed to an experimental treatment and a single measurement/observation is taken afterwards. It only measures the post-test results and does not use a control group.
- A single group of test units is exposed to a treatment X, and then a single measurement on the dependent variable is taken (O). There is no random assignment of test units.
- For e.g. an advertisement of Pears Soap is being shown to the respondent (X) and then they were asked whether they recall the ad or not (O).

b. **One-Group Pretest-Posttest Design** – Symbolized as

$$\begin{array}{c} X \\ O_1 \rightarrow O_2 \end{array}$$

In this design, a group of test units is measured twice. There is no control group. First, a pretreatment measure is taken (O1), and then the group is exposed to the treatment(X). Finally, a post treatment measure is taken (O2). The treatment effect is computed as $O_2 - O_1$.

For e.g. Respondents are first interviewed to know their opinion towards consuming alcohol (O1). An advertisement depicting harmful effects of alcohol is being shown to the respondent (X). After watching ad, the respondents are again being interviewed to test their opinion towards consuming alcohol now (O2). The effectiveness of ad is measured as $O_2 - O_1$.

c. **Static Group design** – It is a two-group experimental design. One group, called the experimental group (EG), is exposed to the treatment, and the other, called the control group (CG), is not exposed to the treatment. Measurements on both groups are made only after the treatment. Symbolically as:

$$\begin{array}{c} X \\ \text{EG: } \rightarrow O_2 \\ \text{CG: } \quad O_3 \\ \text{TE} = O_2 - O_3 \end{array}$$

For eg. HUL was trying to find out the impact of free samples of shampoo on the sales of shampoo. To the experimental group, they offered both the free samples and redemption coupon, and to Control Group only the redemption coupon was being offered. Coupons were coded and the number of coupons redeemed by the respondents were calculated. Difference between the coupons redeemed by the EG and CG will give the impact of free samples on sales of the shampoo.

2. **True Experimental design** – Researcher randomly assigns test units to experimental groups and treatments to experimental groups.

a. **Pretest-Posttest Control Group Design** – Test units are randomly assigned to either the experimental or the control group, and a pretreatment measure is taken on each group. The design is symbolized as

$$\begin{array}{c} X \\ \text{EG: } R \quad O_1 \rightarrow O_2 \\ \text{CG: } R \quad O_3 \quad O_4 \end{array}$$

The Treatment Effect (TE) is measured as $(O_2 - O_1) - (O_4 - O_3)$

E.g. In order to measure the impact of tuition on the performance of students, first a sample of respondents would be selected at random. Half of these would be randomly assigned to the experimental group and the other half would form the control group. Respondents in both groups were given a test to check their performance. Only the respondents in the experimental group were given a tuition and then both groups were given test and their performance was checked.

b. **Posttest-Only Control Group Design** – Experimental group is exposed to the treatment but the control group is not and no pretest measure is taken. It is symbolized as:

$$\begin{array}{ccc} & X & \\ \text{EG:} & R & \rightarrow O2 \\ \text{CG:} & R & O3 \end{array}$$

The treatment effect is obtained by $TE = O2 - O3$

E.g. To measure the effectiveness of ad, a sample of respondents is selected at random. Half of them would be taken as Experimental Group and the other half would be Control Group. An advertisement on harmful effects of alcohol would be shown to only the experimental group and not to the control group. Then the opinion of both the groups on alcoholism would be recorded. Difference in their opinion will tell us the impact of advertisement.

3. **Quasi-Experimental Designs** – Researcher can control when measurements are taken and on whom they are taken but is **unable to expose test units to the treatments randomly**.

1. **Time series design** – Time series designs involve having only one sample but taking measurements of the dependent variable on three or more occasions. Involves a series of periodic measurements on the dependent variable for a group of test units. The treatment is then administered by the researcher or occurs naturally. After the treatment, periodic measurements are continued to determine the treatment effect. It may be symbolized as: X

$$O1 O2 O3 O4 \rightarrow O5 O6 O7 O8$$

2. **Multiple Time Series Design** – A time series design that includes another group of test units to serve as a control group. Symbolically, it may be described as

$$\begin{array}{ccc} & X & \\ \text{EG:} & O1 O2 O3 O4 & \rightarrow O5 O6 O7 O8 \\ \text{CG:} & O1 O2 O3 O4 & O5 O6 O7 O8 \end{array}$$

4. **Statistical designs** – Allows for statistical control and analysis of external variables.

a. **Latin Square Design** – The Latin square design is used where the researcher aims to control the variation in an experiment that is related to rows and columns in the field. Treatments are assigned at random within rows and columns, with each treatment once per row and once per column. There are equal numbers of rows, columns, and treatments.

Study: The influence of Price on sales

3 Level of Price Categories: X1 – Low, X2 - Medium, X3 - High Sales are influenced by 2 Extraneous variables:

- o Store Size (1- Small, 2- Medium, 3-Large) o Type of Pacaking (I, II, III)

3X3 Latin Square Design

Store Size	Packaging		
	I	II	III
1	X1	X2	X3
2	X2	X3	X1
3	X3	X1	X2

b. Factorial Design – when Researcher chooses multiple independent variable in a single study it is called as factorial design, the independent variables are called as factors

For e.g. The Sales of a product may be influenced by 2 factors

- **Price Level:** (P1- Low, P2 – Medium, P3 – High)
- **Store Size:** Sales of each of the combinations is recorded in six different stores. Combination giving maximum will be taken as the best.

Price	Store	
	X1	X2
P1	P1X1	P1X2
P2	P2X1	P2X2
P3	P3X1	P3X2

Combinations	Sales	
P1X1	Rs. 12000	Best Combination
P1X2	Rs. 200	
P2X1	Rs. 476	
P2X2	Rs. 800	
P3X1	Rs. 700	
P3X2	Rs. 1100	

OBSERVATION RESEARCH

Observation (watching what people do) would seem to be an obvious method of carrying out research in psychology. Observational Research (OR Field Research) is a type of correlation (ie, non-experimental) research in which a researcher Observes ongoing behavior.

E.G : How cans an observational study can be conducted to determine which two brand of soda is more popular in college campus?

By developing a research questions, identifying variables, and population of interest and developing an appropriate study

So Hypothesis is: Soda B is more popular on this college campus

Variables: Soda A and B

Population: All the students on the campus

PARTICIPANT OBSERVATION:

Participant observation is a method by which researchers systematically observe people while joining in their routine activities.

The participant observation means watching the events or situation or activities from inside by taking part in the group to be observed. He freely interacts with the other group members, participates in various activities of the group, acquires the way of life of the observed group or his own, and studies their behaviour or other activities not as an outsider but by becoming a member of that group.

NON-PARTICIPANT OBSERVATION: When the observer observes the group passively from a distance without participating in the group activities, it is known as non-participant observation.

RESEARCH METHODS

Unit 3:

Sampling: Concepts- Types of Sampling - Probability Sampling – simple random sampling, systematic sampling, stratified random sampling, cluster sampling -Non Probability Sampling – convenience sampling-judgmental sampling, snowball sampling- quota sampling - Errors in sampling.

Important Projective Techniques/Qualitative Techniques

1. **Word Association Test:** An individual is given a clue or hint and asked to respond to the first thing

that comes to mind. The association can take the shape of a picture or a word. There can be many interpretations of the same thing. A list of words is given and you don't know in which word they are most interested. The interviewer records the responses which reveal the inner feeling of the respondents. The frequency with which any word is given a response and the amount of time that elapses before the response is given are important for the researcher. For eg: Out of 50 respondents 20 people associate the word "Fair" with "Complexion".

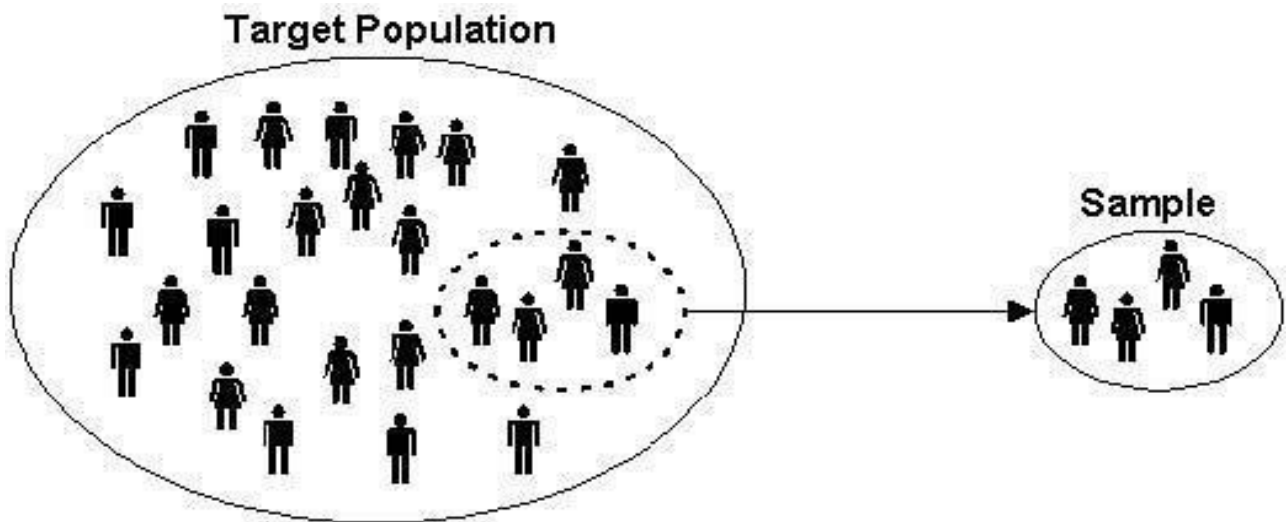
2. **Sentence Completion Test:** In this the respondents are asked to complete an incomplete sentence or story. The completion will reflect their attitude and state of mind.
3. **Construction Test:** This is more or less like completion test. They can give you a picture and you are asked to write a story about it. The initial structure is limited and not detailed like the completion test. For e.g.: 2 cartoons are given and a dialogue has to be written by respondents.
4. **Expression Techniques:** In this the people are asked to express the feeling or attitude towards other people.
5. **The Thematic Apperception Test (TAT)** is a widely used projective technique used in mainstream **clinical psychology** where an image of a vague social scene/picture is shown and an individual is asked to create a story to explain the image. The assumption is that subconscious or non-conscious feelings and beliefs will be "projected" onto ambiguous stimuli.

Sample Design: A sample design is a specific plan for obtaining a sample from a given population. It refers to the technique or procedure the researcher would adopt in selecting items for the sample from universe.

Sampling: Concepts

- All items in any field of inquiry constitute a „Universe“ or „Population.“ A complete enumeration of all items in the „population“ is known as a census inquiry.
- A **population** is a large well defined collection of individuals known to have similar characteristics that will focus on scientific Inquiry. The entire group of people to which the researcher wishes to conduct research and generalize the findings.
- A **census** is a count of all the elements in a population. If 4,000 files define the population, a census would obtain information from every one of them.
- It can be presumed that in such an inquiry (census), when all items are covered, no element of chance is left and highest accuracy is obtained.
- Population parameter:

- **Definition of Sampling:** A sample is a subgroup of the population selected for participation in the study. Sample characteristics, called statistics, are then used to make inferences about the population parameters.
- The process of selecting a number of individuals for a study in such a way that the individuals represent the larger group from which they were selected
- The process of selecting sample for the purpose of research study is called sampling.
- The respondents selected should be as representative of the total population as possible in order to produce a miniature cross-section. The selected respondents constitute what is technically called a „sample“ and the selection process is called „sampling technique.“ The survey so conducted is known as „sample survey“. Algebraically, let the population size be N and if a part of size n (which is $< N$) of this population is selected according to some rule for studying some characteristic of the population, the group consisting of these n units is known as „sample“.



Distinction between Census and Sampling:

- A census involves a complete enumeration of the elements of a population. A sample, on the other hand, is a subgroup of the population selected for participation in the study.

When is a Census Appropriate?

1. A census is appropriate if the size of population is small. For e.g. A researcher may be interested in contacting firms in iron and steel industry. These industries are limited in number, so a census will be suitable.
2. Sometimes, the researcher is interested in gathering information from every individual. Eg. Quality of food served in a mess.

When is Sample Appropriate?

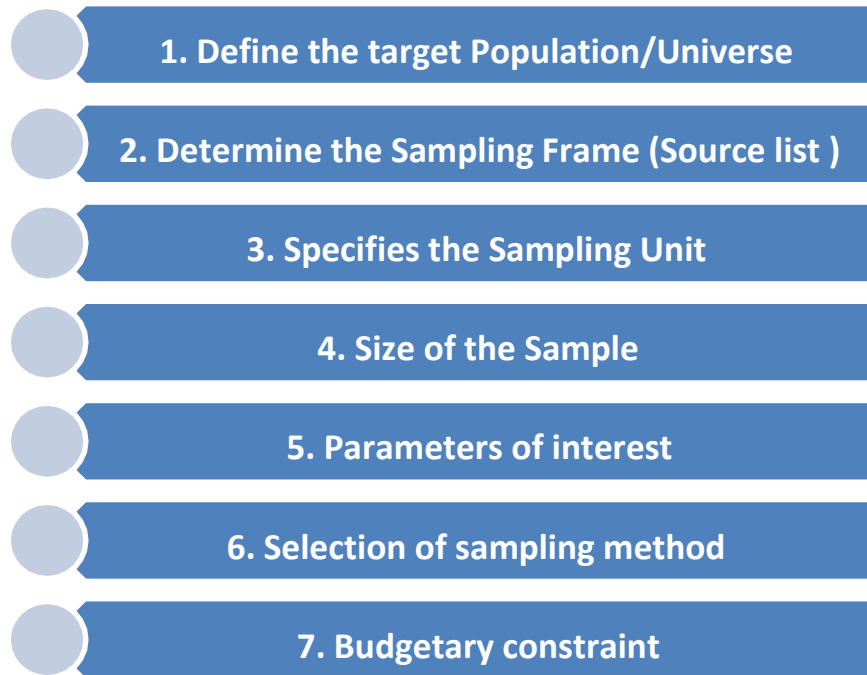
1. When the size of population is large.
2. When time and cost are the main considerations in research.
3. If the population is homogeneous.
4. Circumstances when a census is not possible. Eg. Reactions to global advertising by a company.

Characteristics of a good sample design:

- True representative of the whole population.

- Appropriate sample size
- Sample should be chosen properly by appropriate sampling technique.
- A perfect mix of all the population elements.

Steps in Sampling Design Process:



1. Define the target population/Universe – The target population is the collection of elements or objects that possess the information sought by the researcher and about which inferences are to be made. The target population should be defined in terms of elements, sampling units, extent and time. An element is the object about which or from which the information is desired. A sampling unit is an element or a unit containing the element, which is available for selection at some stage of the sampling process. Suppose that Revlon wanted to assess consumer response to new line of lipsticks and wanted to sample females over 18 years of age. Here the sampling unit would be households and all females over 18 in each selected household would be population element. Extent refers to the geographical boundaries, and the time factor is the time period under consideration.

For eg., For a study of Customer Satisfaction:

Elements: Customers

Extent: Bangalore City

Time: 2016

2. Determine the Sampling Frame (Source list): A sampling frame is a representation of the elements of the target population. It consists of a list or set of directions for identifying the target population. Examples of a sampling frame include the telephone directory, an association directory listing the firms in an industry, a mailing list purchased from an organization, a city directory or a map. **EG.** You want to learn about scooter owners in a city. The RTO will be the frame which provides you names, addresses and the types of vehicles possessed.

E.G: Students are your respondents, and then College admin data base is sampling Frame

3. Specifies the Sampling Unit – Individuals who are to be contacted are the sampling units. If retailers are to be contacted in a locality, they are the sampling units.

4. Size of the Sample: This refers to the number of items to be selected from the universe to constitute a

sample. This is a major problem for a researcher. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility.

5. **Parameters of interest:** In determining the sample design, one must consider the question of the specific population parameters which are of interest. For instance, we may be interested in estimating the proportion of persons with some characteristic in the population, or we may be interested in knowing some average or the other measure concerning the population.
6. **Selection of sampling method** – The researcher must decide whether to use Bayesian or traditional sampling approach, to sample with or without replacement, and to use non probability or probability sampling. In *probability sampling technique*, sampling units are selected by chance. There is no biasness involved at the time of selecting the sample and each element is getting a fair chance to be a part of the sample. In *non probability sampling technique*, the sample is selected based on personal judgment of the researcher and not chance. Thus some biasness is involved.
7. **Budgetary constraint:** Cost considerations, from practical point of view, have a major impact upon decisions relating to not only the size of the sample but also to the type of sample. This fact can even lead to the use of a non-probability sample.

Types of Sampling/Techniques of Sampling:

A. Probability sampling: Probability sampling is also known as „random sampling“ or „chance sampling“. Under this sampling design, every item of the universe has an equal chance of inclusion in the sample. When population is defined and known.

1. **Simple Random Sampling:** Each element in the population has a known and equal probability of selection. This implies that every element is selected independently of every other element. The sample is drawn by a random procedure from a sampling frame. This method is equivalent to a lottery system – Take a population containing four departmental stores: A, B, C & D. Suppose we need to pick a sample of two stores from the population. We write down all possible combinations AB, AC, AD, BC, BD, CD on pieces of papers and fold the pieces. Put them in a box. Mix them and pull one at random.

2. **Systematic Sampling** – In some instances, the most practical way of sampling is to select every *ith*/*Kth* item on a list. Sampling of this type is known as systematic sampling. Sample is chosen by selecting a random starting point and then picking every *Kth* element in succession from the sampling frame. There are three steps:

1. Sampling interval *K* is determined by the following formula:

$$K = \frac{\text{No. of units in the population}}{\text{No. of units desired in the sample}}$$

No. of units desired in the sample

2. One unit between the first and *Kth* unit in the population list is randomly chosen.

3. Add *Kth* unit to the randomly chosen number.

Example – Consider 1000 households from which we want to select 50 units.

Calculate $K = \frac{1000}{50} = 20$

50

To select the first unit, we randomly pick one number between 1 to 20, say 17. So our sample begins with 17, 37, 57 Only the first item is randomly selected and rest are systematically selected.

3. Stratified Random Sampling – if a population from which a sample is to be drawn does not constitute a homogeneous groups, stratified sampling, the population is divided into several sub population that are homogeneous the sub populations are called as strata. Strata are formed on the basis of common characteristics of items to be put in each stratum and heterogeneous characteristics between groups/strata. Simple random sampling is used to select items for each stratumxdsf **Stratified samplings are of two types:**

1. **Proportionate stratified Sampling** – The number of sampling units drawn from each stratum is in proportion to the population size of that stratum.

To illustrate it, let us suppose that we want a sample of size $n = 30$ to be drawn from a population of size $N = 8000$ which is divided into three strata of size $N_1 = 4000$, $N_2 = 2400$ and $N_3 = 1600$.

Adopting proportional allocation, we shall get the sample sizes as under for the different strata:

For strata with $N_1 = 4000$, we have $P_1 = 4000/8000$

And hence $n_1 = n * P_1 = 30 (4000/8000) = 15$

Similarly, for strata with $N_2 = 2400$, we have $n_2 = n * P_2 = 30 (2400/8000) = 9$, and

For strata with $N_3 = 1600$, we have $n_3 = n * P_3 = 30 (1600/8000) = 6$.

Thus, using proportional allocation, the sample sizes for different strata are 15, 9 and 6 respectively which is in proportion to the sizes of the strata viz., 4000 : 2400 : 1600. Proportional allocation is considered most efficient and an optimal design.

2. **Disproportionate stratified Sampling** – The number of sampling units drawn from each stratum is based on analytical variation and consideration, but not in proportion to the size of the population of that stratum. When differences in the stratum size and difference in stratum variability disproportionate stratified sampling technique can be used

where $\sigma_1, \sigma_2, \dots$ and σ_k denote the standard deviations of the k strata, N_1, N_2, \dots, N_k denote the sizes of the k strata and n_1, n_2, \dots, n_k denote the sample sizes of k strata. This is called 'optimum allocation' in the context of disproportionate sampling. The allocation in such a situation results in the following formula for determining the sample sizes different strata:

$$n_i = \frac{n \cdot N_i \sigma_i}{N_1 \sigma_1 + N_2 \sigma_2 + \dots + N_k \sigma_k} \quad \text{for } i = 1, 2, \dots \text{ and } k.$$

4. Cluster Sampling – The Cluster sampling refers to a sampling method that has the following properties.

- The population is divided into N groups, called clusters.
- The researcher randomly selects n clusters to include in the sample.
- If the total area of interest happens to be a big one, a convenient way in which a sample can be taken is to divide the area into a number of smaller non-overlapping areas and then to randomly select a number of these smaller areas (usually called clusters), with the ultimate sample consisting of all (or samples of) units in these small areas or clusters.

Differentiate Between Stratified and cluster sampling:

Sl No.	Stratified	Cluster
1	The stratified sampling method is a sampling method wherein a population is divided into several strata and a sample is taken from each stratum.	Cluster sampling is a sampling method wherein the population is divided into 2 or more clusters
2	Randomly selected individuals are taken from all the strata	All the individuals are taken from randomly selected clusters.
3	Stratified sampling takes a longer period of time	Cluster sampling is time efficient.

4	Stratified sampling requires a larger number of samples since the population is divided into several strata	While cluster sampling does not.
5	Stratified sampling can be expensive.	Cluster sampling is very cost efficient
6	Within strata – homogeneous characteristics Between strata – Heterogeneous characteristics	Within Cluster – Heterogeneous characteristics Between strata – Homogeneous characteristics



Stratified Sampling Vs Cluster Sampling

Advantages of Probability Sampling:

- It is unbiased.
- Quantification is possible in probability sampling.
- Less knowledge of universe is sufficient.

Disadvantages of Probability Sampling

- It takes time.
- It is costly.
- More resources are required to design and execute than in non-probability design.

B. Non-probability sampling: Non-probability sampling is that sampling procedure which does not afford any basis for estimating the probability that each item in the population has of being included in the sample. Non-probability sampling is also known by different names such as deliberate sampling, purposive sampling and judgment sampling. In this type of sampling, items for the sample are selected deliberately by the researcher; his choice concerning the items remains supreme. For instance, if economic conditions of people living in a state are to be studied, a few towns and villages may be purposively selected for intensive study on the principle that they can be representative of the entire state.

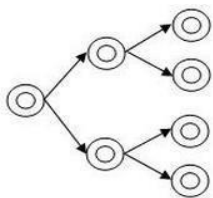
1. **Convenience Sampling** – Attempts to obtain a sample of convenient elements. The selection of sampling units is left primarily to the interviewer. Often, respondents are selected because they happen to be in the right place at the right time. Examples of convenience sampling include: 1) use of students, church groups and members of social organizations, 2) mall intercept interviews without qualifying the respondents, 3) department stores, 4) tear-out questionnaires in a magazine, 5) people on the street

interviews. Least expensive and least time-consuming of all sampling techniques.

2. **Judgmental Sampling** –It is a form of convenience sampling in which the population elements are selected based on the judgment of the researcher. The researcher exercising judgment or expertise, chooses the elements to be included in the sample, because he or she believes that they are representative of the population of interest or are otherwise appropriate. Common examples of judgmental sampling include 1) test markets selected to determine the potential of a new product, 2) purchase engineers selected in industrial marketing research because they are considered to be representative of the company, 3) expert witnesses used in court.
3. **Quota Sampling** – It involves the fixation of certain quotas, which are to be fulfilled by the interviewers. It involves two stages:
 - i The first stage consists of developing control categories, or quotas of population elements. To develop these quotas, the researcher lists relevant control characteristics and determines the distribution of these characteristics in the target population. The control characteristics include sex, age and race.
 - ii In the second stage, Sample elements are selected based on convenience or judgment. Suppose 200, 000 students are appearing for a competitive examination. We need to select 1% of them based on quota sampling.

	Chocolate Buyers	Respondent quota (sample size = 200)
Men	40%	80
Women	60%	120

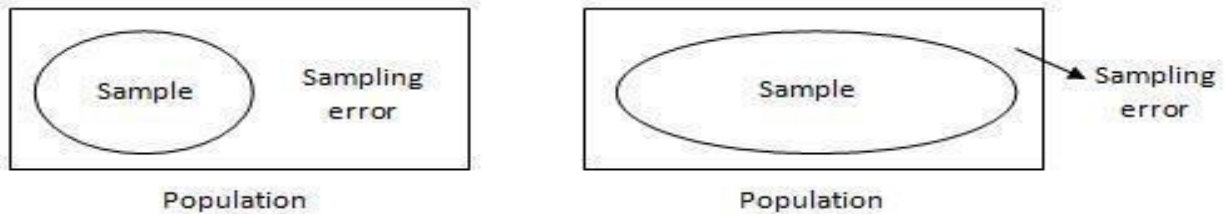
4. **Snow ball Sampling** - An initial group of respondents is selected. After being interviewed, these respondents are asked to identify others who belong to the target population of interest. Subsequent respondents are selected based on the opinion or referrals provided by the initial respondents. This process may be carried out in waves by obtaining referrals from referrals, thus leading to a snowballing effect. Examples if you are studying the level of customer satisfaction, you will find it increasingly difficult to find primary data sources unless a member is willing to provide you with contacts of other members. This sampling method involves primary data sources nominating another potential primary data sources to be used in the research.



Errors in Sampling:

- **Sampling Error** – Error due to inappropriate selection of sample size. It can be minimized by choosing the appropriate sample size. As the sample keeps on increasing, the sampling error decreases. Eg. If a study is done amongst Maruti-car owners in a city to find the average monthly

expenditure on the maintenance of car, it can be done by including all Maruti-car owners.



- **Non-sampling error** – Occurs in some systematic way, which is other than sampling.
- **Sampling Frame Error** – Errors in the specific list of population units, from which the sample for a study is being chosen.
- Eg. Assume that a bank wants to contact the people belonging to a particular profession over phone to market a home loan product. The sampling frame in this case is the telephone directory. This sampling frame may pose several problems:1) People might have migrated. 2) Numbers have changed. 3) Many numbers were not yet listed. Residents who are included in the directory likely to differ from those who are not included.
- **Non-response error** – The two major non-response issues in sampling are improving response rates and adjusting for non-response. Non-response error arises when some of the potential respondents included in the sample do not respond.
- **Refusals**, which result from the unwillingness or inability of people included in the sample to participate, result in lower response rates.
- **Attempts to lower refusal rates:**
- **Prior notification** – Potential respondents are sent a letter notifying them of the about to happen mail, telephone, personal or internet survey.
- **Motivating the respondents** – The interviewer starts with a small request such as “Will you please take five minutes to answer five questions?” which is followed by a larger request (*foot-in-the-door strategies*). In the reverse strategy, the initial request is relatively large, followed by a smaller request (*door-in-the-face strategy*).
- **Incentives** – Offering monetary as well as nonmonetary incentives to potential respondents.
- **Follow-up** – Contacting the non respondents periodically after the initial contact or by sending a letter to remind non respondents to complete and return the questionnaire.
- **Data Error** – This occurs during the data collection, analysis of data or interpretation. Respondents sometimes give distorted answers unintentionally for questions which are difficult, or if the question is exceptionally long and the respondent may not have answer.

RESEARCH METHODS

Data Collection: Primary and Secondary data

Primary data collection methods - Observations, survey, Interview and Questionnaire,
Qualitative Techniques of data collection

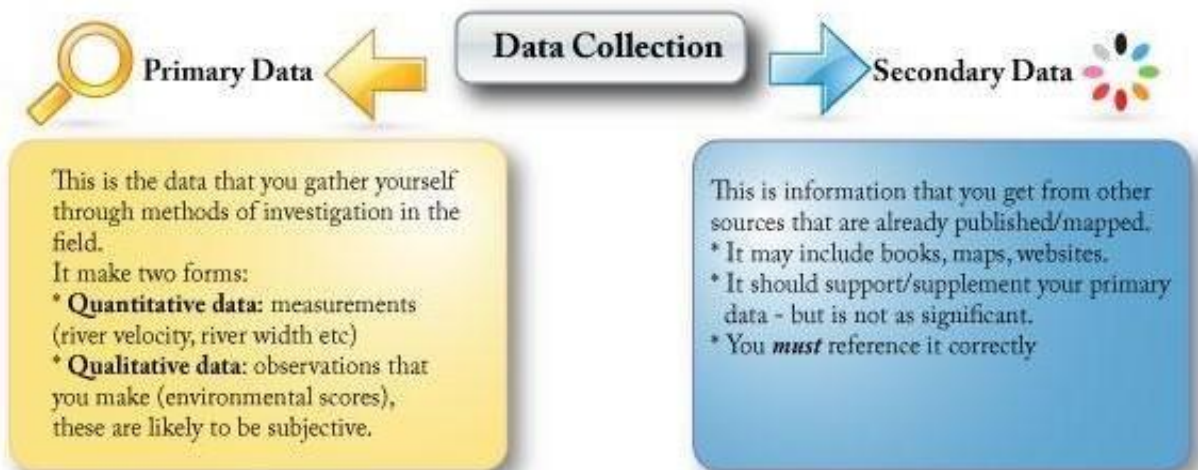
Questionnaire design – Meaning - process of designing questionnaire.

Secondary data -Sources – advantages and disadvantages

Measurement and Scaling Techniques: Basic measurement scales-Nominal scale, Ordinal scale, Interval scale, Ratio scale. Attitude measurement scale – Likert’s Scale, Semantic Differential Scale, Thurstone scale, Multi-Dimensional Scaling

Data Collection: The task of data collection begins after a research problem has been defined and research design/plan chalked out. While deciding about the method of data collection to be used for the study, the researcher should keep in mind two types of data viz., primary and secondary. The *primary data* are those which are collected afresh and for the first time, and thus happen to be original in character. The *secondary data*, on the other hand, are those which have already been collected by someone else and which have already been passed through the statistical process.

- Quantitative** – based on numbers – 56% of 18 year olds drink alcohol at least four times a week – doesn’t tell you why, when, how.
- E.G: Questionnaire**
- Qualitative** – more detail – tells you why, when and how!



Differences between Primary and Secondary Data

	Primary data	Secondary Data
Meaning	Primary data refers to the first hand data gathered by the researcher himself.	Secondary data means data collected by someone else earlier.

Data	Real time data	Past data
Process	Very Involved/Long	Quick and Easy
Sources	Survey, observation, questionnaire and interview	Websites, publications, articles and magazines
Cost	Expensive	Economical
Time	Long	Short

Primary Data and Secondary Data

- Primary data are originated by a researcher for the specific purpose of addressing the problem at hand.
- Obtaining primary data can be expensive and time consuming.
- Primary Data- Primary data is the data which is collected first hand specially for the purpose of study. It is collected for addressing the problem at hand. Thus, primary data is original data collected by researcher first hand.
- Secondary data are data that have already been collected for purposes other than the problem at hand.
- These data can be located quickly and inexpensively.

Primary Data Collection Methods:

Primary data received from first hand source such as: direct observation, survey, Interview and Questionnaire etc.

We collect primary data during the course of doing experiments in an experimental research but in case we do research of the descriptive type and perform surveys, whether sample surveys or census surveys, then we can obtain primary data either through observation or through direct communication with respondents in one form or another or through personal interviews.

- 1. Observation:** Observation involves recording the behavioral patterns of people, objects and events in a systematic manner. The major aim of this type of observation is to get a spontaneous picture of life and persons.
 - The observation method is the most commonly used method especially in studies relating to behavioral sciences. Observation becomes a scientific tool and the method of data collection for the researcher, when it serves a formulated research purpose, is systematically planned and recorded and is subjected to checks and controls on validity and reliability. Under the observation method, the information is sought by way of investigator's own direct observation without asking from the respondent.
 - **Structured Observation:** the observation is characterized by a careful definition of the units to be observed, the style of recording the observed information, standardized

RESEARCH METHODOLOGY

conditions of observation and the selection of pertinent data of observation, then the observation is called as structured observation.

- **Unstructured Observation:** But when observation is to take place without these characteristics to be thought of in advance, the same is termed as unstructured observation. Structured observation is considered appropriate in descriptive studies, whereas in an exploratory study the observational procedure is most likely to be relatively unstructured.
- **Participant Observation:** If the observer observes by making himself, more or less, a member of the group he is observing so that he can experience what the members of the group experience, the observation is called as the participant observation
- **Non Participant Observation:** when the observer observes as a detached emissary without any attempt on his part to experience through participation what others feel, the observation of this type is often termed as non-participant observation
- **Uncontrolled Observation:** If the observation takes place in the natural setting, it may be termed as uncontrolled observation. Here the observer does not plan in advance.
- **Controlled Observation:** when observation takes place according to definite prearranged plans, involving experimental procedure, the same is then termed controlled observation. Controlled observations are likely to be carried out in a psychology laboratory. Here participant and situation/subject are under control.

2 Survey: A survey is a technique in which a prospective respondents is chosen and then studied with a view to drawing inferences from their responses to the statements in a questionnaire, or the questions in a series of interviews.

- Sample survey: the research conducted on the selected respondents chosen from the population is called as sample survey
- Census survey: the research conducted on entire group of respondents is called as census survey

3 Interview:

(a) **Personal Interviews:** Personal interview method requires a person known as the interviewer asking questions generally in a face-to-face contact to the other person. Usually the interviewer initiates the interview and collects the information. The interview has been called „a conversation with a purpose“, and more formally „a purposeful discussion between two or more people“ (Kahn and Cannell 1957). You can collect data using structured, unstructured and semi structured interviews.

- 1) **Structured interview** is one in which the interviewer simply reads out a set of closed questions in a particular order and notes the interviewee's responses. Structured interviews are sometimes referred to as standardized interviews (Healey and Rawlinson 1994). Such interviews involve the use of a set of predetermined questions and of highly standardized techniques of recording
- 2) **Semi-structured interview** is one in which the interviewer has a pre-set type and order of questions which includes both open ended and closed ended, but is prepared to add to the number of questions, vary the theme of the interview and the order in which the questions are asked if doing so is of benefit to the research objectives.

RESEARCH METHODOLOGY

- 3) **Un- structured interview** In a non-structured interview, the interviewer is allowed much greater freedom to ask, in case of need, supplementary questions or at times he may omit certain questions if the situation so requires. He may even change the sequence of questions. He has relatively greater freedom while recording the responses to include some aspects and exclude others.
 - 4) **Focused interview** is meant to focus attention on the given experience and knowledge of the respondent and its effects.
- (b) **Telephone interviews:** This method of collecting information consists in contacting respondents on telephone itself. It is not a very widely used method, but plays important part in industrial surveys, particularly in developed regions.
- Traditional Telephonic Interview
 - Computer assisted telephonic Interview.
- 4 **Questionnaire:** The questionnaire is the most widely used technique for collecting primary data. Depending on the nature of the data you are looking for, the form may ask questions, make statements, or do both. If you choose to use questions, always use closed questions, which are questions to which there is only one answer.
- Before using this method, it is always advisable to conduct „pilot study“ (Pilot Survey) for testing the questionnaires. In a big enquiry the significance of pilot survey is felt very much. Pilot survey is in fact the replica and rehearsal of the main survey. Such a survey, being conducted by experts, brings to the light the weaknesses (if any) of the questionnaires and also of the survey techniques. From the experience gained in this way, improvement can be effected.
 - **Structured questionnaires** are those questionnaires in which there are definite, concrete and predetermined questions. The questions are presented with exactly the same wording and in the same order to all respondents. When these characteristics are not present in a questionnaire, it can be termed as **unstructured or non-structured** questionnaire.

SOME OTHER METHODS OF DATA COLLECTION

Let us consider some other methods of data collection, particularly used by big business houses in modern times.

1. **Warranty cards:** Warranty cards are usually postal sized cards which are used by dealers of consumer durables to collect information regarding their products. The information sought is printed in the form of questions 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.
2. **Distributor or store audits:** Distributor or store audits are performed by distributors as well as manufactures through their salesmen at regular intervals. Distributors get the retail stores audited through salesmen and use such information to estimate market size, market share, seasonal purchasing pattern and so on. The data are obtained in such audits not by questioning but by observation. For instance, in case of a grocery store audit, a sample of stores is visited periodically and data are recorded on inventories on hand either by observation or copying from store records.
3. **Pantry audits (Warehouse):** Pantry audit technique is used to estimate consumption of the basket of goods at the consumer level. In this type of audit, the investigator collects an inventory of types, quantities and prices of commodities consumed. Thus in pantry audit data are recorded from the examination of consumer's pantry.

4. **Consumer panels:** An extension of the pantry audit approach on a regular basis is known as “consumer panel”, where a set of consumers are arranged to come to an understanding to maintain detailed daily records of their consumption and the same is made available to investigator on demands. In other words, a consumer panel is essentially a sample of consumers who are interviewed repeatedly over a period of time.
5. **Qualitative/Projective techniques:** Projective techniques (or what are sometimes called as indirect interviewing techniques) for the collection of data have been developed by psychologists to use projections of respondents for inferring about underlying motives, urges, or intentions which are such that the respondent either resists to reveal them or is unable to figure out himself. We may now briefly deal with the important projective techniques.
 - (i) **Word association tests:** These tests are used to extract information regarding such words which have maximum association. In this sort of test the respondent is asked to mention the first word that comes to mind, without thinking, as the interviewer reads out each word from a list.
 - (ii) **Sentence completion tests:** These tests happen to be an extension of the technique of word association tests. Under this, informant may be asked to complete a sentence
 - (iii) **Story Construction tests:** Such tests are a step further wherein the researcher may plan stories instead of sentences and ask the informants to complete them.
 - (iv) **Pictorial techniques:** There are several pictorial techniques. The important ones are as follows:
 - a. **Thematic Apperception Test (T.A.T.):** The TAT consists of a set of pictures (some of the pictures deal with the ordinary day-to-day events while others may be ambiguous pictures of unusual situations) that are shown to respondents who are asked to describe what they think the pictures represent. The replies of respondents constitute the basis for the investigator to draw inferences about their personality structure, attitudes, etc.

SECONDARY DATA:

Secondary data means data that are already available i.e., they refer to the data which have already been collected and analyzed by someone else. When the researcher utilizes secondary data, then he has to look into various sources from where he can obtain them.

Secondary data can help you:

- Identify the problem.
- Better define the problem.
- Develop an approach to the problem.
- Formulate an appropriate research design.
- Answer certain research questions and test some hypotheses.
- Interpret primary data more insightfully.

18MBA23 – RESEARCH METHODOLOGY

SECONDARY DATA COLLECTION METHODS:

Classification of Secondary data:

>**Internal data** are those generated within the organization for which the research is being conducted.

- This information may be available in a ready-to-use format, such as information routinely supplied by the management decision support system.
- On the other hand, these data may exist within the organization but may require considerable processing before they are useful to the researcher. For eg. A variety of information can be found on sales invoices. Yet this information may not be easily accessible; further processing may be required to extract it.
- Accounting resources- This gives so much information which can be used by the marketing researcher. They give information about internal factors.
- Sales Force Report- It gives information about the sale of a product.

>**External data** are those generated by sources outside the organization. These are mainly published materials, computerized databases and syndicated services.

1. Sources of Secondary Data: Published Materials

- It is possible to locate information on a particular topic in several different publications by using an index. Indexes can, therefore, increase the efficiency of the search process. E.g. Business Periodical Index.
- Published statistical data are of great interest to researchers. Graphic and statistical analyses can be performed on these data to draw important insights. Eg. A Guide to Consumer Markets.
- Provides detailed view of the human population, their income and education level. The quality of census data is high and the data are often extremely detailed. Important census data include Census of Housing, Census of Manufacturers, Census of Population, Census of Retail Trade, Census of Service Industries and Census of Wholesale Trade.
- Addition to the census, the government collects and publishes a great deal of statistical data. The more useful publications are Business Conditions Digest and Survey of Current Business.

2. Computerized Databases

- Databases, stored in computers, which require a telecommunications network to access.
- Internet databases can be accessed, searched and analyzed on the internet. It is also possible to download data from the internet and store them in the computer or an auxiliary storage device.
- Databases those are available on diskette or CD-ROM.
- Databases composed of citations to articles in journals, magazines, newspapers, marketing research studies, technical reports, government documents and the like. They often provide summaries or abstracts of the material cited.
- Contain numerical and statistical information that may be important sources of secondary data. Databases containing the complete text of secondary source documents comprising the database. Provide information on individuals, organizations and services. Eg. National Electronic Yellow Pages. Contain information of a specific nature, e.g. data on a specialized industry.

3. Syndicated Sources of Secondary Data:

Syndicated sources, also referred to as syndicated services, are companies that collect and sell common pools of data of known commercial value, designed to serve information needs shared by a number of clients. These data are not collected for the purpose of marketing research problems specific to individual clients, but the data and reports supplied to client companies can be personalized to fit particular needs.

- Provide syndicated data about industrial firms, businesses and other institutions. Financial, operating and employment data are also collected by these syndicated research services. These data are collected by making direct inquiries, from clipping services that monitor newspapers, the trade press and broadcasts; and from corporate reports.

Advantages and uses of Secondary Data:

- Secondary data are easily accessible, relatively inexpensive and quickly obtained.
- Available on topics where it would not be feasible for a firm to collect primary data.

Disadvantages of secondary Data:

- Because secondary data have been collected for purposes other than the problem at hand, their usefulness to the current problem may be limited in several important ways, including relevance and accuracy.
- The objectives, nature and methods used to collect the secondary data may not be appropriate to the present situation.
- Secondary data may be lacking in accuracy, or they may not be completely current or dependable.

Questionnaire Design

Schedule: Under this method the enumerators are appointed and given training. They are provided with schedules containing relevant questions. These enumerators go to respondents with these schedules. Data are collected by filling up the schedules by enumerators on the basis of replies given by respondents, interview form, or measuring instrument, is a formalized set of questions for obtaining information from respondents. Typically, a questionnaire is only one element of a data-collection package that might also include fieldwork procedures, such as

RESEARCH METHODOLOGY

instructions for selecting, approaching and questioning respondents; some reward, gift or payment offered to respondents, and communication aids, such as maps, pictures, advertisements and products and return envelopes.

Questionnaire Design Process:

1. Determine what information is needed –This will depend upon the nature of the problem, the purpose of the study and hypothesis framed. The target audience must be concentrated on. The characteristics of the respondent group have a great influence on questionnaire design. Questions that are appropriate for college students may not be appropriate for housewives.

2. Type of Questionnaire/Method – Structured or Unstructured, based on the various factors such as cost, time and availability, the type of questionnaire will be selected

Unstructured Questions – Open-ended questions that respondents answer in their own words. E.g. what is your occupation? They are good as first questions on a topic. They enable the respondents to express general attitudes and opinions that can help the researcher interpret their responses to structured questions.

Structured Questions – Specify the set of response alternatives and the response format.

- a. **Multiple-Choice Questions** – Researcher provides a choice of answers and respondents are asked to select one or more of the alternatives given.
- b. **Dichotomous Questions** – Has only two response alternatives: yes or no, agree or disagree, and so on.
- c. **Scales** –Scale can be used as :

Do you intend to buy a new car within the next six months?

Definitely will not buy	Probably will not	Undecided	Probably will buy	Definitely will buy
-------------------------	-------------------	-----------	-------------------	---------------------

RESEARCH METHODOLOGY

- 3. Types of Question and Content** – types of questions includes open ended, closed ended or dichotomous questions has to be chosen which is appropriate to the topic. *Is the Question Necessary?* Every question in a questionnaire should contribute to the information needed or serve some specific purpose. If there is no satisfactory use for the data resulting from a question, that question should be eliminated.

Are several questions needed instead of one? Sometimes, several questions are needed to obtain the required information in an unambiguous manner.

Eg. Do you think Coca-Cola is a tasty and refreshing soft drink?
(Incorrect)

- a. Do you think Coca-Cola is a tasty soft drink? and
- b. Do you think Coca-Cola is a refreshing soft drink?(Correct)

Avoid Double barreled question – A single question that attempts to cover two issues. Such questions can be confusing to respondents and result in ambiguous responses.

- 4. Choosing Question Wording** – Translation of the desired question content and structure into words that respondents can clearly and easily understand.

Define the issue- A question should clearly define the issue being addressed. Define the issue in terms of who, what, when, where and why. Eg. Which brand or brands of shampoo have you personally used at home during the last month? In case of more than one brand, please list all the brands that apply.

Use Ordinary words- Ordinary words should be used in a questionnaire and they should match the vocabulary level of the respondents.

E.g. do you think the distribution of soft drinks is adequate? (Incorrect)

E.g. do you think soft drinks are readily available when you want to buy them? (Correct)

Use Unambiguous Words – The words used in a questionnaire should have a single meaning that is known to the respondents. A number of words that appear to be unambiguous have different meanings to different people. These include „usually“, „normally“, frequently, often and sometimes.

- 5. Sequence, Form and Layout** – The format, spacing and positioning of questions can have a significant effect on the results and should be done properly.

For sequencing, Researcher can use Funnel Technique: Type of Information – Basic information relates directly to the research problem. **Classification information**, consisting of socioeconomic and demographic characteristics, is used to classify the respondents and understand the results. **Identification information** includes name, address and telephone number. Basic information should be obtained first, followed by classification and, finally, identification information.

Sequencing: Structure your Questionnaire using what is called the “funnel” technique. Start with broad general interest questions that are easy for the respondent to answer. These questions serve to warm up the respondent and get them involved in the survey. The most difficult questions are placed in the middle – those that take time to think about and those that are of less general interest. Typically, these last questions include demographic and other classification questions.

Forms and Layouts - Reproduction of the Questionnaire - If the questionnaire is reproduced on poor quality paper or is otherwise shabby in appearance, the respondents will think the project is unimportant and the quality of response will be adversely affected. Therefore, the questionnaire should be reproduced on good-quality paper and have a

professional appearance. A researcher should avoid splitting a question, including its response categories. The tendency to crowd questions together to make the questionnaire look shorter should be avoided. **Determining the Order of Questions –**

Opening Questions- The opening questions can be crucial in gaining the confidence and cooperation of respondents. The opening questions should be interesting, simple and nonthreatening.

Sensitive Information – Respondents are unwilling to disclose information on sensitive topics like money, family life, political and religious beliefs. In order to avoid this, sensitive topics to be placed at the end of the questionnaire.

Difficult Questions– Difficult questions or questions that are sensitive, embarrassing, complex or dull should be placed late in the sequence. After rapport has been established and the respondents become involved, they are less likely to object to these questions.

6. **Pretesting –** Refers to the testing of the questionnaire, on a small sample of respondents to identify and eliminate potential problems. All aspects of the questionnaire should be tested, including question content, wording, sequence, form and layout, question difficulty and instructions. The respondents in the pretest should be similar to those who will be included in the actual survey in terms of background characteristics, familiarity with the topic and attitudes and behaviors of interest.
7. **Revise and Preparation of Final Questionnaire:** final questionnaire should be prepared by correcting spelling mistakes, adding or deleting questions and develop the final one.

MEASUREMENT AND SCALING

MEASUREMENT: It is a process of observing and recording the observation that are collected as a part of research. Measurement can be described as a way of obtaining symbols to represent the properties of persons, objects, events or states under study

SCALING: It means assigning numbers or other symbols to characteristics of objects according to certain pre-specified rules. The ability to assign numbers to objects.

Characteristics of Scales:

- **Classification:** placing of data into categories
- **Order:** measurement scale has an ordered relationship to one another. That is, some values are larger and some are smaller
- **Distance:** Scale units along the scale are equal to one another
- **Origin:** The scale has a true zero point, below which no values exist

PRIMARY SCALES OF MEASUREMENT:

- **Nominal Scale –** Nominal scales are used for labeling variables, without any quantitative value. “Nominal” scales could simply be called “labels.” Nominal scale is simply a system of assigning number symbols to events in order to label them. A nominal scale is a figurative labeling scheme in which the numbers serve only as labels or tags for identifying

and classifying objects. For e.g. the numbers assigned to the respondents in a study constitute a nominal scale. University Registration Numbers assigned to students, Bus Route Numbers and Numbers on the jerseys of cricket players are examples of Nominal scale. The numbers used in nominal scales serve only the purpose of counting and the idea is to make sure that no two persons or objects receive the same number. Nominal scales provide convenient ways of keeping track of people, objects and events.

- A nominal scale of measurement deals with variables that are non-numeric or where the numbers have no value. Think about the numbers on the jerseys of football players. Is the player wearing number 1 a better player than the player wearing number 82? That doesn't have anything to do with the numbers they wear.
- Labeling men as “1” and women as “2” which is the most common way of labeling gender for data recording purpose does not mean women are twice something than men.
- **Ordinal Scale (Ranking Scale)**- it is the order of the values is what's important and significant, An ordinal scale is a ranking scale in which numbers are assigned to objects to indicate the relative extent to which the objects possess some characteristic. Ordinal Scales are used to ascertain the consumer perceptions, preferences etc. For e.g. **how would you rate the service of our staff?**

(1) Excellent (2) Very Good (3) Good (4) Poor (5)

Worst **E.G: University Ranks:** • 1st Rank – 80%

- 2nd Rank – 75%
- 3rd Rank – 72%
- **Interval Scale** – Interval scales are numeric scales in which we know not only the order, but also the exact differences between the values. In an interval scale, numerically equal distances on the scale represent equal values in the characteristic being measured. An interval scale contains all the information of an ordinal scale, but it also allows you to compare the differences between objects. Interval scale provides information between one and the other.

Eg. : Temperature scale i.e., Centigrade and Fahrenheit are also interval scale,

E.G: How many hours do you spend to do assignment

30 Min to 60 Min

60 Min to 90 Min

90 Min to 120 Min

- **Ratio Scale** – It is a special kind of internal scale that has a meaningful zero point. With this scale, length, weight or distance can be measured. In this scale, it is possible to say, how many times greater or smaller one object is being compared to the other.

Eg. Sales this year for product A are twice the sales of the same product last year.

For example, the number of customers of a bank's ATM in the last three months is a ratio scale. This is because you can compare this with previous three months. For example, the difference between 10 and 15 minutes is the same as the difference between 25 and 30 minutes and 30 minutes is twice as long as 15 minutes

RESEARCH METHODOLOGY

Examples

Nominal Scale	Ordinal Scale	Internal	Ratio
Zip code Gender Eye color Specialization	Grade Judging Rating scale Ranking of Students Excellent to Poor	Temperature Time Highly satisfied to highly dissatisfied Strongly agree to strongly disagree	Age Salary Sales Profit Time

ATTITUDE MEASUREMENT SCALE

1. Likert Scale – It is a widely used rating scale that requires the respondents to indicate a degree of agreement or disagreement with each of a series of statements about the stimulus objects. Typically, each scale item has five response categories ranging from “strongly disagree” to “strongly agree”.

It is a widely used rating scale that requires the respondents to indicate a degree of agreement or disagreement with each of a series of statements about the stimulus objects. Typically, each scale item has five response categories ranging from “strongly disagree” to “strongly agree”.

For example, “Statistics is an interesting subject”

Strongly disagree – Disagree - Cannot decide - Agree - Strongly agree

Example of Likert Scale

Listed below are different opinions about Spar Hypermarket. Please indicate how strongly you agree or disagree with each by using the following scale:

1= Strongly disagree

2=Disagree

RESEARCH METHODOLOGY

3=Neither agree nor disagree

4=Agree

5=Strongly agree

Questions:

1. Spar sells high-quality merchandise.
2. Spar has poor in store-service.
3. I like to shop at Spar.
4. Sears charges fair prices.

2 Semantic Differential Scale – The semantic differential is a seven-point rating scale with end points associated with bipolar labels that have semantic meaning. In a typical application, respondents rate objects on a number of itemized, seven point rating scales bounded at each end by one of two bipolar adjectives, such as cold and warm. The respondents mark the blank that best indicates how they would describe the object being rated.

For eg.

Instructions

This part of the study measures what certain department store means to you by having you judge them on a series of descriptive scales bounded at each end by one of two bipolar adjectives. Please mark (X) the blank that best indicates how accurately one or the other adjective describes what the store means to you.

Form

Big Bazaar is:

Powerful _:~::~:~::~: Weak

Unreliable _:~::~:~::~: Reliable

Modern _:~::~:~::~: Old-fashioned

Complex _:~::~:~::~: Simple

3 Thurstone scale was the first formal technique to measure an attitude. It was developed by Louis Leon Thurstone in 1928, as a means of measuring attitudes towards attitude object. It is made up of statements about a particular issue, and each statement has a numerical value

RESEARCH METHODOLOGY

indicating how favorable or unfavorable it is judged to be. People check each of the statements to which they agree, and a mean score is computed, indicating their attitude.

1. **Collect statements** on the topic from people holding a wide range of attitudes, from extremely favorable to extremely unfavorable.

For this example, we will use attitude toward action movies.

- Action movies are thrilling.
- Action movies make the kids courageous.
- Action movies reduce the boredom of our life.
- Action movies provoke the kids to perform dangerous actions.

2. **Duplicate and irrelevant statements are omitted.** The rest are typed on 3/5 cards and given to a group of people who will serve as **judges**.
3. Originally, judges are asked to **sort** the statements into 11 stacks representing the entire range of attitudes from extremely favorable (1) to extremely unfavorable (11). The middle stack is for statements which are neither favorable nor unfavorable. Only the end points and the midpoint are labeled. The assumption is the intervening stacks will represent equal steps along the underlying attitude dimension.

Rate each of the following statements indicating the degree to which the statement is unfavorable or favorable to action movies.

4. Each statement will have a numerical rating (1 to 11) from each judge, based on the stack in which it was placed. The number or weight assigned to the statement is the **average of the ratings** it received from the judges.

If the judges cannot rate the item on its favorability or show a high degree of variability in their judgments, the item is eliminated.

4. **Multi Dimension Scale: MDS** is a statistical technique for taking the preference and perceptions of respondents and representing them on a visual grid, called **perceptual grid/maps**. Potential customers are asked to compare pairs of products and make judgments about their similarity.

Whereas other techniques obtain underlying dimensions from responses to product attributes identified by the researcher, **MDS** obtains the underlying dimensions from respondents' judgments about the similarity of products. The underlying dimensions come from respondents' judgments about pairs of products.

For e.g. Given a matrix of perceived similarities between various brands of deodorants, **MDS** plots the brands on a map such that those brands that are perceived to be very similar to each other are placed near each other on the map and those brands that are perceived to be very different from each other are placed far away from each other on the map.

RESEARCH METHODOLOGY

Characteristics of good Measurement

- **Reliability** – Refers to the extent to which a scale produces consistent results if repeated measurements are made.
Respondents are administered identical sets of scale items at two different times under as nearly equivalent conditions as possible. The time interval between tests or administrations is, typically two to four weeks.
- **Validity** – Validity is the extent to which a test measures what it claims to measure. Researchers may assess:
 1. **Content Validity** – It is a subjective but systematic evaluation of how well the content of a scale represents the measurement task at hand.
 2. **Criterion Validity** – Reflects whether a scale performs as expected in relation to other variables selected as meaningful criteria. It may include demographic and psychographic characteristics, attitudinal or behavioral measures.
 3. **Construct Validity** – Addresses the question of what construct or **characteristic** the scale is, in fact, measuring.
- **Possibility** – Addresses whether the research is possible or not. It includes:
 1. **Time possibility** – whether it is possible in terms of time period available.
 2. **Money possibility** – whether sufficient funds are available to conduct the research.

Unit 5:

Preparing the Data for Analysis: Editing, Coding, Classification, Tabulation, Validation Analysis and Interpretation- **Report writing and presentation of results:** Importance of report writing, types of research report, report structure, guidelines for effective documentation.

Difference between Data and Information:

- Any raw facts or a figure is known as data.
- When the data is processed by doing statistical analysis and some conclusion can be drawn from it, it is known as information.

Steps in Processing of Data

1. **Questionnaire checking** – The initial step in questionnaire checking involves a check of all questionnaires for completeness and interviewing quality. A questionnaire returned from the field may be unacceptable for several reasons:
 - Part of the questionnaire may be incomplete.
 - The pattern of responses may indicate that the respondent did not understand or follow the instructions.
 - The responses show little variance.

RESEARCH METHODOLOGY

- The questionnaire is answered by someone who does not qualify for participation.
- The returned questionnaire is physically incomplete, one or more pages are missing.

2. Editing – Editing of data is a process of examining the collected raw data (especially in surveys) to detect errors and omissions and to correct these when possible. As a matter of fact, editing involves a careful scrutiny of the completed questionnaires and/or schedules. Editing is done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as completed as possible and have been well arranged to facilitate coding and tabulation. Review of the questionnaires with the objective of increasing accuracy and precision. It consists of screening questionnaires to identify illegible, incomplete, inconsistent or ambiguous responses. The main problems in Editing are:

- **Inappropriate Respondents** – Instead of house owners, tenant is interviewed.
- **Incomplete responses:** respondents reluctant/negligent towards filling few questions. While editing, the editor should see that each schedule and questionnaire is complete in all respects.
- **Lack of consistency:** At the time of editing the data for consistency, the editor should see that the answers to questions are not contradictory in nature.
- **Legibility:** the quality of being clear enough to read, some responses are hard to read.
- **Fictitious interview** – Questionnaires are filled by interviewer himself without conducting the interview.

Example of Inconsistency:

A respondent indicated that he doesn't drink coffee, but when questioned about his favorite brand, he replied "BRU".

Treatment of Unsatisfactory Responses

- **Returning to the field** – Questionnaires with unsatisfactory responses may be returned to the field, where the interviewers re contact the respondents.
- **Predict and Assigning missing value** – Editor may assign missing values to unsatisfactory responses. This approach may be desirable if 1) the number of respondents with unsatisfactory responses is small, 2) the proportion of unsatisfactory responses for each of these respondents is small, or 3) the variables with unsatisfactory responses are not the key variables.
- **Discarding unsatisfactory respondents** – This is possible only when proportion of unsatisfactory respondents is small or the sample size is large.

3. Coding – Coding refers to the process of assigning numerical or other symbols to answers so that responses can be put into a limited number of categories or classes. Such classes should be appropriate to the research problem under consideration. Coding is translating answers into numerical values or assigning numbers to the various categories of a variable to be used in data analysis. Coding is done by using a

RESEARCH METHODOLOGY

code book, code sheet, and a computer card. Coding is done on the basis of the instructions given in the codebook. The code book gives a numerical code for each variable. For eg. Gender of respondents may be coded as 1 for males and 2 for females.

4. **Classification:** a process of arranging data in groups or classes on the basis of common characteristics. Most research studies result in a large volume of raw data which must be reduced into homogeneous groups if we are to get meaningful relationships. This fact necessitates classification of data which happens to be the process of arranging data in groups or classes on the basis of common characteristics. Data having a common characteristic are placed in one class and in this way the entire data get divided into a number of groups or classes. Classification can be one of the following two types

- **Classification according to attributes:** As stated above, data are classified on the basis of common characteristics which can either be descriptive (such as literacy, gender, religion, etc.) or numerical (such as weight, height, income, etc.). Descriptive characteristics refer to qualitative phenomenon which cannot be measured quantitatively; only their presence or absence in an individual item can be noticed.
- **Classification according to class-intervals:** Unlike descriptive characteristics, the numerical characteristics refer to quantitative phenomenon which can be measured through some statistical units. Data relating to income, production, age, weight, etc. come under this category. Such data are known as statistics of variables and are classified on the basis of class intervals. E.g: Age of employees ranges from 20 to 60, here 60 is highest value and 20 is lowest value, then number of classes will be 4. **Determining class Interval:**

$$= 60 - 20 / 4 = 10$$

5. **Tabulation** – The process of placing classified data into tabular form is known as tabulation. *Tabulation* is a part of the technical procedure wherein the classified data are put in the form of tables. Refers to counting the number of cases that fall into various categories. The results are summarized in the form of statistical tables. The raw data is divided into groups and sub-groups. The counting and placing of data in a particular group and sub-group are done.

RESEARCH METHODOLOGY

Tables are useful to the researchers and the readers in three ways:

1. They present an overall view of findings in a simpler way.
2. They identify trends.
3. They display relationships in a comparable way between parts of the findings.

By convention, the dependent variable is presented in the rows and the independent variable in the columns.

Tabulation may be of two types:

1. **Simple tabulation** – In simple tabulation, a single variable is counted.
2. **Cross tabulation** – Includes two or more variables, which are treated simultaneously.

Tabulation can be done entirely by hand, or by computers, or by both hand and computers.

Sorting and counting of data: Sorting can be done as follows:

Kinds of Tabulation

1. **Simple or one-way tabulation** – The multiple choice questions which allow only one answer may use one-way tabulation or univariate. The questions are predetermined and consist of counting the number of responses falling into a particular category and calculate the percentage.

Two types of Univariate Table:

- **Questions with only one Response**
- **Multiple Responses to Questions:** Respondents may give more than one answer to a given question, there are chances of overlapping and Responses need not add to 100%.

RESEARCH METHODOLOGY

- 2 **Cross Tabulation or Two-way Tabulation** – This is known as Bivariate Tabulation. The data may include two or more variables. It examines the relationship between 2 variables. Eg.

6. Graphical Representation:

Graphs help to understand the data easily. All statistical packages, MS Excel offers wide range of graphs. E.G: BAR CHART, PIE CHART,

- 7. Data cleaning** – Includes consistency checks and treatment of missing responses. Although preliminary consistency checks have been made during editing, the checks at this stage are more thorough and extensive, because they are made by computer.
- 8. Data Adjusting** – If any correction needs to be done for the statistical analysis, the data is adjusted accordingly.
- **Weights assigning:** each respondent is assigned a weight to reflect its importance relative to other respondents.
 - **Variable Re-specification:** this involves creating new variables or modifying existing variable.
 - **Scale Transformation:** scale transformation is done to ensure the correctness

Validation:

- Data Validity is described as the degree to which a research study measures what it intends to measure.
- There are two main types of validity, internal and external. Internal validity refers to the validity of the measurement and test itself, whereas external validity refers to the ability to generalize the findings to the target population.
- Method validation is the process used to confirm that the analytical procedure employed for a specific test is suitable for its intended use. Results from method validation can be used to judge the quality, reliability and consistency of analytical results; It is defined as „Finding or testing the truth of something“

RESEARCH METHODOLOGY

- Data validation ensures that the survey questionnaires are completed and present consistent data.
- In this step, should not include the questions that were not answered by most respondents in the data analysis as this would result to bias in the results. However, in the case of incomplete questionnaires, must count the actual number of respondents that were able to answer a particular question. This should be the same for the rest of the questions.

Analysis and Interpretation:

- Data analysis and interpretation is the process of assigning meaning to the collected information and determining the conclusions, significance, and implications of the findings.
- "Data analysis is the process of bringing order, structure and meaning to the mass of collected data.
- The steps involved in data analysis are a function of the type of information collected; however, returning to the purpose of the assessment and the assessment questions will provide a structure for the organization of the data and a focus for the analysis.
- The process by which sense and meaning are made of the data gathered in qualitative research, and by which the emergent knowledge is applied to problems.

The most common statistical terms include:

RESEARCH METHODOLOGY

REPORT:

A report is a formal detailed document prepared by the researcher or analysts that focuses on the specific purpose, generally in the sciences, social sciences, engineering and business disciplines.

Generally, findings pertaining to a given or specific task are written up into a report.

- ▶ "Research reports are detailed and accurate accounts of the conduct of disciplined studies accomplished to solve problems or to reveal new knowledge." (Busha and Harter, 1988).
- ▶ A **research report** is a completed study that reports an investigation or exploration of a problem, identifies questions to be addressed, and includes data collected, analyzed, and interpreted by the researcher.

IMPORTANCE OF THE REPORT

- They are the tangible products of the research effort.
- Management decisions are guided by the report and the presentation.
- Management's decision to undertake marketing research in the future or to use the particular research supplier again will be influenced by the perceived usefulness of the report and the presentation.
- It provides factual base for formulating policies and strategies relating to the subject matter studied.
- It serves as a basic reference material for future use in developing research proposals in the same or related area.
- It is used to evaluate researcher's ability and competence to do research.
- It is used for judging the quality of the completed research work/project
- Report should be presented in a systematic and attractive manner.
- Titles, photographs and graphs should be used wherever necessary.
- Report should be clear, to the point and easily understandable. Proverbs and exaggerations should be avoided.
- The analysis of facts should have logical and scientific base so that no one should have the doubt that the report is based on assumption ideas.
- Suggestions provided will be unbiased, creative and useful.

DIFFERENT STEPS IN WRITING REPORT:

- **Logical analysis of the subject matter:** It is the first step which is primarily concerned with the development of a subject matter. There are two ways in which to develop/present 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.

RESEARCH METHODOLOGY

- **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 organization of the material and a reminder of the points to be stressed in the report
- **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
- **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. While rewriting and polishing, one should check the report for weaknesses in logical development or presentation.
- **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
- **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.

Types of research report

- Two types of reports:-
 - **Technical Report**
 - **Popular Report**

– Technical Report:

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

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

1. **Summary of results:** A brief review of the main findings just in two or three pages.
2. **Nature of the study:** Description of the general objectives of study, formulation of the problem in operational terms, the working hypothesis, the type of analysis and data required, etc.
3. **Methods employed:** Specific methods used in the study and their limitations. For instance, in sampling studies we should give details of sample design viz., sample size, sample selection, etc.
4. **Data:** Discussion of data collected, their sources, characteristics and limitations. If secondary data are used, their suitability to the problem at hand is fully assessed. In case of a survey, the manner in which data were collected should be fully described.

RESEARCH METHODOLOGY

5. ***Analysis of data and presentation of findings:*** The analysis of data and presentation of the findings of the study with supporting data in the form of tables and charts be fully narrated. This, in fact, happens to be the main body of the report usually extending over several chapters.
6. ***Conclusions:*** A detailed summary of the findings and the policy implications drawn from the results be explained.
7. ***Bibliography:*** Bibliography of various sources consulted be prepared and attached.
8. ***Technical annexure:*** Annexure is given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular technique of analysis and the like ones.
9. ***Index:*** Index must be prepared and be given invariably in the report at the end.

Popular Report:

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

We give below a general outline of a popular report.

1. ***The findings and their implications:*** Emphasis in the report is given on the findings of most practical interest and on the implications of these findings.
2. ***Recommendations for action:*** Recommendations for action on the basis of the findings of the study is made in this section of the report.
3. ***Objective of the study:*** A general review of how the problem arises is presented along with the specific objectives of the project under study.
4. ***Methods employed:*** A brief and non-technical description of the methods and techniques used, including a short review of the data on which the study is based, is given in this part of the report.
5. ***Results:*** This section constitutes the main body of the report wherein the results of the study are presented in clear and non-technical terms with liberal use of all sorts of illustrations such as charts, diagrams and the like ones.

RESEARCH METHODOLOGY

6. **Technical appendices:** More detailed information on methods used, forms, etc. is presented in the form of appendices. But the appendices are often not detailed if the report is entirely meant for general public.

REPORT FORMAT/STRUCTURE (LAYOUT OF THE RESEARCH): COMPONENTS OF A WRITTEN RESEARCH REPORT:

A) Preliminary Pages:

- **Title Page** – Title of the report, information (Author name, address, and telephone number) about the researcher or organization conducting the research, the name of the client for whom the report was prepared, date of release and nature of the project.
- **Letter of authorization** – Written by the client to the researcher before work on the project begins.
- **Table of Contents** – List the topics covered and the appropriate page numbers.
- **Executive Summary** – It is an extremely important part of the report, as this is often the only portion of the report that executives read. The summary should concisely describe the problem, approach, and research design that was adopted. A summary section should be devoted to the major results, conclusions and recommendations. The executive summary should be written after the rest of the report has been completed.

B) Main text: the main text provides the complete outline of the research report with all the details. The main text of the report should have following sections:

- **Introduction:** the main purpose is to introduce the research project to the readers. It should have objectives, problem statement, hypothesis, methodology adopted.
 - **Problem definition**
 - a) Background to the problem
 - b) Statement of the problem
 - **Research Design**
 - a) Type of Research design
 - b) Information needs
 - c) Data collection from secondary sources
 - d) Data collection from primary sources
 - e) Scaling techniques
 - f) Questionnaire development and pretesting
 - g) Sampling techniques
 - h) Fieldwork

RESEARCH METHODOLOGY

- **Data Analysis** – Describe the plan of data analysis and justify the data analysis strategy and techniques used.
- **Limitations** – Limitations caused by time, budget and other organizational constraints should be presented.
 - **Statement of findings and Recommendations:** after introduction, the research report must contain a statement of findings and recommendation
 - **Results** – Should be organized in a logical way. A detailed presentation of the findings of the study with supporting data in the form of tables and charts together with valid results
 - **Implication of summary:** 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.
 - **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.

- **Bibliography** – Mention the title of the books and websites referred for the purpose of research.
- **Annexure** – Graphs, Tables and Questionnaire should be attached.

GUIDELINES FOR EFFECTIVE DOCUMENTATION

Documentation is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape or CDs. Example are user guides, white papers, on-line help, quick-reference guides. It is becoming less common to see paper (hard-copy) documentation. Documentation is distributed via websites, software products, and other on-line applications.

- **Do the documentation yourself if possible:** The best person to document is the builder. After all, who knows the system better than the system builder?
- **Explore new technologies:** Documentation can be costly even when done correctly. New technologies will continue to be created to help create more effective documentation that is less costly to develop

RESEARCH METHODOLOGY

- **Document with pictures if possible:** The old proverb says a picture is worth a thousand words means that by using pictures to augment your text, you can minimize the length and complexity of your documentation. System users like having pictures, diagrams, tables, and bulleted lists for quick reference.
- **Organization of the Research Report:** Most scientific research reports, irrespective of the field, parallel the method of scientific reasoning. That is: the problem is defined, a hypothesis is created, experiments are devised to test the hypothesis, experiments are conducted, and conclusions are drawn. This framework is consistent with the following organization of a research report:
 - Title
 - Abstract
 - Introduction
 - Experimental Details or Theoretical Analysis
 - Results
 - Discussion
 - Conclusions and Summary
 - References

RESEARCH METHODS NOTES

Hypothesis - types, characteristics, source, formulation of hypotheses, errors in hypotheses.
Parametric and Non-Parametric Tests- t-test, z-test, f-test, u-test, K-W Test (problems on all tests) Statistical analysis- Bivariate and Multivariate Analysis- (problems on Chi-square test only). ANOVA-one-way and two-way classification (theory only)

Hypothesis – Meaning:

A hypothesis is a tentative assumption statement relating to certain phenomenon, which the researcher wants to verify when required. It is an unproven statement or proposition about a factor or phenomenon that is of interest to the researcher. An important role of a hypothesis is to suggest variables to be included in the research design. It is a predictive statement capable of being tested by specific methods or basic assumption statement framed by the researcher to be proved or disproved

To be complete the hypothesis must include three components:

- The variables.
- The population.
- The relationship between the variables.

Arnold formulated a formal hypothesis about his Mentos and Diet Coke experiment: If I drop a half a pack of Mentos through a Geyser tube into a 2-liter of Diet Coke, then the Diet Coke will explode.

Arnold decides to test his hypothesis. So he buys a pack of Mentos, a Geyser tube, and a 2-liter of Diet Coke to experiment. He quickly drops half a pack of Mentos through a Geyser tube into the Diet Coke and runs. The Diet Coke erupts to a height of about 25 feet! Arnold is thrilled because his hypothesis proved to be correct. **Null hypothesis and alternative hypothesis:**

The null hypothesis is generally symbolized as H_0 and the alternative hypothesis as H_a . Suppose we want to test the hypothesis that the population mean is equal to the hypothesized mean Then we would say that the null hypothesis is that the population mean is equal to the hypothesized mean and symbolically we can express as:

$$H_0: \mu = \mu_0$$

$$H_a: \mu \neq \mu_0$$

Confidence level: probability that the value falls within a specific range of values, expected percentage that the actual value will fall within the stated limits

There are 3 confidence levels; they are 99%, 95% and 91%

Significance level: represented as alpha, it is probability of Type I error. 3 significance level are 0.01, 0.05 and 0.1 (1%, 5% and 10%) This is a very important concept in the context of hypothesis testing. It is always some percentage (usually 5%) which should be chosen with great care, thought and reason. In case we take the significance level at 5 per cent, then this implies that H_0 will be rejected and H_a will be accepted when the result (i.e., observed evidence) is a less than 0.05.

Types of Hypothesis:

- **Simple hypothesis** - this predicts the relationship between a single independent variable (IV) and a single dependent variable (DV)
- **Complex hypothesis** - this predicts the relationship between two or more independent variables and two or more dependent variables.
- **Descriptive Hypothesis** – These by name implies describing some characteristics of an object, a situation, an individual or even an organization. **E.g.** Why do youngsters prefer to watch MTV Channel?
- **Relational Hypothesis** – In this case we describe relationship between 2 variables. **E.g.** Rate of attrition is high in those jobs where there is night shift working.
- **Working Hypothesis** – This is a hypothesis framed in the early stages of research. These are altered or modified as investigation proceeds.
E.g. As of now, demand and quality are related. Later on this may not be the fact as investigation proceeds.
- **Common Sense Hypothesis** – Based on what is being observed. Eg. Economically poor students work hard, compared to those, who come from well to do families.
- **Null Hypothesis** – This hypothesis states that there is no difference between the parameter and the statistic that is being computed.
Eg There is no significant difference between the performance of the employees of a bank working in two different branches.

RESEARCH METHODOLOGY

A null hypothesis, on the other hand, is a hypothesis that states that there is no statistical significance between the two variables in the hypothesis. It is the hypothesis that the researcher is trying to disprove.

- **Alternative Hypothesis:** An alternative hypothesis states that there is statistical significance between two variables. In the example, the two variables are Mentos and Diet Coke. The alternative hypothesis is the hypothesis that the researcher is trying to prove.
- **Analytical Hypothesis** – Here relationship of analytical variable is found. These are used when one would like to specify the relationship between changes in one property leading to change in another.
E.g.: Income level related to number of children in the family.

Characteristics of a Hypothesis:

- **Clarity of concepts** – Concepts should not be abstract. If concepts are not clear, precise problem formulation will be difficult leading to difficulty in data collection. Concepts are important because, it means different to different people. Eg. Wearing a sunglasses represents a life style for a student, whereas it is an eye protecting device to a doctor.
- **Ability to test** – It should be possible to verify the hypothesis. Therefore, a good hypothesis is one in which there is empirical evidence. For eg. Sales of Pantaloons is 20% higher than the sales of Shoppers Stop.
- **Specific/Clear** – What is to be tested should be clear. The relationship between the variables should be clear or the statistic under verification should be mentioned clearly. Eg. Two wheeler manufactured by company “A” gives better mileage than that manufactured by company “B”. Here what is to be verified is clear and specific.
- **Statistical Tools** – Hypothesis should be such that, it is possible to use statistical techniques. Such as Anova, Chi square, t- test or other non parametric tests.
- **Logical** – If there is two or more Hypothesis derived from the same basic theory, they should not contradict each other.
- **Subjectivity** – Researchers subjectivity or his biased Judgment should be eliminated from the hypothesis. Eg. Older sales man sells less than younger salesman. This may be a biased opinion. As a matter of fact, older salesman may be selling more due to their experience and rapport developed with the customer.
- **Theory** – Hypothesis must be supported or backed up by theoretical relevance. Eg. Attitude of customer towards a new product introduction. This study is very well backed up by theory on consumer behavior.
- **Relationship:** hypothesis should state the relationship between variables.

Sources of Hypothesis:

- **Theory-** Theory on the subject can act as a source of hypothesis. We start of from a general premise and then formulate hypothesis.
Eg. Providing employment opportunity is an indicator of social responsibility of a government enterprise. From the above hypothesis, it can be deduced that:
 1. Public enterprise has greater social concern than other enterprises.
 2. People’s perception of government enterprise is social concern.

RESEARCH METHODOLOGY

3. Govt. enterprise help in improving the life of less privileged people.

- **Observation** – People's behavior is observed. In this method we use observed behavior to infer the attitudes.

Eg. A shopper in a supermarket may be disguised, to watch the customer in the stores. The following may be observed: a) How the customer approaches the – Product category, b) How long he/she spends in front of display, c) Whether the customer had difficulty in locating the product. Collect all these data and formulate a hypothesis regarding the behavior of the customer towards the product.

- **Past experience** – Here researcher goes by past experience to formulate the hypothesis. Eg. A dealer may state that fastest moving kids apparel is frock. This may be verified.
- **Case studies** – Normally this is done before the launch of a product to find customer taste and preferences.
- **Similarity** – This could be with respect to similarity in activities of human beings. Eg. Dress, food habits or any other activities found in human life in different parts of the globe.

Types of Errors: Type I & Type II Errors- Whenever we draw inferences about a population, there is a risk that an incorrect conclusion will be reached. Two types of errors can occur:

- Type I Error occurs when the sample results lead to the rejection of the null hypothesis when it is in fact true.
- Type II Error occurs when, based on the sample results, the null hypothesis is not rejected when it is in fact false.
- Type I and type II errors are mistakes in testing a hypothesis. A type I error occurs when the results of research show that a difference exists but in truth there is no difference; so, the null hypothesis H_0 is wrongly rejected when it is true. A type II error occurs when the null hypothesis is accepted, but the alternative is true; that is, the null hypothesis, is not rejected when it is false. Type II errors frequently arise when sample sizes are too small. The probability of a type I error is designated by the Greek letter alpha (α) and the probability of a type II error is designated by the Greek letter beta (β).

RESEARCH METHODOLOGY

Steps involved in Hypothesis Testing: (Formulation of Hypothesis)

1. **State the Null and Alternative Hypothesis/Formulate the Hypothesis** – The first step is to formulate the null and alternative hypothesis. A null hypothesis is a statement of no difference or no effect. If the null hypothesis is not rejected, no changes will be made. An alternative hypothesis is one in which some difference or effect is expected. Thus the alternative hypothesis is the opposite of the null hypothesis.

The null hypothesis is always the hypothesis that is tested. The null hypothesis refers to a specified value of the population parameter (eg. μ , π etc.).

For eg. A major department store is considering the introduction of an internet shopping service. The new service will be introduced if more than 40% of the Internet users shop via the internet. The appropriate way to formulate the hypothesis is:

$$\mathbf{H_0: \mu = 0.40 \quad H_1: \mu > 0.40}$$

If the null hypothesis H_0 is rejected, then the alternative hypothesis H_1 will be accepted and the new Internet shopping service introduced. On the other hand, if H_0 is not rejected, then the new service should not be introduced unless additional evidence is obtained.

This test of the null hypothesis is a one-tailed test, because the alternative hypothesis is expressed directionally: the proportion of Internet users who use the Internet for shopping is greater than 0.40. On the other hand, suppose the researcher wanted to determine whether the proportion of Internet users who shop via the Internet is different than 40%.

Then a two tailed test is required, and the hypothesis would be expressed as: **H₀:**

$$\mu = 0.40$$

$$\mathbf{H_1: \mu \neq 0.40}$$

2. **Specify the Level of Significance, α** – The next step is its validity at a certain level of significance. The confidence with which a null hypothesis is accepted or rejected depends upon the significance level. It is probability of committing Type I Error is 5%. A significance level of say 5% means that the risk of making a wrong decision is 5%. The researcher is likely to be wrong in accepting false hypothesis or rejecting a true hypothesis by 5 out of 100 occasions.
3. **Decide a test or correct sampling distribution (Select an Appropriate Test)** - To test the null hypothesis, it is necessary to select an appropriate statistical technique. The test statistic measures how close the sample has come to the null hypothesis. If the hypothesis pertains to a larger sample (30 or more), the Z-test is used. When the sample is small (less than 30), the T-test is used.
4. **Select samples randomly and Calculate the value of Test Statistic** – Sample size is determined after taking into account the desired α and β errors and other qualitative considerations, such as budget constraints. Then the required data are collected and the value of the test statistic computed using an appropriate statistical test based on the sample size. A **test statistic** is a standardized value that is calculated from sample data during a hypothesis **test**.
5. **Calculate Probability/P value at given significant level** – Find the Probability or

RESEARCH METHODOLOGY

Critical Test Value from the statistical table at a given level of significance for the appropriate number of degrees of freedom.

Degree of Freedom:

Simple tabulation: (n-1)

Cross tabulation = (R-1) * (C-1)

Alpha value (designated α value) may refer to: Significance level in statistics μ : represents the population mean.

6. **Comparing the probability:** Comparing the probability thus calculated with the specified value for α , the significance level. If the calculated probability is equal to or smaller than α value in case of one-tailed test (and $\alpha / 2$ in case of two-tailed test), then reject the null hypothesis (i.e., accept the alternative hypothesis), but if the calculated probability is greater, then accept the null hypothesis.

✦ **P value is = or $< \alpha \rightarrow H_a$ is Accepted**

✦ **P value is $> \alpha \rightarrow H_0$ is Accepted**

Parametric Tests:

If the information about the population is completely known by means of its parameters then statistical test is called parametric test Eg: T- test, F-test, Z-test.

- These tests are based on some assumptions about the parent population from which the sample has been drawn. These assumptions can be with respect to sample size, type of distribution or on population parameters like mean, standard deviation etc.
- Parametric tests are more powerful. The data in this test is derived from interval and ratio measurement.
- In parametric tests, it is assumed that the data follows normal distributions. E.g. Of parametric tests are Z Test, T-Test, F-Test
- Observations must be independent, i.e., selection of nay one item should not affect the chances of selecting any others be included in the sample.

T-Test: A t-test's statistical significance indicates whether or not the difference between two groups' averages most likely reflects a "real" difference in the population from which the groups were sampled.

The t-test assesses whether the means of two groups are *statistically* different from each other. This analysis is appropriate whenever you want to compare the means of two groups, and especially appropriate as the analysis for the posttest-only two-group randomized experimental design

RESEARCH METHODOLOGY

Calculation of the t -statistic for one mean

- T-Test is a univariate test.
- Uses t-distribution, which is a symmetrical bell-shaped curve, for testing sample mean and proportion.
- Assumes that the variable is normally distributed and the mean is known and the population variance is estimated from the sample.
- It is used when the standard deviation is unknown and the size of sample is small (i.e. less than 30).

The t-test, and any statistical test of this sort, consists of following steps.

1. Define the null and alternate hypothesis,
2. Specify significance level
2. Calculate the t-statistic for the data,
3. Compare $t(\text{calc})$ to the tabulated t-value, for the appropriate significance level and degree of freedom. If $t(\text{Tabulated}) > t(\text{calculated})$, we accept the null hypothesis and reject the alternate hypothesis. Otherwise, we reject the null hypothesis.

Z-Test:

- It is a popular test for judging the significance of mean and proportions.
- It uses normal distribution also when the size of sample is very large (more than 30) on the presumption that such a distribution tends to approximate normal distribution as sample size becomes larger.
- Testing the hypothesis about difference between two means: This can be used when two population means are given and null hypothesis is $H_0: P_1 = P_2$.

F-Test:

- An F test of sample variance may be performed if it is not known whether the two populations have equal variance.
- It is used to test the equality of variance of two normal populations i.e. to find whether two samples can be regarded as drawn from normal populations having the same variance.
- This test is particularly useful when multiple sample cases are involved and the data has been measured on interval or ratio scale.
- If the probability of F is greater than the significance level α , H_0 is not rejected. On the other hand, if the probability of F is less than or equal to α , H_0 is rejected.

CHI-SQUARE TEST:

Test is based on chi-square distribution and as a parametric test is used for comparing a sample variance to a theoretical population variance.

- The chi square statistic is used to test the statistical significance of the observed association in a cross-tabulation.
- It assists us in determining whether a systematic association exists between the two variables.
- The null hypothesis is that there is no association between the variables.
- The test is conducted by computing the cell frequencies that would be expected if no association were present between the variables, given the existing row and column totals.
- These expected cell frequencies are then compared to the actual observed frequencies, found in the cross tabulation to calculate the chi-square statistic.

Non Parametric Tests:

- Non Parametric tests are used to test the hypothesis with nominal and ordinal data.
- We do not make assumptions about the shape of population distribution.
- These are distribution-free tests.
- The hypothesis of non-parametric test is concerned with something other than the value of a population parameter.
- Easy to compute. There are certain situations particularly in marketing research, where the assumptions of parametric tests are not valid.
- Examples are Chi-Square Test, Mann Whitney U Test and Kruskal-Wallis H Test

Wilcoxon-Mann-Whitney Test (U Test)/Rank Sum Test:

- A statistical test for a variable measured on an ordinal scale comparing the difference in the location of two populations based on observations from two independent samples.
- This test corresponds to the two-independent sample t test for interval scale variables, when the variances of the two populations are assumed equal.
- It measures the degree of separation or the amount of overlap between the two groups.
- The null hypothesis states that the two sets of score do not have differences whereas the alternative hypothesis states that the two sets of scores do differ systematically.

This involves the following procedure:

1. The data of both the samples are arranged in one column in order of their magnitude either in ascending or descending order.
2. Thereafter ranks are assigned.
3. Then the sum of ranks of 1st sample is obtained denoted as R1 and then the sum of ranks of 2nd sample is obtained denoted as R2.
4. The test statistic U is then calculated.

Kruskal-Wallis Test/K-W Test Rank Sum Test:

- Kruskal Wallis Test is used when more than two populations are involved.
- This test will enable us to know whether independent samples have been drawn from the same population or from different populations having the same distribution.
- This test is an extension of Mann Whitney Test. Mann Whitney Test is used when only two populations are involved and Kruskal-Wallis test is used when more than two populations are involved.
- This test is also called the H Test.

Statistical Analysis:

Uni-variate techniques are appropriate when there is a single measurement of each element in the sample, or there are several measurements of each element but each variable is analyzed in isolation.

ANALYSIS OF VARIANCE (ANOVA)

Analysis of variance (abbreviated as ANOVA) is an extremely useful technique concerning researches in the fields of economics, biology, education, psychology, sociology, and business/industry and in researches of several other disciplines. The ANOVA technique enables us to perform this simultaneous test and as such is considered to be an important tool of analysis in the hands of a researcher. Using this technique, one can draw inferences about whether the samples have been drawn from populations having the same mean.

E.g: The ANOVA technique is important in the context of all those situations where we want to compare more than two populations such as in comparing the yield of crop from several varieties of seeds, the smoking habits of five groups of university students and among different gender, there is a variation with respect to IQ level.

WHAT IS ANOVA?

Professor R.A. Fisher was the first man to use the term „Variance“* and, in fact, it was he who developed a very elaborate theory concerning ANOVA, explaining its usefulness in practical field.

ANOVA is essentially a procedure for testing the difference among different groups of data for homogeneity. “The essence of ANOVA is that the total amount of variation in a set of data is broken down into two types, that amount which can be attributed to chance and that amount

RESEARCH METHODOLOGY

which can be attributed to specified causes.” There may be variation between samples and also within sample items. ANOVA consists in splitting the variance for analytical purposes.

ANOVA – One Way and Two Way Classification (Analysis of Variance)

- It is a statistical technique. It is used to test the equality of three or more sample means. Based on the means, inference is drawn whether samples belong to same population or not.

Conditions for using ANOVA:

- Data should be quantitative in nature.
- Data normally distributed.
- Samples drawn from a population follows random variation.

Following are the steps followed in ANOVA:

- a) Calculate the variance between samples.
- b) Calculate the variance within samples.
- c) Calculate F ratio using the formula.

$F = \text{Variance between the samples} / \text{Variance within the sample}$

- d) Compare the value of F obtained above with the critical value of F such as 5% level of significance for the applicable degree of freedom.
- e) When the table value of F is greater than the calculated value of F, the difference in sample means is not significant and a null hypothesis is accepted. On the other hand, when the calculated value of F is more than the critical value of F, the difference in sample means is considered as significant and the null hypothesis is rejected.

$$F(\text{tab}) < F(\text{cal}) \rightarrow H_0 \text{ accepted}$$

- One – Way Analysis of Variance involves only one categorical variable, or a single factor. The differences in preference of heavy, medium, light and non users would be examined by One-way ANOVA.
- In **one way ANOVA** the researcher takes only one factor while in the case of **two way ANOVA** the researcher investigates two factors concurrently.
- Two way ANOVA examines the effect of the two factors on the continuous dependent variable.
- **One –way Analysis of variance** - you have more than two levels (conditions) of a single Independent variable

Marketing researchers are often interested in examining the differences in the mean values of the dependent variable for several categories of a single independent variable or factor.

For e.g.

RESEARCH METHODOLOGY

- Do the various segments differ in terms of their volume of product consumption?
- Do the brand evaluations of groups exposed to different commercials vary?
- Do retailers, wholesalers and agents differ in their attitudes toward the firm's distribution policies?

E.G : Self concept: within group samples and between samples.

Two-way Analysis of Variance:

In marketing research, one is often concerned with the effect of more than one factor simultaneously. For e.g.

- Example: A firm has four types of machines – A, B, C, D. It has put four of its workers on each machines for a specified period, say one week. At the end of one week, the average output of each worker on each type of machine was calculated.
- Two-way ANOVA: you have more than one IV (factor) – EXAMPLE: studying pain relief based on pain reliever and type of pain • Factor A: Pain reliever (aspirin vs. tylenol)
 - Factor B: type of pain (headache vs. back pain)

Bivariate Technique – Chi-square:

- The chi-square test is represented by the symbol χ^2 and owes its origin to greek letter chi. This test was first used by Karl Pearson and is one of the most widely used test today.
- Through the test, we are able to determine the extent of difference between the theory or expected value and the observed or the actual value.

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

Where, O = Observed frequencies

E = Expected frequencies

- It is particularly useful in tests involving nominal data. The chi distribution is positive but an asymmetrical distribution.
- It has only one parameter, namely degrees of freedom. Degrees of freedom (DF) refer to the number of classes to which a value can be assigned freely without exceeding the limitation placed.

To review, the chi-square method of hypothesis testing has seven basic steps

1. State the null and research/alternative hypotheses.
2. Specify the decision rule and the level of statistical significance for the test, i.e., .05, .01, or .001 and Degree of freedom
3. Compute the expected values.
4. Compute the chi-square statistic.
5. Then identify the critical value of chi-square at the specified level of significance and appropriate degrees of freedom.
6. The larger the Chi-square value, the greater the probability that there really is a significant difference.

If the critical value-Tabulated value is greater than or equal to the Chi-square value (Calculated value) then accept null hypothesis

If the critical value-Tabulated value is less than the Chi-square value (Calculated value) then accept alternative hypothesis

Multivariate Techniques – Suitable for analyzing data when there are two or more measurements of each element and the variables are analyzed simultaneously. Concerned with the simultaneous relationships among two or more phenomena.

Multivariate techniques differ from univariate techniques in that they shift the focus away from the levels (averages) and distributions (variances) of the phenomena, concentrating instead upon the degree of relationships among these phenomena.

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

1. Discriminant Analysis:

In this analysis two or more groups are compared. Discriminant Analysis is a technique for analyzing data when the dependent variable is categorical

Linear discriminant function analysis (i.e., discriminant analysis) performs a multivariate test of differences between groups. In addition, discriminant analysis is used to determine the minimum number of **dimensions** needed to describe these differences.

For example, a graduate admissions committee might divide a set of past graduate students into two groups: students who finished the program in five years or less and those who did not. Discriminant function analysis could be used to predict successful completion of the graduate program based on GRE score and undergraduate grade point average.

Two variable discriminant analysis:

$$Y = a + k_1x_1 + k_2x_2$$

Y-Dependent Variable x_1 and x_2 are

Independent Variable k_1 and k_2 are coefficient

of Independent variable a is constant

2. Conjoint Analysis: Conjoint Analysis attempts to determine the relative importance consumers attach to salient attributes/features. This information is derived from consumer's evaluation of brands, or brand profiles composed of these attributes and their levels. The respondents are presented with stimuli that consist of combinations of attribute levels. They are asked to evaluate these attributes in terms of their desirability. In a situation where the company would like to know the most desirable attributes or their combination for a new product or service, the use of conjoint analysis is most appropriate.

Example:

E.g. Of Conjoint Analysis for a laptop:

RESEARCH METHODOLOGY

Weight (3kg or 5 kg), Battery life (2 hrs or 4 hrs), Brand name (Lenovo or Dell)

Rank order the combination of the characteristics, i.e. 3kg, 2hrs,

Lenovo 5kg, 4 hrs, Dell

Every customer making choices between products and services is faced with trade-offs. Is high quality more important than a low price and quick delivery for instance? Or is good service more important than design and looks? Or, are improvements in efficacy outweighed by adverse effects for health care products for instance.

B. Interdependence techniques, the variables are not classified as dependent or independent, rather the whole set of interdependent relationships is examined.

1. Factor Analysis:

- ✦ Factor Analysis is a general name denoting a class of procedures primarily used for data reduction and summarization.
- ✦ In marketing research, there may be a large number of variables, most of which are correlated and which must be reduced to a manageable level.
- ✦ Relationships among sets of many interrelated variables are examined and represented in terms of a few underlying factors.

Example of Factor Analysis:

Respondents in a survey were asked to rate the importance of 15 bank attributes. A five point scale ranging from not important to very important was employed. These data were analyzed via principal component analysis.

A four factor solution resulted, with the factors being labeled as traditional services, convenience, visibility and competence. Traditional services included interest rates on loans, easy to read monthly statements and obtainability of loans. Convenience was comprised of convenient branch location, convenient ATM locations, speed of service, and convenient banking hours. The visibility factor included recommendations from friends and relatives and attractiveness of the physical structure. Competence consisted of employee competence and availability of extra services.

Factor analysis is used in the following circumstances:

- To identify underlying dimensions or factors that explains the correlations among a set of variables.
- To identify a new, smaller set of uncorrelated variables to replace the original set of correlated variables.
- To identify a smaller set of salient variables from a larger set for use in subsequent multivariate analysis.

2. Cluster Analysis:

Cluster Analysis is a techniques used to group objects with similar characteristics or homogeneous groups called clusters. Objects in each cluster tend to be similar to each other and dissimilar to objects in the other clusters.

Cluster Analysis is used:

- To classify persons or objects into small number of clusters or group.

RESEARCH METHODOLOGY

- To identify specific customer segment for the company's brand.

Applications of Cluster Analysis:

- Segmenting the market: For eg. Consumers may be clustered on the basis of benefits sought from the purchase of a product.
- Understanding buyer behaviors
- Identifying new product opportunities – By clustering brands and products, competitive sets within the markets can be determined. A firm can examine its current offerings compared to those of its competitors to identify potential new product opportunities.
- Selecting test markets
- Reducing data- Data reduction tool to develop clusters or subgroups of data.

Example of Cluster Analysis:

In a study examining decision making pattern among international vacationers, 200 respondents were clustered into six clusters. Namely respondents preferring vacations for psychological purpose, educational purpose, social, relaxational, physiological and aesthetic purpose. The behavior of vacationers was studied and appropriate promotional strategies were designed for each of the clusters.

Steps of Cluster Analysis:

- ⑥ Selection of the sample to be clustered(buyers, products, employees).
- ⑥ Definition on which the measurement to be made (Eg. Product attributes, buyer characteristics, employees' qualification) □ Computing the similarities among the entities.
- ⑥ Arrange the cluster in a hierarchy.
- ⑥ Cluster comparison and validation.