RESEARCH METHODOLOGY

UNIT I

Introduction

Research comprises defining and redefining problems, formulating hypotheses or suggested solutions; collecting, organizing, and evaluating data, making deductions and reaching conclusions, and carefully testing the conclusions to determine whether they fit the formulating hypothesis. The manipulation of things, concepts, or symbols to generalize to extend, correct, or verify knowledge, whether that knowledge aids in the construction of theory or the practice of an art.

Research in simple terms refers to the search for knowledge. It is a scientific and systematic search for information on a particular topic or issue. It is also known as the art of scientific investigation. Several social scientists have defined research in different ways.

In the Encyclopedia of Social Sciences, D. Slesinger and M. Stephenson (1930) defined research as "the manipulation of things, concepts or symbols to generalize to extend, correct or verify knowledge, whether that knowledge aids in the construction of theory or the practice of an art".

According to Redman and Mory (1923), research is a "systematized effort to gain new knowledge". It is an academic activity and therefore the term should be used in a technical sense. According to Clifford Woody (Kothari, 1988), the research comprises "defining and redefining problems, formulating hypotheses or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and finally, carefully testing the conclusions to determine whether they fit the formulated hypotheses".

Thus, research is an original addition to the available knowledge, which contributes to its further advancement. It is an attempt to pursue truth through the methods of study, observation, comparison, and experiment. In sum, research is the search for knowledge, using objective and systematic methods to find a solution to a problem.

What is the definition of research methodology?

The process is used to collect information and data to make business decisions. The methodology may include publication research, interviews, surveys, and other research techniques, and could include both present and historical information.

Objective of Research

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of the research is to find out the truth which is hidden and which has not been discovered as yet. Since each research study has its specific purpose, we may think of research objectives as falling into several following broad groupings.

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed exploratory or formative research studies);

2. To portray accurately the characteristics of a particular individual, situation, or group (studies with this object in view are known as descriptive research studies);

3To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies);

4. To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis-testing research studies).

Motivation in Research:

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

1. Desire to get a research degree along with its consequential benefits;

2. Desire to face the challenge in solving unsolved problems, i.e., concern over practical problems initiates research;

3. Desire to get the intellectual joy of doing some creative work;

4. Desire to be of service to society;

5. Desire to get respectability.

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

Role of Research in Business

Making the right decision is an ideal practice in any business whenever the organization encounters a problem. A good organization primarily conducts research to resolve the critical problems surrounding their business such as competition, customer satisfaction, product innovation, customer complaints, and new government policies affecting the industry.

The decision-making process requires systematic and organized efforts to investigate a specific problem in a business setting. The first step in understanding the problem is to identify specifically the main issue that requires further investigation. The next steps are to identify factors associated with the problem, gather the relevant information, analyze data, interpret the output, and provide a recommendation to the manager for his decision-making. It simply means that the decision-making process comprises a series of steps designed and executed to get the best solution to the underlying problem faced by the organization.

Quantitative Business Research

It is a method of analyzing the largest group that meets your target goals. It uses mathematical techniques and data to explain the important stats about your business and market. Usually, this data uses multiple-choice questionnaires that can help you be profitable with your sales.

For instance, quantitative research can answer questions such as;

- Are your customers aware of the services or products you offer?
- How many people are interested in buying your products or services?
- Who are your best customers and what are their buying habits?
- How long the visitor stays on your website, and what is their exit page? The result of quantitative business research is in numerical form, such as;
- 40% of customers rate the new product as “attractive”
- 70% of prospective customers use the Internet to book their hotel room
- 6 out of 10 customers will buy a new food product after trying the free in-store sample The quantitative research methods include various surveys such as postal, telephone, online, and face-to-face.

Qualitative Business Research

- This business research focuses on attitudes, intentions, and beliefs.
- Qualitative research includes questions such as “Why”? Or “How?”

This research aims to gain insights into customers’ distinct behaviors and responses to a new product. This research is beneficial for your new products and marketing initiatives to test reactions and rectify your approach. You can collect qualitative data using common methods such as case studies, focus groups, and interviews. This data is often valuable but can be time-consuming and expensive to collect, especially for a small business or a startup.)

Research Approaches:

There are two main approaches to research, namely the quantitative approach and the qualitative approach. The quantitative approach involves the collection of quantitative data, which are put to rigorous quantitative analysis formally and rigidly. This approach further includes experimental, inferential, and simulation approaches to research. Meanwhile, the qualitative approach uses the method of subjective assessment of opinions, behavior, and attitudes. Research in such a situation is a function of the researcher’s impressions and insights. The results generated by this type of research are either in non-quantitative form or in a form that cannot be put to rigorous quantitative analysis. Usually, this approach uses techniques like in-depth interviews, focus group interviews, and projective techniques.

Types of Research:

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

1. Basic Research:

- It is also known as pure or fundamental research.
- This research is mainly conducted to increase the knowledge base. It is driven purely by interest and a desire to expand our knowledge.
- This type of research tends not to be directly applicable to the real world in a direct way but enhances our understanding of the world around us.
- Pure research can be exploratory, descriptive, or explanatory.
- Basic research generates new ideas, principles, and theories in different fields.
- Basic research concentrates on fundamental principles and testing theories.
- It is sometimes implicitly said that basic research doesn't have practical applications. For example, someone conducting basic research on cheating behavior may design a study examining whether students from illiterate families cheat more often than students from literate families.
- Notice that the research is not done to reduce cheating or help people who cheat or any other "applied" aspect, but to increase the understanding of cheating behavior.

2. Applied Research:

- Applied research is mainly related to solving practical problems rather than focusing on knowledge expansion.
- It is mainly used to find solutions to problems that occur daily and develop new innovative technologies.
- The main aim of applied research is to provide better technologies for humans to enhance their standard of living.
- Example: Investigating which treatment approach is the most effective for treating cancer patients whereas researching which strategies work best to motivate workers.

3. Quantitative Research:

- Quantitative research is generally related to the positivist concept.
- It usually involves collecting and converting data into numerical form so that statistical calculations can be made and conclusions are drawn.
- Objectivity is very vital in quantitative research
- Therefore, researchers try to avoid their presence, behavior, or attitude affecting the results (e.g., by changing the circumstances being studied or causing participants to behave differently).
- They also examine their methods and results for any possible bias.

- Quantitative research aims to develop mathematical models, and theories related to phenomena. Quantitative research is mainly used in social sciences.

4. Qualitative Research:

- Qualitative research is the approach usually related to the social constructivist concept which emphasizes the socially constructed nature of reality.
- It is about recording, analyzing, and attempting to reveal the in debt meaning and significance of human behavior and experience, including conflicting beliefs, behaviors, and emotions.
- The qualitative method tries to answer the why and how of decision-making rather than what and when.
- The approach to data collection and analysis is logical but allows for greater flexibility than in quantitative research.
- Data is collected in textual form based on observation and communication with the participants, e.g. through participant observation, in-depth interviews, and focus groups.
- It is not converted into numerical form and is not statistically analyzed.

5. Descriptive Research:

- Descriptive research is used to describe the characteristics of an observable fact being studied.
- Descriptive studies are structured in such a way that they cannot be changed frequently, so it can be said that they are rigid in nature.
- They cannot identify the cause-and-effect relationship between variables.
- Descriptive research answers questions such as who, when, where, what, and how.
- This type of research describes what exists and may help to reveal new facts and meaning.
- The purpose of descriptive research is to observe, describe, and document.

6. Exploratory Research:

- Exploratory research is carried out for a problem that has not been clearly defined.
- The main aim of this research is to gather initial information which helps to define problems and recommend a hypothesis.
- Exploratory research helps to settle on the best research design, data collection method, and selection of subjects.
- Exploratory research often relies on secondary research such as reviewing available literature, qualitative approaches such as informal discussions with consumers, employees, management, or competitors, and more formal approaches through in-depth interviews, focus groups, projective methods, case studies, or pilot studies.
- Exploratory research can mainly be conducted when researchers lack a clear idea of the problem.

- The results of exploratory research are not generally useful for decision-making, but they can provide major insight into a given situation.

7. Historical Research:

- It is defined as the type of research that examines past events or combinations of events to arrive at an account of what has happened in the past.
- Historical research is carried out to discover the unknown; answer questions, recognize the relationship that the past has to the present; record and assess activities of individuals, agencies, or institutions; and assist in understanding the culture in which we live.
- Historical research can exhibit patterns that occurred in the past and over time which can facilitate us to see where we came from and what kinds of solutions we have used in the past.
- We usually will notice that what we do today is expressly rooted in the past. Historical research involves the process of collecting and reading the research material collected and writing the document from the data collected.

8. Experimental Research:

- It is commonly used in sciences such as sociology and psychology, physics, chemistry, biology, medicine, etc.
- It is a collection of research designs that use manipulation and controlled testing to understand fundamental processes.
- Usually, one or more variables are manipulated to establish their effect on a dependent variable.
- Experimental Research is mainly used when: there is time priority in a causal relationship (cause precedes effect) or there is uniformity in a causal relationship (a cause will always lead to the same effect) or the magnitude of the correlation is great.
- Experimental research is important to society as it helps us to improve our daily lives.

Importance Of Knowing How To Conduct Research:

The importance of knowing how to conduct research is listed below:

i. The knowledge of research methodology provides training to new researchers and enables them to do research properly. It helps them to develop disciplined thinking or a 'bent of mind to objectively observe the field;

ii. The knowledge of doing research inculcates the ability to evaluate and utilize the research findings with confidence;

iii. The knowledge of research methodology equips the researcher with the tools that help him/her to make the observations objectively; and

iv. The knowledge of methodology helps the research consumers to evaluate research and make rational decisions.

Criteria of Good Research:

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

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

In other words, we can state the qualities of good research a good researcher.

The nature of a researcher must be of the temperament that vibrates in unison with the theme that he is searching for. Hence, the seeker of knowledge must be truthful with the truthfulness of nature, which is much more important, much more exacting than what is sometimes known as truthfulness. Truthfulness relates to the desire for accuracy of observation and precision of statement. Ensuring facts is the principal rule of science, which is not an easy matter. The difficulty may arise due to the untrained eye, which fails to see anything beyond what it has the power of seeing and sometimes even less than that. This may also be due to the lack of discipline in the method of science. An unscientific individual often remains satisfied with the expressions like approximately, almost, or nearly, which is never what nature is. Real research cannot see two things that differ, however minutely, as the same.

A researcher must possess an alert mind. Nature is constantly changing and revealing itself in various ways. A scientific researcher must be keen and watchful to notice such changes, no matter how small or insignificant they may appear. Such receptivity has to be cultivated slowly and patiently over time by the researcher through practice. An individual who is ignorant or not alert and receptive during his research will not make a good researcher.

Scientific inquiry is pre-eminently an intellectual effort. It requires the moral quality of courage, which reflects the courage of steadfast endurance. The process of conducting research is not an easy task. There are occasions when a research scientist might feel defeated or completely lost. This is the stage when a researcher would need immense courage and a sense of conviction.

Research Process:

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

Step 1: Identify the Problem

Finding an issue or formulating a research question is the first step. A well-defined research problem will guide the researcher through all stages of the research process, from setting objectives to choosing a technique. There are several approaches to getting insight into a topic and gaining a better understanding of it. Such as:

- A preliminary survey
- Case studies
- Interviews with a small group of people
- Observational survey

Step 2: Evaluate the Literature

A thorough examination of the relevant studies is essential to the research process. It enables the researcher to identify the precise aspects of the problem. Once a problem has been found, the investigator or researcher needs to find out more about it.

This stage gives problem-zone background. It teaches the investigator about previous research, how they were conducted, and its conclusions. The researcher can build consistency between his work and others through a literature review. Such a review exposes the researcher to a more significant body of knowledge and helps him follow the research process efficiently.

Step 3: Create Hypotheses

Formulating an original hypothesis is the next logical step after narrowing down the research topic and defining it. A belief solves logical relationships between variables. To establish a hypothesis, a researcher must have a certain amount of expertise in the field.

Researchers need to keep in mind while formulating a hypothesis that it must be based on the research topic. Researchers can concentrate their efforts and stay committed to their objectives when they develop theories to guide their work.

Step 4: The Research Design

Research design is the plan for achieving objectives and answering research questions. It outlines how to get the relevant information. Its goal is to design research to test hypotheses, address the research questions, and provide decision-making insights.

The research design aims to minimize the time, money, and effort required to acquire meaningful evidence. This plan fits into four categories:

- Exploration and Surveys
- Experiment
- Data Analysis
- Observation

Step 5: Describe the Population

Research projects usually look at a specific group of people, facilities, or how technology is used in the business. In research, the term population refers to this study group. The research topic and purpose help determine the study group.

Suppose a researcher wishes to investigate a certain group of people in the community. In that case, the research could target a specific age group, males or females, a geographic location, or an ethnic group. A final step in a study's design is to specify its sample or population so that the results may be generalized.

Step 6: Data Collection

Data collection is important in obtaining the knowledge or information required to answer the research issue. Every research collected data, either from the literature or the people being studied. Data must be collected from the two categories of researchers.

These sources may provide primary data.

- Experiment
- Questionnaire
- Observation
- Interview

Secondary data categories are:

- Literature survey
- Official, and unofficial reports
- An approach based on library resources

Step 7: Data Analysis

During research design, the researcher plans data analysis. After collecting data, the researcher analyzes it. The data is examined based on the approach in this step. The research findings are reviewed and reported.

Data analysis involves several closely related stages, such as setting up categories, applying these categories to raw data through coding and tabulation, and then drawing statistical conclusions. The researcher can examine the acquired data using a variety of statistical methods.

Step 8: After completing these steps, the researcher must prepare a report detailing his findings. The report must be carefully composed with the following in mind:

The Layout: On the first page, the title, date, acknowledgments, and preface should be on the report. A table of contents should be followed by a list of tables, graphs, and charts if any.

Introduction: It should state the research's purpose and methods. This section should include the study's scope and limits.

Summary of Findings: A non-technical summary of findings and recommendations will follow the introduction. The findings should be summarized if they're lengthy.

Principal Report: The main body of the report should make sense and be broken up into sections that are easy to understand.

Conclusion: The researcher should restate his findings at the end of the main text. It's the final result. Conclusion The research process involves several steps that make it easy to complete the research successfully. The steps in the research process described above depend on each other, and the order must be kept. So, if we want to do a research project, we should follow the research process steps.

Research Problem:

The first and foremost stage in the research process is to select and properly define the research problem. A researcher should first identify a problem and formulate it, to make it amenable or susceptible to research. In general, a research problem refers to an unanswered question that a researcher might encounter in the context of either a theoretical or practical situation, which he/she would like to answer or find a solution to.

The components of a research problem may be summarized as

i. There should be an individual or a group who has some difficulty or problem.
ii. There should be some objective(s) to be pursued. A person or an organization who wants nothing cannot have a problem.

iii. There should be alternative ways of pursuing the objective the researcher wants to pursue. This implies that there should be more than one alternative means available to the researcher. This is because if the researcher has no choice of alternative means, he/she would not have a problem.

iv. There should be some doubt in the mind of the researcher about the choice of alternative means. This implies that research should answer the question relating to the relative efficiency or suitability of the possible alternatives.

v. There should be a context to which the difficulty relates.

Thus, the identification of a research problem is the pre-condition to conducting research. A research problem is said to require a researcher to find the best available solution to the given problem. That is, the researcher needs to find out the best course of action through which the research objective may be achieved optimally in the context of a given situation. Several factors may contribute to making the problem complicated. For example, the environment may alter, thus affecting the efficiencies of the alternative courses of action taken or the quality of the outcomes. The number of alternative courses of action might be very large and the individual not involved in making the decision may be affected by the change in environment and may react to it favorably or unfavorably. Other similar factors are also likely to cause such changes in the context of research, all of which may be considered from the point of view of a research problem.

What is a hypothesis?

A hypothesis states your predictions about what your research will find. It is a tentative answer to your research question that has not yet been tested. For some research projects, you might have to write several hypotheses that address different aspects of your research question.

A hypothesis is not just a guess – it should be based on existing theories and knowledge. It also has to be testable, which means you can support or refute it through scientific research methods (such as experiments, observations, and statistical analysis of data).

Variables in hypotheses

Hypotheses propose a relationship between two or more types of variables.

- An independent variable is something the researcher changes or controls.
- A dependent variable is something the researcher observes and measures.

Developing a hypothesis

Step 1. Ask a question

Writing a hypothesis begins with a research question that you want to answer. The question should be focused, specific, and researchable within the constraints of your project.

Step 2. Do some preliminary research

At this stage, you might construct a conceptual framework to ensure that you're embarking on a relevant topic. This can also help you identify which variables you will study and what you think the relationships are between them. Sometimes, you'll have to operationalize more complex constructs

Step 3. Formulate your hypothesis

Now you should have some idea of what you expect to find. Write your initial answer to the question in a clear, concise sentence.

4. Refine your hypothesis

You need to make sure your hypothesis is specific and testable. There are various ways of phrasing a hypothesis, but all the terms you use should have clear definitions, and the hypothesis should contain:

- The relevant variables
- The specific group being studied
- The predicted outcome of the experiment or analysis

5. Phrase your hypothesis in three ways

To identify the variables, you can write a simple prediction in the, if…then form.

The first part states the independent variable and the second part states the dependent variable hypotheses are more commonly phrased in terms of correlations or effects, where you directly state the predicted relationship between variables. The third part is comparing two groups, the hypothesis can state what difference you expect to find between them.

6. Write a null hypothesis

If your research involves statistical hypothesis testing, you will also have to write a null hypothesis. The null hypothesis is the default position that there is no association between the variables. The null hypothesis is written as H0, while the alternative hypothesis is H1 or Ha.

H_0: no effect

H_1: a positive effect

Example

Step 1 Ask a question

Do students who attend more lectures get better exam results?

Step 2 Do some preliminary research

Your initial answer to the question should be based on what is already known about the topic. Look for theories and previous studies to help you form educated assumptions about what your research will find.

Step 3 Formulate your hypothesis

Attending more lectures leads to better exam results.

Step 4 Refine your hypothesis

You need to make sure your hypothesis is specific and testable.

Step 5 Phrase your hypothesis in three ways

If first-year student starts attending more lectures, then their exam scores will improve.

The number of lectures attended by first-year students has a positive effect on their exam scores.

First-year students who attended most lectures will have better exam scores than those who attended few lectures.

Step 6 Write a null hypothesis

H_0: The number of lectures attended by first-year students does not affect their final exam scores.

H_1: The number of lectures attended by first-year students has a positive effect on their final exam scores.

What is a feasibility study?

A feasibility study aims to make a recommendation as to the likely success of a venture. At the heart of any feasibility study is a hypothesis or question that you want to answer.

How to conduct a feasibility study?

Once you've got a clear hypothesis or question that you want to answer, you need to look at five areas that will impact the feasibility of your idea. Let's look at each of these in turn:

- **Market Feasibility**

Is the market in question attractive? Are there high barriers to entry? Is it of a size that will support our ambitions? Is it growing? Are there any regulatory or legislative requirements to enter or participate in the market?

- **Technical Feasibility**

What technical skills/ability/knowledge/equipment is required? Do you have or could you source the technical expertise required? Do you fully understand the technical requirements underpinning your hypothesis? Could you manufacture/develop the product or service with the resources you have available?

- **Business Model Feasibility**

How will the idea make money? How will you attract users? What costs will you have to pay? Have you modeled the financials? Do you have access to the funding needed? What legal entity structure would you need?

- **Management Model Feasibility**

Who will lead the venture? Do you have the skills and expertise required to manage and operate the venture/product/market? Does the team have the time needed to deliver the venture? If not, can they be recruited or are their skills hard to find?

- **Exit Feasibility**

Do you have the plan to exit the venture and do you need one?

When completing a feasibility study each of the above areas should have a recommendation as to whether it's feasible or not from that specific perspective factoring in the resources you have available. This should conclude with a recommendation based on the analysis as to if the venture is or isn't feasible and the key data points that underpin that recommendation.

Remember that a great feasibility study should not just give you a go / no-go decision. It should provide either a springboard to move forward, highlighting the key areas to focus on to achieve success, or a useful analysis highlighting the key obstacles that make the venture unfeasible and should be considered for any future ideas. Even if the answer is no, it's not a wasted effort, the analysis will leave you better informed for future decisions.

Definition of research proposal

A research proposal is a document written by a researcher that provides a detailed description of the proposed program. It is like an outline of the entire research process that gives a reader a summary of the information discussed in a project.

Importance of research proposal

- Helps examine what the researcher intends to do.
- A research proposal can serve as a document of contract for the project.
- Research proposals can be effective starting places to discuss projects with your professors, too.
- The research proposal is able to give an overview of the research project so that other people understand the scope of the research, the significance of the research, as well as your proposed methodology and chosen research method.

Format of Research Proposal

- **Beginning Part**

TITLE PAGE	Title of the project, Subtitle (where appropriate), Date, Author, Organization, Logo
ACKNOWLEDGEMENT	The author thanks people and an organization that helped during the project
SUMMARY (sometimes called an abstract of the synopsis)	A condensed version of a report – outlines salient points, emphasizes main conclusions, and (where appropriate) the main recommendations. This is often difficult to write and it is suggested that you write it last.
LIST OF CONTENTS	An at–a–glance list that tells the reader what is in the report and what page number(s) to find it on
LIST OF TABLES	As above, specifically for tables
LIST OF APPENDICES	As above, specifically for appendices.
INTRODUCTION	The author sets the scene and states his/ her intentions
AIMS AND OBJECTIVES	AIMS – general aims of the audit/ project, broad statement of intent. OBJECTIVES – specific things expected to do/ deliver (e.g. expected outcomes)

- **Middle Part**

METHOD	Work steps; what was done – how, by whom, when?
RESULT/FINDINGS	An honest presentation of the findings, whether these were as expected or not. Give the facts, including any inconsistencies or difficulties Encountered

- **End Part**

What do I put in the end part?	Explanation of the results. (you might like to keep the SWOT analysis in mind and think about your project's strengths, weaknesses, opportunities and threats, as you write)
CONCLUSIONS	The author links the results/ findings with the points made in the introduction and strives to reach clear, simply stated, and unbiased conclusions. Make sure they are fully supported by evidence and arguments of the main body of your audit/project.
REFERENCES	A section of a report, which provides full details of publications mentioned in the text, or from which extracts have been quoted.

Distinguishing Between Research Method and Research Methodology

Research Method	**Research Methodology**
The techniques and procedures used in solving research problems	The study of research methods in other to logically justify why any particular method should be preferred to others
The major aim is to solve the research problem	The major aim is to ensure that appropriate methods are used to solve research problems
Is a component of research methodology and hence narrower in scope	Encompasses both research methods and the logic behind their adoption and hence broader in scope
Involves the use of quantitative and qualitative research methods and utilizing the knowledge and skills learned through research methodology.	Involves the learning of various techniques to conduct research and acquiring methodical knowledge to perform quantitative, qualitative, and mixed research.

UNIT 2

RESEARCH DESIGN

Meaning of Research Design

The research problem is the preparation of a design for the research project, popularly known as Research Design. A research design is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure.

Research design is a blueprint of a scientific study. It includes research methodologies, tools, and techniques to conduct the research. It helps to identify and address the problem that may arise during the process of research and analysis.

What are the characteristics of Research Design?

- Validity

There are many ways to measure the results of research. A good research design helps select the right measuring tools to gauge results according to the research objective.

- Generalized

A good research design draws an outcome that can be applied to a large set of people and is not limited to sample size or the research group.

- Neutrality

At the start of every research, a researcher needs to make some assumptions that will be tested during the research. A proper research design ensures that the assumptions are free of bias and neutral. It also provides that the data collected throughout the research is based on the assumptions made at the beginning of the research.

Elements of a good research design:

- Purpose statement
- Data collection methods
- Techniques of data analysis
- Types of research methodologies
- Challenges of the research
- Prerequisites required for study
- Duration of the research study
- Measurement of analysis

Important concepts of research design

- **Variable**

The variable is a concept that can take on various quantitative values. For instance, weight, height, etc.

- **Dependent Variable**

A dependent variable is a variable that is tested in an experiment. It is dependent, in some way on the variation of an independent variable.

- **Independent Variable**

An independent variable in an experiment is considered to stand on its own. For instance, if the test scores of a class are an outcome of their efforts; efforts are an independent variable, and the score is a dependent variable.

- **Hypothesis**

It is defined as the hypothesis that needs to be tested in an experiment.

What Are the Different Types of Research Design?

Quantitative research design

Quantitative research design aims at finding answers to who, what, where, how, and when through the course of research. Moreover, the outcome of the quantitative analysis is easy to represent in the form of statistics, graphs, charts, and numbers.

Qualitative research design

Qualitative research design focuses on finding answers to how and why. It uses open-ended questions and helps the subjects express their views clearly. Qualitative research is ideal for businesses that aim to understand customers' behavior and requirements.

Experimental design

This type of research design looks at a problem scientifically by establishing a clear cause and effect of every event. It also tries to understand the impact of the independent variable on the dependable variable. Often social sciences use it to observe human behaviors and understand the social psychology of the human being better.

Descriptive design

Descriptive design is a theory-based research method describing the research's primary subject matter. This type of research design uses data collection techniques like natural observation, case studies, and surveys to derive results. This type of research design provides insight into the why and how of research.

Diagnostic design

In diagnostic research, the design strives to explore the reason behind an issue and find solutions to solve it. This type of research design tries to solve the problems in a structured form divided into three phases- the issue's inception, diagnosis of the issue, and solution for the issue.

The Sources and Collection of Data

'Data' is unorganized statistical facts and figures collected for specific purposes, such as analysis. Sources of Data

There are two main types of data: PRIMARY AND SECONDARY.

Primary data

As the name suggests, is first-hand information collected by the surveyor. The data so collected are pure and original and collected for a specific purpose. They have never undergone any statistical treatment before. The collected data may be published as well. The Census is an example of primary data.

Methods of primary data collection:

- **Interviews:** Interviews are conducted either face-to-face or using telephonic conversations between two individuals to gather the relevant information for the research.
- **Questionnaires:** The questionnaire tool is used to collect primary data by gathering the required information from the individuals by asking those questions and giving them suitable prompts to conduct the study.
- **Surveys:** Surveys are conducted time-to-time by government agencies or businesses to gather relevant information from the general public. They are typically collected from a sample population, and later to be generalized for the whole population.
- **Observation:** Researchers often observe the direct information required for the study.

Secondary data

Secondary data are opposite to primary data. They are collected and published already (by some organizations, for instance). They can be used as a source of data and used by surveyors to collect data from and conduct the analysis. Secondary data are impure in the sense that they have undergone statistical treatment at least once.

Methods of secondary data collection:

- The published data of central, state, local governments, foreign governments, or international bodies and their subsidiary journals.
- Technical and trade journals
- Books, magazines, and newspapers
- Reports and publications of various associations connected with business and industry, books, stock exchange
- Reports proposals by research scholars, universities, economists, etc in different fields.
- Public research and statistics
- Historical documents
- Other sources of published information

Sampling Design or Sampling Techniques

The subset of units that are selected is called a sample. The sample design encompasses all aspects of how to group units on the frame, determine the sample size, allocate the sample to the various classifications of frame units, and finally, select the sample.

Keep in mind the following points when developing your survey design:

- Define the universe of your study: This is the set of objects you are studying. This could be the population of a city, the number of workers in a warehouse, or fans of a particular television show.
- Consider your sampling unit: Will it be geographical, social, or individual?
- Gather your sampling frame: This is the list of names from which your sample will be drawn.
- Determine sample size: Use the equation above or our helpful sample size calculator.
- Factor in budgetary limitations: This will impact both the size and type of sample and may even lead you to use a non-probability sample.

Types of Sampling Techniques

- **Non Probability sampling**
- **Probability sampling**

Probability sampling

Probability sampling ensures that every member of your sample has an equal probability of being selected for your research.

There are four main types of probability sampling:

- Simple Random
- Cluster
- Systematic
- Stratified

Simple random sampling

As the name suggests, simple random sampling is both simple and random. With this method, you may choose your sample with a random number generator or by drawing from a hat, for example, to provide you with a completely random subset of your group. This allows you to draw generalized conclusions about the whole population based on the data provided from the subset (sample).

Cluster sampling

In cluster sampling, your population is divided into subgroups that have similar characteristics to the whole population. Instead of selecting individuals, you randomly select an entire subgroup for your sample.

There is a higher probability of error with this method because there could be differences between the clusters. You cannot guarantee that the sample you use is truly representative of the entire population you're studying.

Systematic sampling

Similar to simple random sampling, systematic sampling is even easier to conduct. In this method, each individual in the desired population is assigned a number. Instead of randomly generating numbers, participants are chosen at regular intervals. There must be no hidden pattern in the list that may skew the sample.

Stratified sampling

In stratified random sampling, you divide a population into smaller subgroups called strata. The strata are based on the shared attributes of the individuals, such as income, age range, or education level. This method is used when you believe that these similarities indicate additional similarities that will resonate with your broader population.

Non-probability sampling

In non-probability samples, the criteria for selection are not random, and the chances of being included in the sample are not equal. While it's easier and less expensive to perform non-probability sampling, there is a higher risk of sampling bias, and inferences about the full population are weaker.

There are five main types of non-probability sampling:

- Convenience
- Judgmental
- Voluntary
- Snowball
- Quota

Convenience sampling

In convenience sampling, the sample consists of individuals who are most accessible to the researcher. It may be easy to collect initial information, but it cannot be generalized to your target population.

Judgmental or purposive sampling

In this type of non-probability sampling, the researcher uses their expertise to choose a sample that they believe will be most useful in reaching their research objectives. Judgmental sampling is frequently used in qualitative research, where statistical inferences are unnecessary, or the population is quite small. To be effective, the sample must have clear inclusion and exclusion criteria.

Voluntary response sampling

Based on ease of access like convenience sampling, voluntary response sampling is when people volunteer to participate in your research. Because some people are more likely to volunteer than others, there will likely be some bias involved

Snowball sampling

The snowball sampling method is used when your population is difficult to access. You reach out to the members of the population that you can and then count on these participants to recruit others for your study. The number of participants “snowballs” as the number increases...

Quota sampling

With quota sampling, your population is divided into categories determined by the researcher. Depending on the research, you may need a particular number of males or females, or you may need your sample to represent a certain income level or age range. Bias may occur simply based on the categories chosen by the researchers.

What are the key steps in sampling design?

There are five key steps in sampling design.

Step 1: Define the target population

What population do you want to study? Determine who will provide you with the most useful information for your research and help you meet your objectives.

Step 2: Choose a sample frame

A sample frame is the group of people from which you’ll pull your sample.

Step 3: Select a sampling method

Choose a sampling method based on your research needs. Take your time and find the best method for your specific study.

Step 4: Determine the sample size

Use our sample size calculator to determine the necessary sample size for your study.

Step 5: Execute the sample

Implement your research plan according to your chosen methodology.

Sample size determination

Sample size determination is the act of choosing the number of observations or replicates to include in a statistical sample. The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample. In practice, the sample size used in a study is usually determined based on the cost, time, or convenience of collecting the data, and the need for it to offer sufficient statistical power.

Five steps to finding your sample size

- Define population size or number of people
- Designate your margin of error
- Determine your confidence level
- Predict expected variance
- Finalize your sample size

1. **Define the size of your population**

Your sample size needs will differ depending on the true population size or the total number of people you're looking to conclude on. That's why determining the minimum number of individuals required to represent your selection is an important first step.

Defining the size of your population can be easier said than done. While there is a lot of population data available, you may be targeting a complex population for which no reliable data currently exists.

Knowing the size of your population is more important when dealing with relatively small, easy-to-measure groups of people.

2. **Designate your margin of error**

Random sample errors are inevitable whenever you're using a subset of your total population. Be confident that your results are accurate by designating how much error you intend to permit: that's your margin of error.

Sometimes called a "confidence interval," a margin of error indicates how much you're willing for your sample mean to differ from your population mean. It's often expressed alongside statistics as a plus-minus (±) figure, indicating a range that you can be relatively certain about.

3. **Determine how confident you can be**

Your confidence level reveals how certain you can be that the true proportion of the total population would pick an answer within a particular range. Researchers most often employ a 95% confidence level.

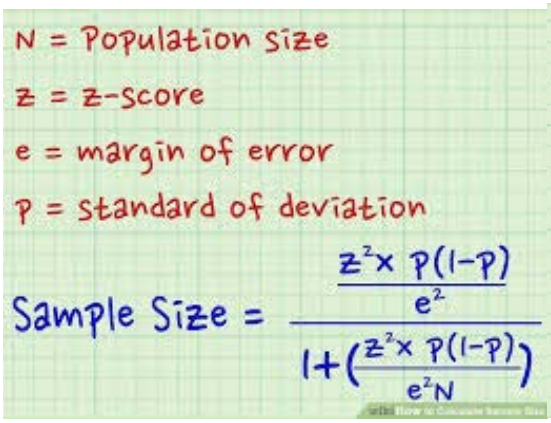
Your confidence level corresponds to something called a "z-score." A z-score is a value that indicates the placement of your raw score (meaning the percent of your confidence level) in any number of standard deviations below or above the population mean.

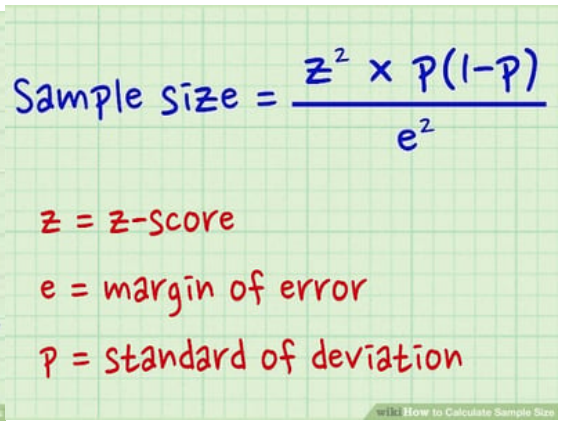
4. **Decide the variance you expect**

Standard deviation measures how much individual sample data points deviate from the average population. Use the standard deviation of 0.5 to make sure your group is large enough.

5. **Finding your ideal sample size**

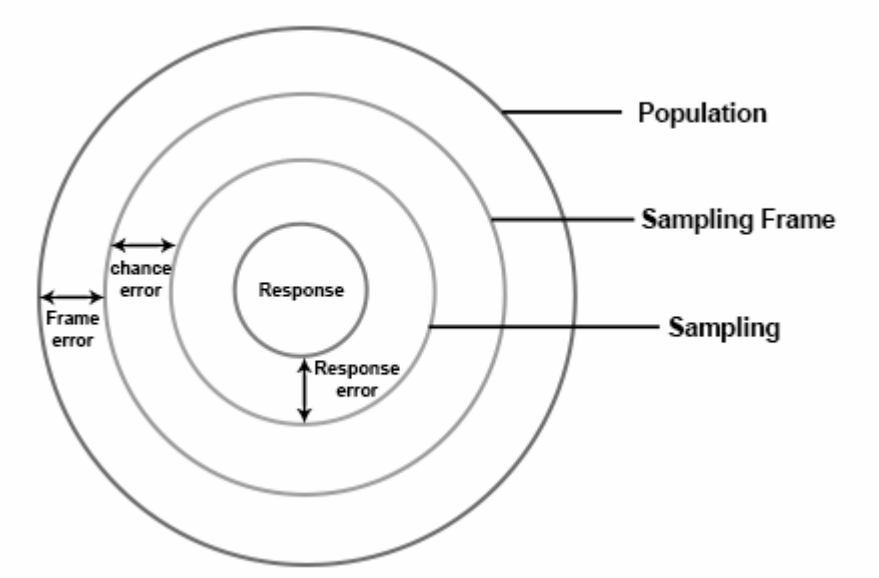
By using the formula





Sampling Error Definition

Sampling error is defined as the amount of inaccuracy in estimating some value, which occurs due to considering a small section of the population, called the sample, instead of the whole population. It is also called an error. Sample surveys take into account the study of a tiny segment of a population, so, there is always a particular amount of inaccuracy in the information obtained. This inaccuracy can be defined as error variance or sampling error.



Sampling Error = (Response Error) + (Frame Error) + (Chance Error)

Types of Sampling Error

Sampling error, which arises when only a part of the population is used to represent the whole population; and

Non-sampling errors can occur at any stage of a sample survey and can also occur with censuses. Sampling error can be measured mathematically whereas measuring non-sampling error can be difficult. Non-sampling error is all other errors in the estimate. Some examples of causes of non-sampling error are non-response, a badly designed questionnaire, respondent bias, and processing errors.

Factors of SAMPLING ERROR

- **Standard Error**

The most commonly used measure of sampling error is called the standard error (SE). The standard error is a measure of the spread of estimates around the "true value". In practice, only one estimate is available, so the standard error cannot be calculated directly. However, if the population variance is known the standard error can be derived mathematically. Even if the population variance is unknown, as happens in practice, the standard error can be estimated by using the variance of the sample units. Any estimate derived from a probability-based sample survey has a standard error associated with it (called the standard error of the estimate, written se(y) where y is the estimate of the variable of interest).

- **Variance**

The variance is another measure of sampling error, which is simply the square of the standard error.

- **Relative Standard Error**

Another way of measuring sampling error is the relative standard error (RSE) where the standard error is expressed as a percentage of the estimate. The RSE avoids the need to refer to the estimate and is useful when comparing the variability of population estimates with different means. RSE is an important measure when expressing the magnitude of standard error relative to the estimate.

- **Confidence Interval**

Assuming that the target population is distributed normally for the characteristic being measured, (or, if estimating the mean, the sample is sufficient to assume the sample mean is distributed normally) the interval which contains the true value is usually calculated as being one, two, or three standard errors above and below the survey estimate.

There is a 95% chance that the confidence interval which extends to two standard errors on either side of the estimate contains the "true value". This interval is called the 95% confidence interval and is the most commonly used confidence interval.

Confidence intervals are the 68% confidence interval (where the confidence interval extends to one standard error on either side of the estimate and has a 68% chance of containing the "true value")

The 99% confidence interval (where the confidence interval extends to three standard errors on either side of the survey estimate has a 99% chance of containing the "true value").

NON-SAMPLING ERROR

Types of NON-SAMPLING ERROR

- **Failure to Identify Target Population / Inadequate Survey Population**

The target population may not be clearly defined through the use of imprecise definitions or concepts. The survey population may not reflect the target population due to an inadequate sampling frame and poor coverage rules. Problems with the frame include missing units, deaths, out-of-scope units, and duplicates

- **Non-Response Bias**

Non-respondents may differ from respondents to the attributes/variables being measured. To improve response rates, care should be taken in designing the questionnaires, training interviewers, assuring the respondent of confidentiality, motivating him/her to cooperate, and calling back at different times if having difficulties contacting the respondent. "Call-backs" are successful in reducing non-response but can be expensive for personal interviews. Non-response is covered in more detail in Non-Response.

- **Questionnaire problems**

The content and wording of the questionnaire may be misleading and the layout of the questionnaire may make it difficult to accurately record responses. Questions should not be loaded, double-barreled, misleading, or ambiguous, and should be directly relevant to the objectives of the survey.

Questionnaires must be tested on a sample of respondents before they are finalized to identify questionnaire flow and question-wording problems and allow sufficient time for improvements to be made to the questionnaire.

- **Respondent Bias**

Refusals to answer questions, memory biases, and inaccurate information because respondents believe they are protecting their interests and integrity may lead to a bias in the estimates. The way the respondent interprets the questionnaire and the wording of the answer the respondent gives can also cause inaccuracies. When designing the survey you should remember that uppermost in the respondent's mind will be protecting their own personal privacy, integrity, and interests.

- **Processing Errors**

There are four stages in the processing of the data where errors may occur: data grooming, data capture, editing, and estimation. Data grooming involves preliminary checking before entering the data into the processing system in the capture stage.

Data grooming involves preliminary checking before entering the data into the processing system in the capture stage. Inadequate checking and quality management at this stage can introduce data loss (where data is not entered into the system) and data duplication (where the same data is entered into the system more than once).

- **Misinterpretation of Results**

This can occur if the researcher is not aware of certain factors that influence the characteristics under investigation. A researcher or any other user not involved in the collection stage of the data gathering may be unaware of trends built into the data due to the nature of the collection, such as its scope.

- **Time Period Bias**

This occurs when a survey is conducted during an unrepresentative period.

Data are various kinds of information formatted in a particular way. Therefore, data collection is the process of gathering, measuring, and analyzing accurate data from a variety of relevant sources to find answers to research problems, answer questions, evaluate outcomes, and forecast trends and probabilities. Accurate data collection is necessary to make informed business decisions, ensure quality assurance, and keep research integrity.

Sources of Data Collection

Meaning of Data Collection

Data are various kinds of information formatted in a particular way. Therefore, data collection is the process of gathering, measuring, and analyzing accurate data from a variety of relevant sources to find answers to research problems, answer questions, evaluate outcomes, and forecast trends and probabilities. Accurate data collection is necessary to make informed business decisions, ensure quality assurance, and keep research integrity.

Data collection breaks down into two methods.

- **Primary**

As the name implies, this is original, first-hand data collected by the data researchers. This process is the initial information-gathering step, performed before anyone carries out any further or related research. Primary data results are highly accurate provided the researcher collects the information. However, there’s a downside, as first-hand research is potentially time-consuming and expensive.

- **Secondary**

Secondary data is second-hand data collected by other parties and already having undergone statistical analysis. This data is either information that the researcher has tasked other people to collect or information the researcher has looked up. Simply put, it’s second-hand information.

Although it’s easier and cheaper to obtain than primary information, secondary information raises concerns regarding accuracy and authenticity. Quantitative data makes up the majority of secondary data.

Data Collection Techniques

- **Primary Data Collection**

Interviews

The researcher asks questions of a large sampling of people, either by direct interviews or means of mass communication such as by phone or mail. This method is by far the most common means of data gathering.

Projective Data Gathering

Projective data gathering is an indirect interview, used when potential respondents know why they're being asked questions and hesitate to answer. For instance, someone may be reluctant to answer questions about their phone service if a cell phone carrier representative poses the questions. With projective data gathering, the interviewees get an incomplete question, and they must fill in the rest, using their opinions, feelings, and attitudes.

Delphi Technique

The Oracle at Delphi, according to Greek mythology, was the high priestess of Apollo’s temple, who gave advice, prophecies, and counsel. In the realm of data collection, researchers use the Delphi technique by gathering information from a panel of experts. Each expert answers questions in their field of specialty, and the replies are consolidated into a single opinion.

Focus Groups

Focus groups, like interviews, are a commonly used technique. The group consists of anywhere from a half-dozen to a dozen people, led by a moderator, brought together to discuss the issue.

Questionnaires

Questionnaires are a simple, straightforward data collection method. Respondents get a series of questions, either open or close-ended, related to the matter at hand.

- **Secondary Data Collection Techniques**

Unlike primary data collection, there are no specific collection methods. Instead, since the information has already been collected, the researcher consults various data sources, such as:

Financial Statements

Sales Reports

Retailer/Distributor/Deal Feedback

Customer Personal Information (e.g., name, address, age, contact info)

Business Journals

Government Records (e.g., census, tax records, Social Security info)

Trade/Business Magazines

The Internet

Data Collection Tools

- **Word Association**

The researcher gives the respondent a set of words and asks them what comes to mind when they hear each word.

- **Sentence Completion**

Researchers use sentence completion to understand what kind of ideas the respondent has. This tool involves giving an incomplete sentence and seeing how the interviewee finishes it.

- **Role-Playing**

Respondents are presented with an imaginary situation and asked how they would act or react if it was real.

- **In-Person Surveys**

The researcher asks questions in person.

- **Online/Web Surveys**

These surveys are easy to accomplish, but some users may be unwilling to answer truthfully, if at all.

- **Mobile Surveys**

These surveys take advantage of the increasing proliferation of mobile technology. Mobile collection surveys rely on mobile devices like tablets or smartphones to conduct surveys via SMS or mobile apps.

- **Phone Surveys**

No researcher can call thousands of people at once, so they need a third party to handle the chore. However, many people have call screening and won't answer.

- **Observation**

Sometimes, the simplest method is the best. Researchers who make direct observations collect data quickly and easily, with little intrusion or third-party bias. Naturally, it's only effective in small-scale situations.

UNIT 3
Attitudes, Behaviors, and Rating Scale

3.1 Meaning of Attitude:

Researchers are interested in people's attitudes. An attitude is a psychological construct. It is a person's predisposition to respond favorably or unfavorably to activities, people, events, and objects. Attitudes are often considered precursors to behavior.

3.2 Attitudes have three components:

1) **Affective**, which deals with a person's feelings and emotions
2) **Cognitive**, which deals with a person's awareness and knowledge
3) **Behavioral**, which deals with a person's actions

3.3 Scales to measure attitude:

Researchers have developed a variety of attitude rating scales to measure the intensity of an attitude's affective, cognitive, and behavioral components. These scales may require a respondent to rank, rate, sort, and choose when we assess an attitude.

Scaling refers to the process of assigning numbers or symbols to measure the intensity of abstract attitudes. Scales can be uni-dimensional or multi-dimensional. Uni-dimensional scales measure a single aspect or dimension of an attitude. Multi-dimensional scales measures more than one dimension of an attitude.

Ranking: Ranking is a measurement that asks respondents to rank a small number of items on some characteristic. Respondents might be asked to rank their favorite hot breakfast beverage: Hot Chocolate, Tea, Coffee, or Herbal Tea. Ranking delivers an ordinal score.

Rating: Rating asks respondents the extent to which an item of interest possesses a characteristic. Scales that require respondents to rank an item result in a quantitative score.

Sorting: Sorting is a measurement task that a respondent to sort several items into categories.

Choice: Choice is a measurement task that requires respondents to select among two or more alternatives.

Category Scales: Category scales are the simplest type of rating scale. They contain only two choices: yes/no or agree/disagree.

Example:
I approve of the Affordable Care Act or Obama Care

O	O
Agree	**Disagree**

How often to you this positively about the Affordable Care Act or Obama Care?

O	O	O	O	O
Never	Rarely	Sometimes	Often	Very Often

Graphic Rating Scales: Graphic ratings scales include a graphic continuum anchored between two extremes. When used for online surveys, graphic rating scales may have a "slider," which respondents can move up or down the scale. Sliders allow respondents to make finely tuned responses using a continuous scale.

Graphic rating scales are easy to create. Researchers must be careful about using overly extreme anchors, which tend to push responses toward the center of the scale. Graphic rating scales are frequently used when conducting research among children. Graphic rating scales are considered non-comparative scales because respondents make their judgments without making comparisons to other objects, concepts, people, or brand

Eating a Happy Meal at McDonald's make me feel:

Itemized Rating Scales: Itemized rating scales require respondents to select from a limited number of ordered alternatives. These scales are easy to construct, but they do not allow the respondent to make the fine distinctions of a graphic rating scale using a slider.

Example:

How likely are you to use an open-source textbook in the courses you teach?

Not at all likely to use	1	2	3	4	5	6	7	Extremely likely to use

Rank-Order Scales: Unlike graphic rating scales and itemized rating scales, rank-order scales are comparative scales. Responses rank the objects, concepts, people, or brands by comparing them to similar alternatives.

Example:
Rank the following smart phones with one being the brand that best meets the characteristic and six being the brand that is the worst on the characteristic.

Brand	Has an elegant design	Is well made	Has a large selection of apps.
Sony Xperia Z4			
iPhone 6 Plus			
Samsung Galaxy S6			
HTC One M9			
iPhone 6			
Microsoft Lumia 940			

Paired Comparisons: Paired comparison is a measurement scale that asks respondents to select one of two alternatives.

Example:
Listed below are some of the characteristics of a McDonald's Big Mac and a Burger King Whopper. Select the answer that best matches your opinion.

Which of the two brands tastes better?

Big Mac is better	Whopper is better	They are the same

Paired comparisons overcome some of the problems of rank-order scales. First, it is easier for respondents to select one item from a choice of two than to rank a larger set of objects, concepts, people, or brands. The question of order bias—bias caused by how the objects, concepts, people, or brands are ordered—is removed. But, the number of pairs to be compared should be kept to a minimum to avoid tiring respondent.

Constant Sum Scales: Constant sum scales require respondents to divide a set number of points, usually 100, to rate two or more attributes. The problem with constant sum scales is that respondents find it difficult to allocate points especially if there are a lot of attributes to be measure

Example:
Below are five attributes of the iPhone 6 Plus, Please allocate 100 points to these attributes so that they reflect the importance of each attribute. Please make certain that the total number of points adds up to 100.

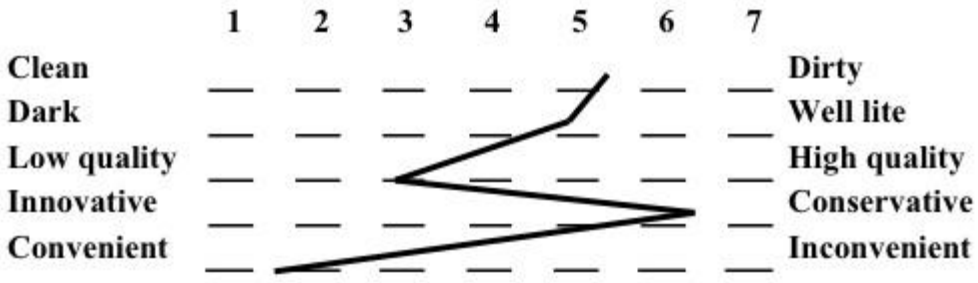
Attribute	Points
It is well made	_____
It is well designed	_____
It has long battery life	_____
It is easy to use	_____
It has a lot of applications	_____
Total	100

Semantic Differential Scales: Semantic differential scales measure respondents' attitudes about the strengths and weaknesses of a concept or construct. With this scale, researchers select a pair of dichotomous adjectives to describe the concept under investigation. Typically researchers use a scale from 1 through 7. The mean of each pair is calculated and then plotted on the table.

Example:
Below is a list of characteristics of Kmart stores. For each pair of adjectives, place an "X" at the point that you believe best reflects your experience at Kmart.

	1	2	3	4	5	6	7	
Clean	___	___	___	___	___	___	___	**Dirty**
Dark	___	___	___	___	___	___	___	**Well lite**
Low quality	___	___	___	___	___	___	___	**High quality**
Innovative	___	___	___	___	___	___	___	**Conservative**
Convenient	___	___	___	___	___	___	___	**Inconvenient**

Semantic Differential Scale Summary Chart



The sematic differential scale is widely used in marketing research because studies have repeatedly shown that this scale is an efficient way to examine the differences in image attributes among a variety of brands or companies. But, semantic differential scales are not without shortcomings. First there are no general scales. Researchers must develop valid and reliable adjective scales for each research project. Researchers should also watch for a "halo" effect, which will bias a respondent's answers. The halo effect is when a respondent's overall impression overwhelms his or her views on a single adjective pair. To counteract the halo effect, researchers never place all of the positive adjectives on the same side of the scale.

Stapel Scale: The Stapel Scale is a uni-polar scale that requires respondents to rate a concept on a scale of negative 5 to positive 5 on how closely an adjective at the center of the scale represents the concept. The chief advantage of the Stapel Scale is that the researcher does not have to spend the time and energy to creating bipolar pairs.

Example:
Select the appropriate plus number for the phrase that best represents attributes of the iPhone 6. If the phrase does not represent the iPhone 6, select the appropriate negative number that reflects your attitude.

+5	+5	+5
+4	+4	+4
+3	+3	+3
+2	+2	+2
+1	+1	+1
High quality	**Well designed**	**Easy to use**
-1	-1	-1
-2	-2	-2
-3	-3	-3
-4	-4	-4
-5	-5	-5

Likert Scale: The Likert scale allows respondents to state how strongly they agree or disagree with an attitude. The scale is named after Rensis Likert, who developed this scale in 1932 for his doctoral dissertation. Likert is pronounced "Lick-ert," not "Like-urt.".

Although the Likert scale is typically a five-point scale that ranges from "strongly disagree" to neutral to "strongly agree." It is not uncommon to see a six-point or seven-point variant. A six-point Likert scale has three levels of disagreement and three levels of agreement with no neutral point. The seven-point Likert scale adds a neutral point.

Example:
McDonald's Happy Meals are good value for the money.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O
1	2	3	4	5

Researchers disagree on whether the Likert Scale is an ordinal or interval scale. Those who argue that it is an ordinal scale say the intervals between the five-points of the scale are unknowable. Those who argue that it is an interval scale score.

"Strongly Disagree" as a 1,
"Disagree" as a 2,
"Neutral" as a 3,
"Agree" as a 4,
"Strongly Agree" as a 5

Closely related to the Likert Scale is a **Purchase Intent scale**. The disagreement and agreement statements are replaced with answers that reflect a respondent's intent to purchase a product.

Example:
After owning a Chevrolet Impala for three years, how likely are you to purchase a new Chevrolet Impala?

Definitively Will Not Buy	Probably Will Not Buy	Neutral	Probably Will Buy	Definitively Will Buy
O	O	O	O	O
1	2	3	4	5

3.4 Creating a scale typically involves eight steps.

Step 1: Clarify what is to be measured.

Step 2: Select scale formats (Likert, Stapel, Semantic Differential, etc.). Researchers typically restrict themselves to a limited number of scale formats.

Step 3: Generate a pool of items that will be used to measure the concept or construct.

Step 4: Have others critique the pool of items.

Step 5: Consider adding items that will provide a check on internal consistency. For example, in non-adjacent places ask the respondent's age and birth date.

Step 6: Pre-test the instrument. This is a critical step because it helps researchers learn if respondents are misinterpreting questions.

Step 7: Drop redundant items.

Step 8: Optimize the scale, which involves consideration of reliability and the length of the instrument.

3.5 Basic Method of Collection of Data

1. Survey method
2. Personal interviewing
3. Telephone interviewing
4. Self administered surveys

3.5.1 Survey Method

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

Survey method pursues two main purposes:

- Describing certain aspects or characteristics of population and/or
- Testing hypotheses about nature of relationships within a population

Survey method can be broadly divided into three categories: mail survey, telephone survey and personal interview.

Survey method	Description
Mail survey	A written survey that is self-administered
Telephone survey	A survey conducted by telephone in which the questions are read to the respondents
Personal interview	A face-to-face interview of the respondent

3.5.2 Personal Interview Method

`A personal or face-to-face interview employs a standard structured questionnaire (or interview schedule) to ensure that all respondents are asked questions in the same sequences.
It is a two-way conversation initiated by an interviewer to obtain information from a respondent. The questions, the wording, and the sequence define the structure of the interview, and the interview is conducted face-to-face.

Advantages of Personal Interviews

Flexibility

Flexibility is the major advantage of the interview study. Interviewers can probe for more specific answers and can repeat and clarify a question when the response indicates that the respondents misunderstood the question.

Response rate

The personal interview tends to have a higher response rate than the mail questionnaire. Illiterate persons can still answer questions in an interview, and others unwilling to spend their time and energy to reply to an impersonal mail questionnaire may be glad to talk.

Nonverbal behavior

The interviewer is personally present to observe nonverbal behavior and to assess the validity of the respondent's answer directly.

Control over the interview environment

An interviewer can standardize the interview by ensuring that the interview was conducted in privacy, that there was none to influence neither the respondent nor that there was anyone to dictate.

He can prescreen to ensure that the correct respondent is replying, and he can set up and control the interviewing condition.

This is in contrast to a mailed study, where the questionnaire may be completed by people other than the respondent himself/herself under drastically different conditions. The respondent can thus not 'cheat' by receiving prompting or answers from others.

Spontaneity

The interviewer can record spontaneous answers. The respondent does not have the chance to retract his or her first answer and write another, while this is possible in the mail questionnaire.

Spontaneous answers are generally more reliable and informative and less normative than answers about which the respondent has had time to think.

Completeness

In a personal interview, the interviewer can ensure that all questions have been answered. This reduces the chances for item no response, which refers to the collection of incomplete or missing data for one or more (but not all) characteristics of the individuals.

Scope to deal with greater complexity of the questionnaire

A more complex questionnaire can be used in an interview study. A skilled, experienced, and well-trained interviewer can fill in a questionnaire full of skips, arrows, and detailed instructions that even a well-educated respondent would feel hopelessly lost in a mail questionnaire.

Recording of time to conduct an interview

The interviewer can record the time required to complete the interview. This record can greatly help subsequent surveys prepare a budget, particularly in determining the optimum sample size in terms of cost.

Various Interviewing Techniques

The first goal of an interview is to establish a friendly relationship with the respondent. Three factors help in motivating the respondents to cooperate:

The respondents must believe that their interaction with the interviewer will be pleasant and satisfying. Whether the interaction will be pleasant and satisfying largely depends on the interpersonal skills of the interviewer.

The respondents must think that answering the survey is an important and worthwhile use of their time. To ensure this, some explanation of the purpose of the study is necessary. It is the interviewer's responsibility to ascertain what explanation is needed and to supply it.

The respondents must have any mental reservations satisfied. This arises when respondents have misconceptions and thus might have reservations about being interviewed. The interviewer's responsibility is to remove these misconceptions.

Guidelines on How the Interviewer Should Approach A Respondent

1. Tell the respondent who you are and whom you represent (show your identification card, if needed).

2. Check if the respondent is busy or away. If it is obvious that the respondent is busy, give a general introduction, and try to stimulate enough interest to arrange an interview at another time. If the respondent is not at home, keep provision for a revisit.

3. Tell the respondent what you are doing in a way that will stimulate his or her interest.

4. Tell the respondent how he or she was chosen, emphasizing that he or she was chosen in an impersonal way merely because a cross-section of the population is needed.

5. Adapt your positive approach to the situation. Assume that the respondent will not be too busy for an interview. Approach him or her as follows:

I would like to come in and talk to you about this," rather than saying, "May I come in?" "Should I come later?" or "Do you have time now?" or any other approach that gives the respondent a chance to say "no."

6. Try to establish a good relationship. This is what we call rapport building, meaning a relationship of confidence and understanding between interviewer and respondent.

7. Adopt probing whenever necessary. The technique of stimulating respondents more fully and relevantly is termed.

The chief function of a probe is to lead the respondent to answer more fully and accurately or at least to provide a minimally acceptable answer.

A second function is to structure the respondent's answer and ensure that all topics of interest to the interviewer are covered and the amount of irrelevant information is reduced.

Since a probe presents a great potential for bias, a probe should be neutral and appear as a neutral part of the conversation. Appropriate probes should be specified by the designer of the data collection instruments.

3.5.3 Telephone Surveys

Among the traditional methods of research, telephone surveys have been a popular tool for decades. With the widespread availability of telephones across the population (landlines and cell phones), administering a survey by telephone has been increasingly common. It offers an efficient and cost-effective way to gather data from a wide population on a wider range of topics.

What are Telephone Surveys?

. A telephone survey, also known as CATI or computer-assisted telephonic interview, is a research method where the researcher survey's respondents over the telephone. Unlike email surveys, researchers collect data by conducting phone interviews and punching the responses.

A CATI is very similar to paper surveys, except that the researcher punches the gathered responses to a survey link on a computer. The researcher cannot alter or modify the research questions and must follow a script for the telephonic survey.

Uses of telephone surveys

Telephonic surveys are helpful in a more casual setup, in cases where respondents may have a direct relationship with the surveying organization. They are also helpful in reaching out to respondents whose email ids you don't have. It is a quick way of collecting feedback, especially for a skilled researcher. As most people own telephones and phone numbers are captured at almost every POS, telephonic surveys are a cheap and functional alternative to email surveys

Advantages of telephone surveys

Here are the advantages of conducting telephonic surveys:

Immediate response: Unlike emails, telephonic emails gather quicker responses, especially when the audience is vast and does not belong to a research panel.

Personal touch: Telephonic surveys are more expressive than email surveys, thus adding a personal touch and capturing more responses.

Cost-effective: CATIs are more profitable, considering the high response rate compared to us surveys.

3.5.4 Self-Administered Survey

A self-administered survey is a questionnaire that is designed explicitly to be completed by a respondent without an interviewer's assistance (or bias). Self-administered surveys are widely used for collecting quantitative research data.

Traditionally, self-administered surveys were distributed by mail or in-person to a large group of people and completed with paper and pencil. Although mail surveys are still standard in countries with a strong postal system, advances in technology have pushed many self-administered surveys online and to mobile phones. Utilizing digital survey tools enables researchers to gather data from almost any geographic location in less time and for less money than traditional methods.

Importance of a Self Administered Survey

- It helps you to reduce the costs of data collection in research. For instance, instead of traveling all the way to meet up with research subjects or hiring face-to-face interviewers, you can simply send mail-in questionnaires to respondents and gather the data you need easily.

- Self-administered surveys are more convenient for participants because they do not have to fill the questionnaires immediately. This can improve your survey participation rates.

- Because research subjects do not have to fill and submit your questionnaire immediately, they can take their time to think about each question and fill in the best responses. This helps to improve the validity of your research data.

- It also reduces research bias since the researcher does not have any contact with the respondents as they fill out the survey. This limits their ability to subtly influence the responses from participants physically.

- Survey respondents enjoy better privacy with self-administered questionnaires. The absence of the researcher can make the respondent feel at ease and more willing to provide unique and unconventional answers.

- Using self-administered surveys and questionnaires for data collection allows you to gather data from a large sample size spread over different geographical locations.

3.6 Instruments for Respondent Communication

A questionnaire is a research instrument that consists of a set of questions or other types of prompts that aims to collect information from a respondent. A research questionnaire is typically a mix of close-ended questions and open-ended questions.

Open-ended, long-form questions offer the respondent the ability to elaborate on their thoughts. Research questionnaires were developed in 1838 by the Statistical Society of London.

The data collected from a data collection questionnaire can be both qualitative as well as quantitative in nature. A questionnaire may or may not be delivered in the form of a survey, but a survey always consists of a questionnaire.

3.6.1 Advantages of a good questionnaire design

- With a survey questionnaire, you can gather a lot of data in less time.
- There is less chance of any bias creeping if you have a standard set of questions to be used for your target audience. You can apply logic to questions based on the respondents' answers, but the questionnaire will remain standard for a group of respondents that fall in the same segment.
- Surveying online survey software is quick and cost-effective. It offers you a rich set of features to design, distribute, and analyze the response data.
- It can be customized to reflect your brand voice. Thus, it can be used to reinforce your brand image.
- The responses can be compared with the historical data and understand the shift in respondents' choices and experiences.
- Respondents can answer the questionnaire without revealing their identity. Also, much survey software complies with significant data security and privacy regulations.

3.6.2 Characteristics of a good questionnaire

Uniformity: Questionnaires are very useful to collect demographic information, personal opinions, facts, or attitudes from respondents. One of the most significant attributes of a research form is uniform design and standardization. Every respondent sees the same questions. This helps in data collection and statistical analysis of this data.

Exploratory: It should be exploratory to collect qualitative data. There is no restriction on questions that can be in your questionnaire. Open-ended questions give you more insight and allow the respondents to explain their practices. A very structured question list could limit the data collection.

Question Sequence: It typically follows a structured flow of questions to increase the number of responses. This sequence of questions is screening questions, warm-up questions, transition questions, skip questions, challenging questions, and classification questions.

3.6.3 Structural Types of Questionnaires

Structured Questionnaires: Structured questionnaires collect quantitative data. The questionnaire is planned and designed to gather precise information. It also initiates a formal inquiry, supplements data, checks previously accumulated data, and helps validate any prior hypothesis.

Unstructured Questionnaires: Unstructured questionnaires collect qualitative data. They use a basic structure and some branching questions but nothing that limits the responses of a respondent. The questions are more open-ended to collect specific data from participants**.**

3.6.4 Types of questions in a questionnaire

Open-Ended Questions: Open-ended questions help collect qualitative data in a questionnaire where the respondent can answer in a free form with little to no restrictions.

Dichotomous Questions: The dichotomous question is generally a "yes/no" close-ended question. This question is usually used in case of the need for necessary validation. It is the most natural form of a questionnaire.

Multiple-Choice Questions: Multiple-choice questions are a close-ended question type in which a respondent has to select one (single-select multiple-choice question) or many (multi-select multiple choice question) responses from a given list of options.

The multiple-choice question consists of an incomplete stem (question), right answer or answers, incorrect answers, close alternatives, and distractors. Of course, not all multiple-choice questions have all of the answer types. For example, you probably won't have the wrong or right answers if you're looking for customer opinion.

Scaling Questions: These questions are based on the principles of the four measurement scales – nominal, ordinal, interval, and ratio. A few of the question types that utilize these scales' fundamental properties are rank order questions, Likert scale questions, semantic differential scale questions, and Stapel scale questions.

Pictorial Questions: This question type is easy to use and encourages respondents to answer. It works similarly to a multiple-choice question. Respondents are asked a question, and the answer choices are images. This helps respondents choose an answer quickly without over-thinking their answers, giving you more accurate data.

3.6.5 Types of Questionnaires

Online Questionnaire: In this type, respondents are sent the questionnaire via email or other online mediums. This method is generally cost-effective and time-efficient. Respondents can also answer at leisure. Without the pressure to respond immediately, responses may be more accurate. The disadvantage, however, is that respondent can easily ignore these questionnaires

Telephone Questionnaire: A researcher makes a phone call to a respondent to collect responses directly. Responses are quick once you have a respondent on the phone. However, a lot of times, the respondents hesitate to give out much information over the phone. It is also an expensive way of conducting research. You're usually not able to collect as many responses as other types of questionnaires, so your sample may not represent the broader population.

In-House Questionnaire: This type is used by a researcher who visits the respondent's home or workplace. The advantage of this method is that the respondent is in a comfortable and natural environment, and in-depth data can be collected. The disadvantage, though, is that it is expensive and slow to conduct.

Mail Questionnaire: These are starting to be obsolete but are still being used in some market research studies. This method involves a researcher sending a physical data collection questionnaire request to a respondent that can be filled in and sent back. The advantage of this method is that respondents can complete this on their own time to answer truthfully and entirely. The disadvantage is that this method is expensive and time-consuming. There is also a high risk of not collecting enough responses to make actionable insights from the data.

3.6.6 Steps Involved in Questionnaire Design

1. Identify the scope of your research:

Think about what your questionnaire is going to include before you start designing the look of it. The clarity of the topic is of utmost importance as this is the primary step in creating the questionnaire. Once you are clear on the purpose of the questionnaire, you can begin the design process

2. Keep it simple:

The words or phrases you use while writing the questionnaire must be easy to understand. If the questions are unclear, the respondents may simply choose any answer and skew the data you collect.

3. Ask only one question at a time:

At times, a researcher may be tempted to add two similar questions. This might seem like an excellent way to consolidate answers to related issues, but it can confuse your respondents or lead to inaccurate data. If any of your questions contain the word "and," take another look. This question likely has two parts, which can affect the quality of your data.

4. Be flexible with your options:

While designing, the survey creator needs to be flexible in terms of “option choice” for the respondents. Sometimes the respondents may not necessarily want to choose from the answer options provided by the survey creator. An “other” option often helps keep respondents engaged in the survey.

5. The open-ended or closed-ended question is a tough choice:

The survey creator might end up in a situation where they need to make distinct choices between open or close-ended questions. The question type should be carefully chosen as it defines the tone and importance of asking the question in the first place.

If the questionnaire requires the respondents to elaborate on their thoughts, an open-ended question is the best choice. If the surveyor wants a specific response, then close-ended questions should be their primary choice. The key to asking closed-ended questions is to generate data that is easy to analyze and spot trends.

6. It is essential to know your audience:

A researcher should know their target audience. For example, if the target audience speaks mostly Spanish, sending the questionnaire in any other language would lower the response rate and accuracy of data. Something that may seem clear to you may be confusing to your respondents. Use simple language and terminology that your respondents will understand, and avoid technical jargon and industry-specific language that might confuse your respondents.

For efficient market research, researchers need a representative sample collected using one of the many sampling techniques, such as a sample questionnaire. It is imperative to plan and define these target respondents based on the demographics required.

3.7 Differences between a Questionnaire and a Survey

	Questionnaire	Survey
Meaning	A questionnaire can is a research instrument that consists of a set of questions to collect information from a respondent.	A survey is a research method used for collecting data from a pre-defined group of respondents to gain information and insights on various topics of interest.
What is it?	The instrument of data collection	Process of collecting and analyzing that data
Characteristic	Subset of survey	Consists of questionnaire and survey design, logic and data collection
Time and Cost	Fast and cost-effective	Much slower and expensive
Usage	Conducted on the target audience	Distributed or conducted on respondent
Questions	Close-ended and very rarely open-ended	Close-ended and open-ended
Answers	Objective	Subjective or objective

UNIT 4

Data Preparation Process:

We researchers spend a lot of time interviewing our clients to determine their needs. Then we go about carefully creating a plan to collect the data that will be most useful. Having done that, the appropriate instrument is carefully crafted that will generate data that can ultimately be transformed into knowledge. All this up-front work necessitates and lot of time and effort. And well it should! But sooner or later we will have collected data and need to start the grunt work of data preparation**.**

1. **Questionnaire checking**
2. **Editing**
3. **Coding**
4. **Classification**
5. **Tabulation**
6. **Graphical representation**
7. **Data clearing**
8. **Data adjusting**

Univariate Analysis:

`While 'uni' means one, variate indicates a variable. Therefore, univariate analysis is a form of analysis that only involves a single variable. In a practical setting, a univariate analysis means the analysis of a single variable (or column) in a dataset (data table).

Steps to conduct univariate analysis

There are 4 steps to conducting univariate analysis, as follows:

- Accessing the dataset of interest
- Identifying the variable that needs to be analyzed
- Identifying the questions that need to be answered through the analysis
- Determining the appropriate type of univariate analysis techniques to answer the above-identified question.

Types of Univariate Analysis

These techniques can be categorized into the following groups:

- Graphical
- Tables
- Descriptive statistics
- Inferential statistics (i.e., use of frequency distributions)

1. **Graphical analysis**

Histograms: A histogram displays the frequency of each value or group of values (bins) in numerical data. This helps in understanding how the values are distributed.

Boxplot: A boxplot provides several important information such as minimum, maximum, median, 1st, and 3rd quartiles. It is beneficial in identifying outliers in the data.

Density Curve: The density curve helps in understanding the shape of the data's distribution. It helps answer questions such as if the data is bimodal, normally distributed, skewed, etc.

Bar Chart: Bar Charts, mainly frequency bar charts, is a univariate chart used to find the frequency of the different categories of categorical data.

Pie Chart: Frequency Pie charts convey similar information to bar charts. The difference is that they have a circular formation with each slice indicating the share of each category in the data.

2. **Univariate tables**

Frequency Tables: Each unique value and its respective frequency in the data is shown through a table. Thus, it summarizes the frequency the way a histogram, frequency bar, or pie chart does but in a tabular manner.

Grouped Tables: Rather than finding the count of each unique value, the values are binned or grouped, and the frequency of each group is reflected in the table. It is typically used for numerical data with high cardinality.

Percentage (Proportion) Tables: Rather than showing the frequency of the unique values (or groups), such a table shows their proportion in the data (in percentage).

Cumulative Proportion Tables: It is similar to the proportion table, with the difference being that the proportion is shown cumulatively. It is typically used with binned data having a distinct order (or with categorical ordinal data).

3. **Descriptive Statistics**

Measure of Central Tendency: Statistics such as mean, median, and mode are considered here. They help in summarizing all the data through a single central value.

Measure of Variability: Analysts also need to understand how the data varies from the central point. To understand this, specific univariate statistics can be calculated, such as range, interquartile range, variance, standard deviation, etc.

Measure of Shape: The shape of the data distribution can explain a great deal about the data as the shape can help in identifying the type of distribution followed by the data. Each of these distributions has specific properties that can be used to your advantage. By analyzing the shapes, you will know if the data is symmetrical, non-symmetrical, left or right-skewed, is suffering from positive or negative kurtosis, among other things.

4. Inferential Statistics

Z Test: Used for numerical (quantitative) data where the sample size is greater than 30 and the population's standard deviation is known.

One-Sample t-Test: Used for numerical (quantitative) data where the sample size is less than 30 or the population's standard deviation is unknown.

Chi-Square Test: Used with ordinal categorical data

Kolmogorov-Smirnov Test: Used with nominal categorical data

T-Test & Z- Test

BASIS FOR COMPARISON	T-TEST	Z-TEST
Meaning	T-test refers to a type of parametric test that is applied to identify, how the means of two sets of data differ from one another when variance is not given.	Z-test implies a hypothesis test which ascertains if the means of two datasets are different from each other when variance is given.
Based on	Student-t distribution	Normal distribution
Population variance	Unknown	Known
Sample Size	Small	Large

Definition of T-test

A t-test is a hypothesis test used by the researcher to compare population means for a variable, classified into two categories depending on the less-than interval variable. More precisely, a t-test is used to examine how the means taken from two independent samples differ.

T-test follows t-distribution, which is appropriate when the sample size is small, and the population standard deviation is not known. The shape of a t-distribution is highly affected by the degree of freedom. The degree of freedom implies the number of independent observations in a given set of observations.

Assumptions of T-test:

- All data points are independent.
- The sample size is small. Generally, a sample size exceeding 30 sample units is regarded as large, otherwise small but that should not be less than 5, to apply t-test.
- Sample values are to be taken and recorded accurately.
  The test statistic is:

The test statistic is:

$$\text{T-test} = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$\bar{x}$ is the sample mean
s is sample standard deviation
n is sample size
μ is the population mean
Paired t-test: A statistical test applied when the two samples are dependent and paired observations are taken.

Definition of Z-test

Z-test refers to a univariate statistical analysis used to test the hypothesis that proportions from two independent samples differ greatly. It determines to what extent a data point is away from its mean of the data set, in standard deviation.

The researcher adopts z-test, when the population variance is known, in essence, when there is a large sample size, sample variance is deemed to be approximately equal to the population variance. In this way, it is assumed to be known, despite the fact that only sample data is available and so normal test can be applied**.**

Assumptions of Z-test:

- All sample observations are independent
- Sample size should be more than 30.
- Distribution of Z is normal, with a mean zero and variance 1.

The test statistic is:

$$\text{Z-test} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$\bar{x}$ is the sample mean

σ is population standard deviation

n is sample size

μ is the population mean

What is bivariate analysis?

Bivariate analysis is a statistical method examining how two different things are related. The bivariate analysis aims to determine if there is a statistical link between the two variables and, if so, how strong and in which direction that link is.
It is a helpful technique for determining how two variables are connected and finding trends and patterns in the data.

Recognizing bivariate data is a prerequisite for analysis. Typically, X and Y are two of the measures included. The bivariate data can be understood as a pair (X, Y).

Here are some reasons why bivariate analysis is important:

- Bivariate analysis helps identify trends and patterns: It can reveal hidden data trends and patterns by evaluating the relationship between two variables.

- Bivariate analysis helps identify cause and effect relationships: It can assess if two variables are statistically associated, assisting researchers in establishing which variable causes the other.

- It helps researchers make predictions: It allows researchers predict future results by modeling the link between two variables.

- It helps inform decision-making: Business, public policy, and healthcare decision-making can benefit from bivariate analysis.

Types of bivariate analysis
Many kinds of bivariate analysis can be used to determine how two variables are related. Here are some of the most common types.

Scatterplots

A scatterplot is a graph that shows how two variables are related to each other. It shows the values of one variable on the x-axis and the values of the other variable on the y-axis. The pattern shows what kind of relationship there is between the two variables and how strong it is.

Correlation

Correlation is a statistical measure that shows how strong and in what direction two variables are linked. A positive correlation means that when one variable goes up, so does the other. A negative correlation shows that when one variable goes up, the other one goes down.

Regression

This kind of analysis gives you access to all terms for various instruments that can be used to identify potential relationships between your data points. The equation for that curve or line can also be provided to you using regression analysis. Additionally, it may show you the correlation coefficient.

Chi-square test

The chi-square test is a statistical method for identifying disparities in one or more categories between what was expected and what was observed. The test's primary premise is to assess the actual data values to see what would be expected if the null hypothesis was valid. Researchers use this statistical test to compare categorical variables within the same sample group. It also helps to validate or offer context for frequency counts.

T-test

A t-test is a statistical test that compares the means of two groups to see if they have a big difference. This analysis is appropriate when comparing the averages of two categories of a categorical variable.

ANOVA (Analysis of Variance)

The ANOVA test determines whether the averages of more than two groups differ from one another statistically. This comparison of averages of a numerical variable for more than two categories of a categorical variable is appropriate.

Correlation:

Correlation research is a type of non-experimental research method in which a researcher measures two variables and understands and assesses the statistical relationship between them with no influence from any extraneous variable.

Types of correlation research tools

Mainly three types of correlation research have been identified:

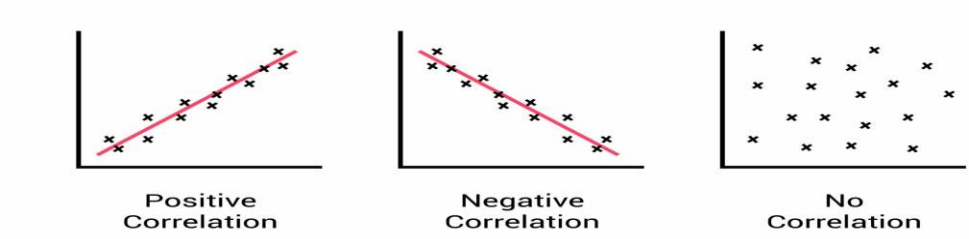
1. Positive correlation: A positive relationship between two variables is when an increase in one variable leads to a rise in the other variable. A decrease in one variable will see a reduction in the other variable.

For example, the amount of money a person has might positively correlate with the number of cars the person owns.

2. Negative correlation: A negative correlation is quite literally the opposite of a positive relationship. If there is an increase in one variable, the second variable will show a decrease and vice versa.

For example, being educated might negatively correlate with the crime rate when an increase in one variable leads to a decrease in another and vice versa. If a country's education level is improved, it can lower crime rates. Please note that this doesn't mean that lack of education leads to crimes. It only means that a lack of education and crime is believed to have a common reason – poverty.

3. No correlation: There is no correlation between the two variables in this third type. A change in one variable may not necessarily see a difference in the other variable. For example, being a millionaire and happiness are not correlated. An increase in money doesn't lead to happiness.



Types of correlation coefficients

1. **Pearson's r**

The Pearson's product-moment correlation coefficient, also known as Pearson's r, describes the linear relationship between two quantitative variables.

These are the assumptions your data must meet if you want to use Pearson's r:

- Both variables are on an interval or ratio level of measurement
- Data from both variables follow normal distributions
- Your data have no outliers

- Your data is from a random or representative sample
- You expect a linear relationship between the two variables

The Pearson's r is a parametric test, so it has high power. But it's not a good measure of correlation if your variables have a nonlinear relationship, or if your data have outliers, skewed distributions, or come from categorical variables. If any of these assumptions are violated, you should consider a rank correlation measure.

The formula for the Pearson's r is complicated, but most computer programs can quickly churn out the correlation coefficient from your data. In a simpler form, the formula divides the covariance between the variables by the product of their standard deviations.

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

- r_{xy} = strength of the correlation between variables x and y
- n = sample size
- $\sum$ = sum of what follows…
- X = every x-variable value
- Y = every y-variable value
- XY = the product of each x-variable score and the corresponding y-variable score

2. Spearman's rho

Spearman's rho, or Spearman's rank correlation coefficient, is the most common alternative to Pearson's r. It's a rank correlation coefficient because it uses the rankings of data from each variable (e.g., from lowest to highest) rather than the raw data itself.

You should use Spearman's rho when your data fail to meet the assumptions of Pearson's. This happens when at least one of your variables is on an ordinal level of measurement or when the data from one or both variables do not follow normal distributions.

While the Pearson correlation coefficient measures the linearity of relationships, the Spearman correlation coefficient measures the monotonicity of relationships.

In a linear relationship, each variable changes in one direction at the same rate throughout the data range. In a monotonic relationship, each variable also always changes in only one direction but not necessarily at the same rate.

Positive monotonic: when one variable increases, the other also increases.

Negative monotonic: when one variable increases, the other decreases.

$$r_s = 1 - \frac{6\sum d_i^2}{(n^3 - n)}$$

- r_s= strength of the rank correlation between variables
- d_i = the difference between the x-variable rank and the y-variable rank for each pair of data
- $\sum d^2_i$ = sum of the squared differences between x- and y-variable ranks
- n = sample size

Regression analysis

Regression analysis is a quantitative research method which is used when the study involves modelling and analysing several variables, where the relationship includes a dependent variable and one or more independent variables. In simple terms, regression analysis is a quantitative method used to test the nature of relationships between a dependent variable and one or more independent variables.

The basic form of regression models includes unknown parameters (β), independent variables (X), and the dependent variable (Y).

Regression model, basically, specifies the relation of dependent variable (Y) to a function combination of independent variables (X) and unknown parameters (β)

$$Y \approx f(X, \beta)$$

Regression equation can be used to predict the values of 'y', if the value of 'x' is given, and both 'y' and 'x' are the two sets of measures of a sample size of 'n'. The formulae for regression equation would be

$$y^* = a + bx$$

Where,

$$b = \frac{n\sum xy - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$a = \frac{\sum y - b\sum x}{n}$$

Linear regression analysis is based on the following set of assumptions:

1. Assumption of linearity. There is a linear relationship between dependent and independent variables.

2. Assumption of homoscedasticity. Data values for dependent and independent variables have equal variances.

3. Assumption of absence of collinearity or multicollinearity. There is no correlation between two or more independent variables.
4. Assumption of normal distribution. The data for the independent variables and dependent variable are normally distributed

Chi-Square Test

The Chi-Square test is a statistical procedure for determining the difference between observed and expected data. This test can also be used to determine whether it correlates to the categorical variables in our data. It helps to find out whether a difference between two categorical variables is due to chance or a relationship between them.

Chi-Square Test Definition

A chi-square test is a statistical test that is used to compare observed and expected results. The goal of this test is to identify whether a disparity between actual and predicted data is due to chance or to a link between the variables under consideration. As a result, the chi-square test is an ideal choice for aiding in our understanding and interpretation of the connection between our two categorical variables.

A chi-square test or comparable nonparametric test is required to test a hypothesis regarding the distribution of a categorical variable. Categorical variables, which indicate categories such as animals or countries, can be nominal or ordinal. They cannot have a normal distribution since they can only have a few particular values.

Formula for Chi-Square Test

$$x_c^2 = \frac{\Sigma\,(O_i - E_i)^2}{E_i}$$

Where

c = Degrees of freedom

O = Observed Value

E = Expected Value

The degrees of freedom in a statistical calculation represent the number of variables that can vary in a calculation. The degrees of freedom can be calculated to ensure that chi-square tests are statistically valid. These tests are frequently used to compare observed data with data that would be expected to be obtained if a particular hypothesis were true.

The Observed values are those you gather yourselves.
The expected values are the frequencies expected, based on the null hypothesis.

There are two main types of Chi-Square tests namely -

- Independence
- Goodness-of-Fit

Independence

The Chi-Square Test of Independence is a derivable (also known as inferential) statistical test which examines whether the two sets of variables are likely to be related with each other or not. This test is used when we have counts of values for two nominal or categorical variables and is considered as non-parametric test. A relatively large sample size and independence of obseravations are the required criteria for conducting this test.

For Example-
In a movie theatre, suppose we made a list of movie genres. Let us consider this as the first variable. The second variable is whether or not the people who came to watch those genres of movies have bought snacks at the theatre. Here the null hypothesis is that th genre of the film and whether people bought snacks or not are unrelatable. If this is true, the movie genres don’t impact snack sales.

Goodness-Of-Fit

In statistical hypothesis testing, the Chi-Square Goodness-of-Fit test determines whether a variable is likely to come from a given distribution or not. We must have a set of data values and the idea of the distribution of this data. We can use this test when we have value counts for categorical variables. This test demonstrates a way of deciding if the data values have a " good enough" fit for our idea or if it is a representative sample data of the entire population.

For Example-

Suppose we have bags of balls with five different colours in each bag. The given condition is that the bag should contain an equal number of balls of each colour. The idea we would like to test here is that the proportions of the five colours of balls in each bag must be exact.

When to use a chi-square test

A Pearson's chi-square test may be an appropriate option for your data if all of the following are true:

You want to test a hypothesis about one or more categorical variables. If one or more of your variables is quantitative, you should use a different statistical test. Alternatively, you could convert the quantitative variable into a categorical variable by separating the observations into intervals.

The sample was randomly selected from the population.

There are a minimum of five observations expected in each group or combination of groups.

Limitations of Chi-Square Test

There are two limitations to using the chi-square test that you should be aware of.

The chi-square test, for starters, is extremely sensitive to sample size. Even insignificant relationships can appear statistically significant when a large enough sample is used. Keep in mind that "statistically significant" does not always imply "meaningful" when using the chi-square test.

Be mindful that the chi-square can only determine whether two variables are related. It does not necessarily follow that one variable has a causal relationship with the other. It would require a more detailed analysis to establish causality.

Analysis of Variance (ANOVA)

Analysis of Variance (ANOVA) is a statistical formula used to compare variances across the means (or average) of different groups. A range of scenarios use it to determine if there is any difference between the means of different groups.

ANOVA Terminology

Dependent variable: This is the item being measured that is theorized to be affected by the independent variables.

Independent variable/s: These are the items being measured that may have an effect on the dependent variable.

A null hypothesis (H0): This is when there is no difference between the groups or means. Depending on the result of the ANOVA test, the null hypothesis will either be accepted or rejected.

An alternative hypothesis (H1): When it is theorized that there is a difference between groups and means.

Factors and levels: In ANOVA terminology, an independent variable is called a factor which affects the dependent variable. Level denotes the different values of the independent variable that are used in an experiment.

Fixed-factor model: Some experiments use only a discrete set of levels for factors. For example, a fixed-factor test would be testing three different dosages of a drug and not looking at any other dosages.

Random-factor model: This model draws a random value of level from all the possible values of the independent variable.

One-Way ANOVA

The one-way analysis of variance is also known as single-factor ANOVA or simple ANOVA. As the name suggests, the one-way ANOVA is suitable for experiments with only one independent variable (factor) with two or more levels. For instance a dependent variable may be what month of the year there are more flowers in the garden. There will be twelve levels. A one-way ANOVA assumes:

Independence: The value of the dependent variable for one observation is independent of the value of any other observations.

Normalcy: The value of the dependent variable is normally distributed

Variance: The variance is comparable in different experiment groups.
Continuous: The dependent variable (number of flowers) is continuous and can be measured on a scale which can be subdivided.

Full Factorial ANOVA (also called two-way ANOVA)

Full Factorial ANOVA is used when there are two or more independent variables. Each of these factors can have multiple levels. Full-factorial ANOVA can only be used in the case of a full factorial experiment, where there is use of every possible permutation of factors and their levels. This might be the month of the year when there are more flowers in the garden, and then the number of sunshine hours. This two-way ANOVA not only measures the independent vs the independent variable, but if the two factors affect each other. A two-way ANOVA assumes:

Continuous: The same as a one-way ANOVA, the dependent variable should be continuous.

Independence: Each sample is independent of other samples, with no crossover.

Variance: The variance in data across the different groups is the same.

Normalcy: The samples are representative of a normal population.

Categories: The independent variables should be in separate categories or groups.

Multivariate analysis

Multivariate analysis is used to describe analyses of data where there are multiple variables or observations for each unit or individual.

Often times these data are interrelated and statistical methods are needed to fully answer the objectives of our research.

Types of Multivariate Analyses

Multiple linear regression: A linear regression method where the dependent variable Y is described by a set of X independent variables. An example would be to determine the factors that predict the selling price or value of an apartment.

Multiple linear correlation: Allows for the determination of the strength of the strength of the linear relationship between Y and a set of X variables.

Multivariate nonlinear regression: A form of regression analysis in which the dependent variable Y is described by a nonlinear combination of the independent variables X.

Response Surface Regression: A form of multivariate non-linear regression where the influences of several independent or "response" variables on a dependent variable are determined. The goal of response surface regression is to optimize a response.

Discriminant analysis: Discriminant analysis is a versatile statistical method often used by market researchers to classify observations into two or more groups or categories. In other words, discriminant analysis is used to assign objects to one group among a number of known groups.

When To Use Discriminant Analysis

By performing discriminant analysis, researchers are able to address classification problems in which two or more groups, clusters, or populations are known up front, and one or more new observations are placed into one of the known classifications based on measured characteristics.

Discriminant analysis is also used to investigate how variables contribute to group separation, and to what degree. For this reason, it's often leveraged to compliment the findings of cluster analysis.

Market researchers are continuously faced with situations in which their goal is to obtain a better understanding of how groups (customers, age cohorts, etc.) or items (brands, ideas, etc.), differ in terms of a set of explanatory or independent variables.

Principal component analysis (PCA): Is used to simplify the description of a set of interrelated variables. PCA considers all variables equally; they are not divided into dependent and independent variables. In PCA, the interrelated variables are in essence transformed into new, uncorrelated values.

Using the data from the lung function example, the data for each individual are highly interrelated since they were all recorded on one breath. Because the data are interrelated, you need to use a method that develops a new set of measurements that are uncorrelated with each other. PCA allows development of new uncorrelated measurements called principal components. It is hoped that the first 2-3 of the principal components can be used to explain the original variation in lung function. Use of PCA may allow you to use fewer principal components than the number of variables in the original data set and help to simply the interpretation and explanation of the results.

Factor analysis: Is similar to PCA in that it allows one to determine the interrelationships among a set of variables. Like PCA, factor analysis does not have a dependent variable that is described by a set of independent variables.

Using our political survey example, factor analysis will allow you to group each of the questions into subgroups that are uncorrelated with each other

Cluster analysis: Is a method for grouping individuals or objects into unknown groups. This method differs from discriminant analysis in that the number and the characteristics of the groups are unknown prior to the analysis.

Tabulation of Data

Tabulation is defined as the process of placing classified data in tabular form. A table is a systematic arrangement of statiscal information in rows and columns. The rows of a table are the horizontal arrangement of data whereas the columns of a table are the vertical arrangement of data.

What are the Essential Parts of a Table?

Table Number – This is the first part of a table and is given on top of any table to facilitate easy identification and for further reference.

Title of the Table – One of the most important parts of any table is its title. The title is either placed just below the table number or at its right.It is imperative for the title to be brief, crisp and carefully-worded to describe the tables' contents effectively.

Headnote –The headnote of a table is presented in the portion just below the title. It provides information about the unit of data in the table, like "amount in Rupees" or "quantity in kilograms", etc.

Column Headings or Captions – The headings of the columns are referred to as the caption. It consists of one or more column heads. A caption should be brief, short, and self-explanatory, Column heading is written in the middle of a column in small letters.

Row Headings or Stubs – The title of each horizontal row is called a stub.

Body of a Table – This is the portion that contains the numeric information collected from investigated facts. The data in the body is presented in rows which are read horizontally from left to right and in columns, read vertically from top to bottom.

Footnote – Given at the bottom of a table above the source note, a footnote is used to state any fact that is not clear from the table's title, headings, caption or stub. For instance, if a table represents the profit earned by a company, a footnote can be used to state if said profit is earned before, or after tax calculations.

Source Note – As its name suggests, a source note refers to the source from where the table's information has been collected.

Types of Tabulation

- **Simple Tabulation or One-way Tabulation**

When the data in the table are tabulated to one characteristic, it is termed as a simple tabulation or one-way tabulation.

For example, Data tabulation of all the people of the World is classified according to one single characteristic like religion.

- **Double Tabulation or Two-way Tabulation**

When the data in the table are tabulated considering two different characteristics at a time, then it is defined as a double tabulation or two-way tabulation.

For example, Data tabulation of all the people of the World is classified by two different characteristics like religion and sex.

- **Complex Tabulation**

When the data in the table are tabulated according to many characteristics, it is referred to as a complex tabulation.

For example, Data tabulation of all the people of the World is classified by three or more characteristics like religion, sex, and literacy, etc.

What are the Objectives of Tabulation

For Simplification of Complex Data – When any information is tabulated, the volume of raw data is compressed and presented in a much more simplified manner. This facilitates easy comprehension and analysis of previously complex data.

To Highlight Important Information – Representing any data in tabular form increases the scope to highlight important information. Since data is presented in a concise manner without any textual explanation, any crucial information is automatically highlighted without difficulty.

To Enable Easy Comparison – When data is presented in an orderly fashion in rows and columns, it becomes easier to compare between them on the basis of several parameters. For example, it becomes easier to determine the month when a country has received the maximum amount of rainfall if the data is presented in a table. Otherwise, there always remains room for making a mistake in processing the data correctly.

To Help in the Statistical Analysis of Data – Statistical analysis involves computing correlation, average, dispersion, etc. of data. When information is presented in an organised manner in a table, statistical analysis becomes a lot simpler.

Saves Space- Even though it might not seem as important as the other objective of tabulation, saving space without sacrificing the quality of data can be extremely helpful in the long run. Additionally, a table helps to present facts in a much more concise manner than page after page of text.

What are the Rules of Tabulation?

There are a few general rules that have to be followed while constructing tables. These are–

The tables illustrated should be self-explanatory, simple and attractive. There should be no need for further explanation (details). If the volume of information is substantial, it is best to put them down in multiple tables instead of a single one. This reduces the chances of mistakes and defeats the purpose of forming a table. However, each table formed should also be complete in itself and serve the purpose of analysis.

- The number of rows and columns should be kept minimal to present information in a crisp and concise manner.
- Before tabulating, data should be approximated, wherever necessary.
- Stubs and captions should be self-explanatory and should not require the help of footnotes to be comprehended.
- If certain positions of data collected cannot be tabulated under any stub or captions, they should be put down in a separate table under the heading `` miscellaneous.
- Quantity and quality of data should not be compromised under any scenario while forming a table.

How is Data in Tabulation Executed

Direct Tally Method –

Here, codes are first written down in tally sheets. Then a stroke is marked against codes to denote response. After every fourth stroke, the fifth response is given by putting a horizontal or diagonal line through the stroke.

Card Sort and Count Method –

This is perhaps the most efficient hand tabulation method. Here the data is recorded in cards of various sizes and shapes with the help of a series of holes. Next, cards belonging to each of the categories are segregated and counted, and their frequency is recorded. This way, a total of 40 items can be included in a single page.

List and Tally Method –

With this method, a large number of questionnaires are listed in one sheet. The responses to each question are then entered into rows, and the code corresponding to each question is represented in columns.

UNIT 5

PRESENTATION OF RESEACH REPORT

5.1 Meaning of Report:

A report is a document that presents information in an organized format for a specific audience and purpose. Although summaries of reports may be delivered orally, complete reports are almost always in the form of written documents

5.2 Types of Report:

a) **Written Report**
b) **Oral Report**
c) **Technical Report**
d) **Survey based Report**

1. Written Report:

Written reports present information and results of particular investigations while making recommendations and making proposals. They are a formal method to present the findings of an investigation. There is a specific format to follow when writing reports.

Moreover, there are different types of reports, such as

- Research reports
- Building reports
- Science reports

The structure of the report can include

A title page, a summary, a content page, an introduction, terms of reference, procedure, findings, conclusion, recommendations, references, and appendices.

Due to the structure of written reports, the details and information can be presented in a clearer and more accurate way. The writing style of the report is very simple and concise in order to present clear details.

2. Oral Report

An oral report presents the findings of a research-based experiment. It may also have a format to present the information clearly to an audience.

The elements of an oral presentation may consist of an introduction, body, and conclusion. At the same time, posters, slide shows, videos, movies, and other demonstrations can also be used in presenting.

When presenting an oral report, the speaker should also pay attention to the presentation skills. Maintaining eye contact, use of correct body language and use of facial expression may appeal to the audience. They also help to present an effective oral report.

When presenting the oral reports, the speaker should memorize the information and details. Oral reports can be used for formal gatherings as well as for informal gatherings.

3. Technical Report

A technical report is described as a written scientific document that conveys information about technical research in an objective and fact-based manner. This technical report consists of the three key features of a research i.e. process, progress, and results associated with it.

Some common areas in which technical reports are used are agriculture, engineering, physical, and biomedical science. So, such complicated information must be conveyed by a report that is easily readable and efficient.

How to Write a Technical Report?

Approach

When writing a technical report, there are two approaches you can follow, depending on what suits you the best.

- **Top-down approach-** In this, you structure the entire report from title to sub-sections and conclusion and then start putting in the matter in the respective chapters. This allows your thought process to have a defined flow and thus helps in time management as well.

- **Evolutionary delivery-** This approach is suitable if you're someone who believes in 'go with the flow'. Here the author writes and decides as and when the work progresses. This gives you a broad thinking horizon. You can even add and edit certain parts when some new idea or inspiration strikes.

Structure of Technical Report

A technical report must have a defined structure that is easy to navigate and clearly portrays the objective of the report. Here is a list of pages, set in the order that you should include in your technical report.

Cover page- It is the face of your project. So, it must contain details like title, name of the author, name of the institution with its logo. It should be a simple yet eye-catching page.

Title page- In addition to all the information on the cover page, the title page also informs the reader about the status of the project.

Abstract- Also referred to as the executive summary, this page gives a concise and clear overview of the project. It is written in such a manner that a person only reading the abstract can gain complete information on the project.

Preface– It is an announcement page wherein you specify that you have given due credits to all the sources and that no part of your research is plagiarized. The findings are of your own experimentation and research.

Dedication- This is an optional page when an author wants to dedicate their study to a loved one. It is a small sentence in the middle of a new page. It is mostly used in theses.

Acknowledgment- Here, you acknowledge the people parties, and institutions that helped you in the process or inspired you for the idea of it.

Table of contents– Each chapter and its subchapter is carefully divided into this section for easy navigation in the project. If you have included symbols, then a similar nomenclature page is also made. Similarly, if you've used a lot of graphs and tables, you need to create a separate content page for that. Each of these lists begins on a new page.

Introduction- Finally comes the introduction, marking the beginning of your project. On this page, you must clearly specify the context of the report. It includes specifying the purpose, objectives of the project, the questions you have answered in your report, and sometimes an overview of the report is also provided. Note that your conclusion should answer the objective questions.

Central Chapter(s) - Each chapter should be clearly defined with sub and sub-sub sections if needed. Every section should serve a purpose.

While writing the central chapter, keep in mind the following factors:

- Clearly define the purpose of each chapter in its introduction.
- Any assumptions you are taking for this study should be mentioned. For instance, if your report is targeting globally or a specific country. There can be many assumptions in a report. Your work can be disregarded if it is not mentioned every time you talk about the topic.
- Results you portray must be verifiable and not based upon your opinion.

Conclusion- The purpose of the conclusion is to basically conclude any and everything that you talked about in your project. Mention the findings of each chapter, objectives reached, and the extent to which the given objectives were reached. Discuss the implications of the findings and the significant contribution your research made.

Appendices- They are used for complete sets of data, long mathematical formulas, tables, and figures. Items in the appendices should be mentioned in the order they were used in the project.

References- This is a very crucial part of your report. It cites the sources from which the information has been taken from. This may be figures, statistics, graphs, or word-to-word sentences. The absence of this section can pose a legal threat for you. While writing references, give due credit to the sources and show your support to other people who have studied the same genres.

Bibliography- Many people tend to get confused between references and bibliography. Let us clear it out for you. References are the actual material you take into your research, previously published by someone else. Whereas a bibliography is an account of all the data you read, got inspired from, or gained knowledge from, which is not necessarily a direct part of your research.

4. Survey Research Report

The survey report is a document whose purpose is to convey the information acquired during the survey in its whole and objectively. The report includes all of the results that were gathered.

The following are included in the full survey report:

Completion Rate

- In basic words, the completion rate is the number of questions answered divided by the total number of questions in your survey. This is crucial to understand for a variety of reasons.

Number of Responses

- In order to fully assess our survey findings, we must know exactly how many individuals responded. As a result, it's critical that our survey platform allows us to tally the number of distinct people that replied so that we can assess whether we have a substantial sample size. How do we figure out how many samples we'll need? This depends on the type of data we want to study; however, we may select to examine data from our whole audience or just a certain group.

Date of Last Response

- This may not appear relevant if we are performing a survey for a limited and specified time period. Even yet, if we ask clients to complete a customer service evaluation survey once each case is closed, we may have years of data. A lot may change for our product, staff, and customers over time; therefore it's critical to determine if the data we're evaluating is still relevant.

Survey Views

- We need to know the overall number of survey views as well as the total number of unique survey views (the number of total views versus the number of different people who viewed the survey, as some people may have viewed it more than once).
- If there is a significant difference between these two totals, this might indicate a number of reasons.
- First, our survey may be aimed at a big number of people, and the questions may not be relevant enough for all of our respondents to answer.
- Respondents may potentially read the survey and opt not to complete it for the following reasons:
- They just do not have the time.
- They lack the necessary equipment (things like open-ended questions can be difficult and tedious to answer on a small phone screen)
- They look at the first few questions and determine that doing the survey is not for them.

Breakdown of Survey Respondent Answers

- We want to observe how each person responded all of the questions so that we can examine how individuals answered all of the survey questions. This might be useful for identifying trends in particular respondents' responses.
- If we discover a really smart response to one of their questions, we can also uncover their other responses.

Breakdown of Closed-ended Questions

- When you think of a survey report, you probably see graphs and pie charts summarizing the results of closed-ended questions.

- This is vital for a successful survey report since it helps you to take in a huge amount of data at a look and communicate it readily to individuals who may find the data useful.
- The use of graphics in survey analysis makes it more user-friendly and does not necessitate a lot of effort or prior knowledge to evaluate.

5.3 Applications of Research in Business Decisions

1. Marketing Function

This is one area of business where research is the lifeline and is carried out on a vast array of topics and is conducted both in-house by the organization itself and outsourced to external agencies. Broader industry- or product-category-specific studies are also carried out by market research agencies and sold as reports for assisting in business decisions.

Studies like these could be:

- Market potential analysis market segmentation analysis and demand estimation.
- Market structure analysis which includes market size players and market share of the key players.
- Sales and retail audits of product categories by players and regions as well as national sales consumer and business trend analysis—sometimes including short- and long-term forecasting.

Other than these, an organization also carries out researches related to all **four Ps of marketing**, such as:

- Product Research: This would include new product research; product testing and development; product differentiation and positioning; testing and evaluating new products and packaging research; brand research—including equity to tracks and imaging studies.
- Pricing Research: This includes price determination research; evaluating customer value; competitor pricing strategies; alternative pricing models and implications.

- Promotional Research: This includes everything from designing of the communication mix to design of advertisements, copy testing, measuring the impact of alternative media vehicles, impact of competitors' strategy.

- Place Research: This includes location analysis, design and planning of distribution channels and measuring the effectiveness of the distribution network.

These days, with the onset of increased competition and the need to convert customers into committed customers, Customer Relationship Management (CRM), customer satisfaction, loyalty studies and lead user analysis are also areas in which significant research is being carried out.

2. Personnel and Human Resource Management

Human Resources (HR) and organizational behaviour is an area which involves basic or fundamental research as a lot of academic, macro-level research may be adapted and implemented by organizations into their policies and programmers.

Applied HR research by contrast is more predictive and solution-oriented. Though there are a number of academic and organizational areas in which research is conducted.

Yet some key contemporary areas which seem to attract more research are as follows:

- Performance Management: This includes leadership analysis development and evaluation; organizational climate and work environment studies; talent and aptitude analysis and management; organizational change implementation, management and effectiveness analysis.

- Employee Selection and Staffing: This includes pre and on-the-job employee assessment and analysis; staffing studies.

- Organizational Planning and Development: This includes culture assessment—either organization specific or the study of individual and merged culture analysis for mergers and acquisitions; manpower planning and development.

- Incentive and Benefit Studies: These include job analysis and performance appraisal studies; recognition and reward studies, hierarchical compensation analysis; employee benefits and reward analysis, both within the organization and industry best practices.

- Training and Development: These include training need gap analysis; training development modules; monitoring and assessing impact and effectiveness of training.

- Other Areas: Other areas include employee relationship analysis; labor studies; negotiation and wage settlement studies; absenteeism and accident analysis; turnover and attrition studies and work-life balance analysis.

3. Financial and Accounting Research

- The area of financial and accounting research is so vast that it is difficult to provide a pen sketch of the research areas.

- Asset Pricing, Corporate Finance and Capital Markets: The focus here is on stock market response to corporate actions (IPOs or Initial Public Offerings, takeovers and mergers), financial reporting (earnings and firm specific announcements) and the impact of factors on returns, e.g., liquidity and volume.

- Financial Derivatives and Interest Rate and Credit Risk Modeling: This includes analyzing interest rate derivatives, development and validation of corporate credit rating models and associated derivatives; analyzing corporate decision- making and investment risk appraisal.

- Market Based Accounting Research: This includes analysis of corporate financial reporting behaviour; accounting-based valuations; evaluation and usage of accounting information by investors and evaluation of management compensation schemes.

- Auditing and Accountability: This includes both private and public sector accounting studies, analysis of audit regulations; analysis of different audit methodologies; governance and accountability of audit committees.

- Financial Econometrics: This includes modeling and forecasting inviolability, risk estimation and analysis.

- Other Areas: Other related areas of investigation are in merchant banking and insurance sector and business policy and economics areas.

4. Production and Operation Management

This area of management is one in which quantifiable implementation of the research results takes on huge cost and process implications. Research in this area is highly focused and problem specific.

The decision areas in which research studies are carried out are as follows:

- Operation planning which includes product or service design and development resource allocation and capacity planning

- Demand forecasting and decision analysis.

- Process planning which includes production scheduling and material requirement management work design plan and monitoring production scheduling and material requirement management work design planning and monitoring

- Project management and maintenance management studies

- Logistics and supply chain, and inventory management analysis.

- Quality estimation and assurance studies which include Total Quality Management (TQM) and quality certification analysis

- This area of management also invites academic research which might be macro and general but helps in developing technologies, such as JIT (Just-In-Time) technology and EOQ (Economy Order Quantity) an inventory management model which is then adapted by organizations for optimizing operations.

5. **Cross-Functional Research**

Business management being an integrated amalgamation (result of combining) of all these and other areas sometimes requires a unified thought and approach to research. These studies require an open orientation where experts from across the disciplines contribute to and gain from the study.

For example, an area, such as new product development requires the commitment of the marketing, production and consumer insights team to exploit new opportunities.

Other areas requiring cross-functional efforts are:

Corporate governance and ethics—the role of social values and ethics and their integration into a company's working is an area that is of critical significance to any organization.

Technical support systems, enterprise resource planning systems, knowledge management, and data mining and warehousing are integrated areas requiring research on managing coordinated efforts across divisions.

Ecological and environmental analysis legal analysis of managerial actions human rights and discrimination studies

5.4 GUIDELINES FOR PREPARING A RESEARCH REPORT

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

Title and Title Page

The title should reflect the content and emphasis of the project described in the report. It should be as short as possible and include essential key words.

Abstract

The abstract should, in the briefest terms possible, describe the topic, the scope, the principal findings, and the conclusions. It should be written last to reflect accurately the content of the report. The length of abstracts varies but it should not exceed 200 words.

Introduction

The nature of the problem and why it is of interest should be conveyed in the opening paragraphs. This section should describe clearly but briefly the background information on the problem, what has been done before (with proper literature citations), and the objectives of the current project. A clear relationship between the current project and the scope and limitations of earlier work should be made so that the reasons for the project and the approach used will be understood.

Experimental Details or Theoretical Analysis

In theoretical reports, this section would include sufficient theoretical or mathematical analysis to enable derivations and numerical results to be checked..

If the experimental section is lengthy and detailed, as in synthetic work, it can be placed at the end of the report or as an appendix so that it does not interrupt the conceptual flow of the report. Its placement will depend on the nature of the project and the discretion of the writer.

Results

In this section, relevant data, observations, and findings are summarized. Tabulation of data, equations, charts, and figures can be used effectively to present results clearly and concisely. Schemes to show reaction sequences may be used here or elsewhere in the report.

Discussion

The difficulty of the report is to analysis and interpretation of the results. What do the results mean? How do they relate to the objectives of the project? To what extent have they resolved the problem? Because the "Results" and "Discussion" sections are interrelated, they can often be combined as one section.

Conclusions and Summary

Summary refers to the concise statement or account of the key points of a text, research or essay. The conclusion is that section of the text, essay or book which serves as the final answer to the research question. To outline a vital points to arrive at a decision or by judgment giving a reason to it

References

Literature references should be collated at the end of the report.

5.5 Preparation of Written Report

What is a report?

A report is a written document that presents the results of an investigation, project or initiative. It can also be an in-depth analysis of a particular issue or data set.

Purpose of Report

The purpose of a report is to inform, educate and present options and recommendations for future action. Reports are an integral element of dozens of industries, including science, tech, health care, criminal justice, business and academia.

Reports typically consist of several key elements, including:

- Detailed summaries of events or activities
- Analysis of the impact of the event

- Evaluations of the facts and data
- Predictions for what may happen as a result of an event
- Recommendation for next course of action
- Conclusion

How to draft a Written Report? Typing Instruction

Here are some steps to follow when writing a report:

1. Decide on terms of reference

Many formal reports include a section that details the document's "terms of reference" (or ToR). These terms include:

- What the report is about
- Why it's necessary
- When it was written
- What its purpose is

Setting these terms helps both the writer and their readers to understand why the report is important and what it hopes to accomplish. The terms of reference are usually explained in the first paragraph so that the reader can determine their relevance without having to read the entire document.

2. Conduct your research

Most reports will require you to collect a store of data that directly relates to your topic. You're tasked with analyzing an issue and/or investigating an event, you'll likely need to spend some time requesting, finding and organizing data.

Interpreting data and formatting it in a way your readers will understand and follow is an important part of writing a report. For your report, you may need to create charts, graphs or timelines that make your raw information easier to comprehend. You'll also need to carefully cite your sources and keep track of where and how you found your report's data to present it professionally.

3. Create a report outline

`The next step in writing a report is to construct your report's outline. This typically looks like a bulleted or numbered list of all the different sections in the document. Your report's outline might look similar to this:

- Title page
- Table of contents
- Introduction
- Terms of reference
- Summary of procedure
- Findings
- Analysis
- Conclusion
- References or bibliography

The most important thing to do when writing your outline is to include all the necessary sections and eliminate anything that does not directly contribute to the report's purpose.

4. Write the first draft

Writing the first draft of your report is one of the most important stages of constructing a successful one. The purpose of the first draft is not to write a perfect document, but rather to get all the main points of your information out of your head and onto the page. You'll have time to add to and edit this first attempt, so your primary goal is just to organize your data and analysis into a rough draft that will eventually become a final product.

While writing your report's first draft, you'll likely find gaps in your data or holes in your analysis. Make note of these issues, but don't try addressing them as you write. Instead, finish the draft and save problem-solving for when you begin the editing process.

5. Analyze data and record findings

The focus of every report is the "findings" section, i.e., the part where you present your interpretation of the data.

The findings section should always provide valuable information related to the topic or issue you're addressing, even if the results are less than ideal. If you conclude that the data was insufficient or the research method was flawed, you'll need to explain this professionally and accurately.

6. Recommend a course of action

The final section of your report's body is your recommendation(s). After examining the data and analyzing any outcomes, you're qualified to present an idea as to what actions should be taken in response to your findings

7. Edit and distribute the report

The final stage of writing a report is editing it thoroughly and distributing it to your audience. You'll need to edit for grammar mistakes, spelling errors and typing mistakes. You'll also need to double-check your data, make sure your citations are correct and read over the entire document to ensure it presents a cohesive narrative.

Distributing the report can take different forms depending on your particular occupation. You might email it to your supervisor, present it verbally during a staff meeting or publish it in a journal. Regardless of how or where it's read, your goal is always to create a concise, informative and effective document that will contribute to increased productivity in your workplace.

6.1 Preparation of Oral Report

What is oral report?

An oral report is a presentation in which you speak to an audience about a topic. You will only have a certain amount of time to talk, so you'll have to pick and choose the most important points you want to make.

Types of Oral Report

Informal oral reports are generally characterized by small-group settings with a high degree of audience interaction and a relaxed manner of delivery and dress. An informal oral report might be an impromptu presentation. Informal oral presentations can foster the free exchange of ideas and be important for producing action items.

A formal oral report is distinguished by its adherence to an agreed-upon format or outline. Formal oral reports are usually prepared well in advance of presentation and are therefore well rehearsed. Your manner of delivery is extremely important in a formal oral report situation. Audience interaction is generally limited to the question and answer period at the conclusion of your report.

Oral Report Guidelines Process

- **Thesis**

Every presentation should have a thesis statement. Tell the audience in the first minute or so what you plan to do in the presentation. Often this will be exactly the same thesis used in a written research paper that is associated with your presentation, but sometimes the presentation will have a narrower focus due to time limitations.

- **Time**

Typically a scholarly presentation at a professional meeting is 20 minutes. Oral reports may be 20 minutes, but they also may be as short as 5 minutes. Make sure you understand the time limits. You must practice your written presentation and time it.

- **Development of the topic**

If your presentation is 15-20 minutes, you need to demonstrate that you are familiar with the scholarly sources you have consulted. For your main points, clearly identify the source of your information; this does not mean that you need to mention a source for every statement you make. Organize your points to create a clear and logical discussion. As you develop your topic, make sure that you are creating a persuasive discussion.

- **Reading your presentation**

The model for an oral presentation is what happens at a scholarly meeting: the presentation is read. You should not use as a model a classroom lecture, which has a less structured quality so an instructor can have discussion. In writing your presentation, use clear language and clear sentences. Often shorter sentences work better in this format.

- **Pronunciation**

Many times artist's names, technical terms, and foreign language terms used in art history are difficult to pronounce. Practice these words so you can say them with confidence when giving your presentation.

- **Imagery**

Presentations in art history should be about images. When you plan a presentation, think about what the imagery will be, and then construct your text to support the imagery. If you find you have long paragraphs about "background" and introductory material, unrelated to an image on the screen, you should rethink how effective that is. It is wise to have something in your written document reminding you when to change slides.

- **Quality of Imagery**

Get the best quality images you can locate. Don’t just assume the first one that pops up in a search is the best one. Some websites have pretty good images. Scanned images from books generally do not look as good as those from the internet.

- **Variety of Imagery**

Think about how the layout of your slides will help to make your points. Use details beside the whole work, or put two works you want to compare side by side. Use the Power-point tools to do things like circle details on slides.

- **Quality of Power-Points**

In making your PowerPoint presentation, “less is more” in terms of slide design is best. The emphasis should be on the art images. Use a black background, and put labeling information in white lettering at 18 pt. Avoid fancy backgrounds, strange fonts, and anything else that would detract from the imagery. Check spelling and dates as carefully as you would in a written paper.

- **First and last slides**

Unless your instructor tells you otherwise, your first slide should list the title of your presentation, your name, and the date. You do not need any special slide at the end saying something like “The End” or “Thank You.” Your last slide should be the image or images you most want the audience to remember from your presentation.

- **Presenting yourself**

Be on time where your presentation is to take place. Present yourself professionally. Use appropriate language, not slang. Speak clearly and slowly so you can be understood. Practicing in advance is essential. When appropriate, use the laser pointer to show the audience a detail that is important.

Basic Outline for an Oral Design Review

1. Opening:

a) Title: Prepare overheads showing

Title of project and project investigators, managers, date, and type of report

b) Introduction: Prepare overheads showing

Motivating problem and need for investigation, statement of objective

c) Body: Present overheads showing:

- Present state of planning and final experimental designs
- Any major changes in approach or design (significant questions raised and how you have resolved them)
- Working drawings of experimental apparatus
- Final test matrices

2. Closing: Prepare overheads showing:

a) Final list of materials needed

b) Status of equipment procurement

c) Final time schedule for completion of project