Master of Business Administration (MBA)

BUSINESS RESEARCH METHODOLOGY

Semester-II

Author- Dr. Swati Mishra

SURESH GYAN VIHAR UNIVERSITY
Centre for Distance and Online Education
Mahal, Jagatpura, Jaipur-302025

EDITORIAL BOARD (CDOE, SGVU)

Published by:

S. B. Prakashan Pvt. Ltd.

WZ-6, Lajwanti Garden, New Delhi: 110046

Tel.: (011) 28520627 | Ph.: 9625993408

Email: info@sbprakashan.com | Web.: www.sbprakashan.com

Designed & Graphic by : S. B. Prakashan Pvt. Ltd.

Printed at :

INDEX

Learning Outcomes

The student will be able to understand:

Unit I

- Understand the importance of research in business and its significance in decision-making processes.
- Explain the process of research, including the various steps involved from problem identification to data analysis and interpretation.
- Identify the key characteristics of research, such as systematic inquiry, objectivity, and replicability.
- Recognize the qualities of a good researcher, including critical thinking, attention to detail, and ethical conduct.

Unit II

- Recognize the importance of a research design in guiding the overall research process and ensuring the validity and reliability of study outcomes.
- Understand the major types of research designs, including experimental, quasi-experimental, correlational, descriptive, and exploratory designs.
- Identify the need for a research design in establishing a clear framework for conducting research and addressing research questions.

Unit III

- Understand the sources of data available for research, including primary and secondary sources.
- Define primary data and identify various sources of primary data, such as surveys, interviews, observations, and experiments.
- Describe the sampling process, including defining the target population, selecting a sampling method, determining the sample size, and collecting data from the sample.
- Discuss the factors influencing the determination of sample size, such as population size, variability, confidence level, and margin of error.

Unit IV

- Understand the principles and objectives of qualitative research and its relevance in various fields such as social sciences, psychology, and business.
- Develop skills in data collection and analysis within a qualitative research framework, including the ability to interpret and make meaning from non-numerical data.
- Demonstrate knowledge of hypothesis testing concepts, including Type I and Type II errors, and understand their implications for research outcomes.

Unit V

- Understand the purpose and importance of report writing in academic and professional contexts.
- Demonstrate knowledge of the guidelines and structure for different parts of a thesis or dissertation, including the introduction, literature review, methodology, results, discussion, and conclusion.
- Apply critical thinking and analytical skills to evaluate and synthesize information from various sources to support arguments and conclusions in the report.

BUSINESS RESEARCH METHODOLOGY

SYLLABUS

UNIT I

BUSINESS RESEARCH METHODS

Introduction - Importance of Research, Process of Research, Characteristics of Research , Qualities of Good Researcher , Characteristics of Researcher , Types of Research , Variables - Hypothesis , Parameters of Good Hypothesis Defining Research Problem Introduction , Types of research problem , Sources of problems for investigation, Features of good research statement, Asking analytical questions about the research problem , Precaution in formulating research problem , The question hierarchy: how ambiguous questions become actionable research , Literature Review , Research Proposal , Format of Research Proposal .

UNIT II

GENERALIZATION IN RESEARCH

Introduction, Validity and Reliability in Quantitative Studies, Validity, Reliability, Difference between Validity and Reliability. Research Plan Introduction, need for Research Design, Major Types of Research Designs, Features of Good Research Design, Nine Essential Research Design Parameters

UNIT III

DATA COLLECTION

Sources of Data, Primary Data, Sources of Primary Data, Advantages and Disadvantages of Primary Data, Secondary Data, The problems of Secondary Sources, Sources of Secondary Data, Advantages and Disadvantages of Secondary Data. Sampling Techniques Introduction, Reason for Sampling Instead of Census, Sampling Process, Type of Sampling, Sampling Size Determination, Sampling Error

UNIT IV

QUALITATIVE RESEARCH

Introduction, Qualitative Research, Techniques for Qualitative Research, Quantitative Research, Techniques for Quantitative Research, Difference between Quantitative and Qualitative Research Approach. Quantitative Research Definition of Quantitative Methods, Testing of Hypothesis, Type I and Type II Error, Techniques for Quantitative Data Analysis, Mean, Standard Deviation, Testing for Significant Differences between Two Means Using the t-Test - (Independent Groups), Testing for Significant Differences between Two Means Using the t-test - (Dependent groups), Testing for Differences between Means Using One-Way Analysis of Variance - (ANOVA), Correlation Coefficient.

UNIT V

REPORT WRITING

Introduction, Guideline for different parts of a thesis or a dissertation. Use Of Computer Software In Data Analysis Introduction, Frequency distributions, Data Analysis, Analyzing Frequencies: Chisquare, Comparing two groups using T-tests, Paired T-tests, Non- parametric - Two independent groups: Mann-Whitney U, Paired groups: Wilcoxon Signed Rank Test Nonparametric: Spearman' s rho, Comparing Multiple Groups – Parametric One-Way Analysis of Variance (ANOVA).

UNIT I

BUSINESS RESEARCH METHODS

STRUCTURE

NOTES

1.1 LEARNING OBJECTIVE

After completing this chapter, you will get updated about theoretical foundation of Research

- Its Importance.
- Its Essence, objective, features, function.
- Stages of research.

1.2 INTRODUCTION

Research design is a kind of blueprint that you prepare before actually carrying out research. It is a systematically prepared outline stating the manner in which you plan to carry out your research. You may like to contemplate your research in terms of two facets, namely the inter facet and the analytical facet. The two facets remain in your mind together while in practical terms you may piian your research in terms of a phase of data collection and another phase of analyzing the data.

The theoretical nature and models of ideas in your mind help you determine the type of data you will collect and to some extent and how you will collect it. Later, while analyzing your data, and your understanding of the theory and concept of social realities will generally guide you to break down data and see patterns to explain and present your findings. Research is an ongoing process that involves a series of steps, which begin by identifying the various concepts related to your research theme. Once started, it continues with a set of controlled steps until its conclusion. it is about the steps you take in your research design. We will discuss each of the ten most common steps that often cover the basics of social science research. In your work of creating a small research project, you may be preparing a research project.

1.3 MEANING OF RESEARCH

Research is a process of systematic inquiry that entails collection of data; documentation of critical information; and analysis and interpretation of that data/information, in accordance with suitable methodologies set by specific professional fields and academic disciplines.

Research is defined as careful consideration of study regarding a particular concern or problem using scientific methods.

According to the American sociologist Earl Robert Babbie, "research is a systematic inquiry to describe, explain, predict, and control the observed phenomenon Research is conducted with a purpose to:

- Identify potential and new customers
- Understand existing customers
- Set pragmatic goals
- Develop productive market strategies
- Address business challenges
- Put together a business expansion plan

- Identify new business opportunities

Research is conducted to...

- Evaluate the validity of a hypothesis or an interpretive framework.
- To assemble a body of substantive knowledge and findings for sharing them in appropriate manners.
- To help generate questions for further inquiries.

Research is a systematic process of research that involves data collection; texts for important information; and the analysis and interpretation of that data / information, in accordance with the appropriate procedures set by the specific professional fields and fields of study.

1.4 CHARACTERISTICS OF RESEARCH

1. **Systematic Process**
   Research is a systematic process that focuses on investigating and discovering new facts. This process should follow a logical sequence to get the best result. All steps should go in the right order and should not be done in a random way. All steps are sequenced and connected.
2. **Valid and Verifiable**
   Valid and verifiable conclusion is must for every research project undertaken. Findings of research process should be logical and based on correct and fair information. Researchers collecting various information for analysis purposes should ensure that its source is genuine and accurate. It should be easily verifiable by researcher himself and others.
3. **Cyclical Nature**
   The research process is a natural cycle. It begins with a research question that explains the main purpose of the research project and ends with a variety of questions from the research conclusion. Most of the time, research findings raise a number of new questions in people's minds.
4. **Critical**
   Critical research and analysis of available information and methods should be used to conduct better research. Researchers need to make an informed choice during this process. They should not be biased and judgmental when conducting research. The procedures and method used must be able to withstand critical scrutiny.
5. **Generalization**
   Generalization refers to the ability to apply the results to a large portion of the population. In the research term, it simply means how far the finding of research can be applied to the large population. Researcher generally chooses a small sample termed as target population out of whole large population for his analysis and research purpose. This target population is the representative of the whole population and in the same say, sample findings are also termed as the findings of the whole population. Research is called generalizable if the findings of the sample can be applied to any portion or sample of the whole population.

NOTES 

1.5 IMPORTANCE

1. **To find out the real facts-**
   As we know, every type of research has its own purpose but the basic purpose of research is always to find or obtain information from markets and communities and the number of respondents. The researcher examines or obtains accurate or specific information about our queries related to the problem.
2. **To achieve the new thoughts-**
   The first aim of the research is to find out the information and then evaluate them in an appropriate or efficient manner so that they can easily design the research problem and solve them also. A researcher evaluates the information through various scientific approaches and methods, statistical analysis and procedures, and another type of tables and graphs.
3. **To evaluate the information-**
   The primary purpose of research is to find information and evaluate it appropriately or effectively so that they can easily design a research problem and solve it.

   The researcher examines information using various scientific methods and methods, analyzes statistics and processes, and other types of tables and graphs.
4. **To test a hypothesis-**
   In this the researcher does the causal relationship between the variables (it can also be said that the hypothesis testing research studies). The hypothesis testing study represents the number of actions like these terms:

   a. Making a formal statement,

   b. Selecting a significance level,

   c. Deciding the distribution use,

   d. Selecting a random sample and computing an appropriate value,

   e. Calculation of the probability,

   f. Comparing the probability.
5. **To design or implement the research-**
   After collecting all the information, the researcher prepares the company's research design framework so that it can easily explain or identify the structure of a particular research topic. Research projects can be categorized into two types such as experimental projects and non-experimental projects.

   After the structure of the research design, the researcher implements them in a problem and find out the optimum factor to solve them.
6. **To improve the understanding-**
   In this case the researcher helps to develop an understanding of a particular topic by asking what else needs to be proved before the study becomes objective, any information that can be incorporated into a more focused study, or analysis of existing findings

NOTES 

1.6 RESEARCH PROCESS

Step – 1: Identifying the Problem

The first and foremost task in the entire process of scientific research is to identify a research problem.

A well-identified problem will lead the researcher to accomplish all-important phases of the research process, starting from setting objectives to the selection of the research methodology. But the core question is: whether all problems require research. We have countless problems around us, but all that we encounter do not qualify as research problems, and thus, these do not need to be researched.

Keeping this point in view, we must draw a line between a research problem and a non-research problem.

Step – 2: Reviewing of Literature

Appropriate literature reviews are an important part of the research process. It enables the researcher to establish his or her problem by following some of the areas of interest that have not yet been explored.

Such a review not only provides him with exposure to a larger body of information but also equips him with advanced knowledge to effectively follow the research process.

By reviewing relevant literature, the researcher may develop a correlation between the results of his research and those of others.

Step – 3: Setting research questions, objectives, and hypotheses

After identifying and describing the research problem, researchers should make a formal statement of the problem leading to the research objectives.

The policy will specify what should be researched, define the type of information to be collected, and provide a comprehensive framework for research. The best presentation of the research objective is a well-structured, experimental concept of research.

A hypothesis is an unconfirmed statement or suggestion that can be refuted or based on evidence data. The fictional statements confirm the possible answer to the research question.

Step - 4: Choosing the study design

The **research design** is the blueprint or framework for fulfilling objectives and answering research questions.

It is a master plan specifying the methods and procedures for collecting, processing, and analyzing the collected data. There are four basic research designs that a researcher can use to conduct his or her study;

1. Survey,
2. Experiment,
3. Secondary data study, and
4. Observational study

NOTES 

Step – 5: Deciding on the sample design

Sampling is an important and separate step in the research process. The basic idea of sampling is that it involves any procedure that uses a relatively small number of items or portions (called a **sample**) of a universe (called **population**) to conclude the whole population.

It contrasts with the process of complete enumeration, in which every member of the population is included. Such a complete enumeration is referred to as census.

Step – 6: Collecting data

- Data collection may range from simple observations to major surveys in any population. There are many ways to collect data.
- The method chosen depends on the research objectives, research design, and availability of time, money, and staff.
- Depending on the type of data (quality or amount) to be collected, the method of data collection also varies.
- The most common way to collect quantity data is systematic discussion.

Step-7: Processing and Analyzing Data

- Data processing usually begins with editing and encoding data. Data is organized to ensure consistency in all respondents and to find omissions, if any.
- In survey data, editing reduces recording errors, improves eligibility, and clarifies vague and inappropriate responses. In addition to editing, data also requires coding.
- Because it is not possible to put raw data in a report, alphabetical codes and numbers are used to reduce responses into manageable forms for storage and processing in the future.

Step-8: Writing the report –

- Develop research proposals, write reports, publicize and apply results.
- The complete work of the research study is collected in a document called the proposal.
- A research proposal is an action plan, prospectus, outline, proposal, intention or commitment statement made by an individual researcher or organization to produce a product or provide service to a potential customer or sponsor.
- The proposal is prepared keeping in view the sequence presented in the research process. The proposal tells us what, how, where and for whom it will be done.
- The benefit of doing so should also be shown. It always involves the purpose of the study (research objectives) or the definition of the problem.
- It systematically describes a specific research methodology and describes the approaches used at each stage of the research process.

1.7 QUALITIES OF GOOD RESEARCHER

1. 1 He should be a votary of truth; truth should be his goal.

NOTES 

2. He should be able to dispel prejudice. He should not conceive any pre-conceived notion; rather he should maintain objectivity while gathering information
3. The researcher should be capable of gathering accurate and in-depth information from the respondents.
4. The researcher should be a keen observer of the phenomena and should not be complacent with approximates.
5. He should always maintain precision and must try to avoid unnecessary details.
6. He must analyze and interpret the collected information with a positive spirit and in the proper sense, notwithstanding his personal requirement or benefit.
7. As a scientific genius, the research investigator must be adequately sensitive to difficulties "Where less gifted people pass by untroubled by doubt."
8. He should be in possession of sufficient moral courage to face the difficult situation and should not be discouraged due to non-cooperation of the respondents or nature of the research problem under investigation.
9. The researcher should be able to utilize his time properly in a balanced manner.
10. While making generalizations, the researcher must cautiously bear in mind that there is no short cut to truth. Therefore, he must wait to obtain complete data and always eschew hasty statement. As a scientific man, says Karl Pearson, he should strive at self-elimination in his judgment to provide an argument which is true for each individual mind as for his own.
11. A good researcher is always apathetic to the approval or disapproval of society. Rather, he should be bold enough to present his findings of research to the society, notwithstanding its disapproval.
12. The researcher should be conceptually clear. He should use the terms uniformly and appropriately. Otherwise, his whole exercise will be defective.
13. The researcher should not only be careful in selecting the research tools but also properly trained so as to use these tools to procure reliable and valid data.
14. The researcher should also develop proper communicative skill and the ability to establish rapport with the respondents so as to elicit proper response.
15. Knowledge in the language of the respondents will be of immense help for the researcher. This will enable him not only to communicate the questions properly but also to cognize the responses properly.
16. Awareness of the possible drawbacks and shortcomings of research is very essential on the part of a good researcher. By knowing it before, the researcher may try to minimize such problems, although it is well high impossible to claim complete perfection of a research work.
17. A good researcher will always be well behaved and well clad. These qualities will attract the respondents towards him; sufficiently motivate them to produce necessary information required for the purpose of research.

NOTES 

1.7 CHARACTERISTICS OF RESEARCHER

1. **Accuracy:**
   A researcher must ensure that his research work is accurate. He should ensure that the facts and figures which he is presenting are true and verifiable. There should be no room for conjecture or guesses.
2. **Open mindedness:**
   To explain how powerful the mind is, **Albert Einstein** once said that the measure of intelligence is the ability to change the mind. It is one of the most important characteristics of a good researcher because researching has to do with finding new fact which may sometimes require that the researchers alter previously valid facts.
3. **Motivation**
   A researcher must have the ability to motivate himself to work. He should not be easily discouraged. In the course of his research, he might come across some hostile respondents. This should not deter him from carrying on his research work.
4. **Patience**
   One of the sterling attributes of a good researcher is patience. This quality is a follow-up attribute to being motivated. A researcher must exhibit a high degree of patience, both with his respondents and in the course of his research when the much-needed result is not forthcoming, in addition to his being consistent with the effort he puts in.
5. **Prudence**
   The quality of being prudent has to do with his ability to manage the resources at his disposal. Research is a capital-intensive project and there are possibilities that one might not be well funded to carry out such project
6. **Expertise:**
   Though the aim of research is to add knowledge to already existing knowledge (as one ventures into new areas not yet explored), the researcher must have reasonable amount of knowledge in the field he intends carrying out his research
7. **Interest**
   A researcher must show sufficient interest in the work he is doing. He should not be distracted. His interest should be focused on the work. This is quite different from being motivated. This is because it is the interest one has in a task that keeps him motivated.
8. **Amiable Personality**
   A researcher must have a friendly disposition. He should be easily approachable and should also have the ability to communicate with people in a friendly and coherent manner. A researcher that is unfriendly, gloomy and unapproachable may find it difficult extracting information from his respondents.

1.9 TYPES OF RESEARCH

1. **Fundamental research**
   Basic, or basic, research is designed to help researchers better understand certain

phenomena in the world; It looks at how things work. This research seeks to broaden your understanding and broaden scientific theories and explanations.

2. **Applied research**
   Applied research is designed to identify solutions to specific problems or to find answers to specific questions. Research is intended to provide knowledge that is applicable and applicable. For example, applied research may include the study of ways to increase student participation in the classroom. This research focuses on the problem being defined and the solution based.

3. **Qualitative research**
   Qualitative research involves nonnumerical data, such as opinions and literature. Examples of qualitative data may include:

   - Focus groups
   - Surveys
   - Participant comments
   - Observations
   - Interviews

4. **Quantitative research**
   Quantitative research is based on numerical data such as statistics and measurements. For example, a car manufacturer may compare the number of red sedan sales compared to the white sedan. Uses objective data — red and white sedan sales data — to formulate research conclusions.

5. **Mixed research**
   Combined research involves both qualitative and quantitative data. Compare sales of car sedans. After purchasing a red or white sedan, the company may also ask car buyers to complete a survey asking how much color their decision and other opinion-based questions have been influenced by.

6. **Exploratory research**
   Exploratory research is designed to examine what is already known about a topic and what additional information may be relevant. It rarely answers a specific question, but introduces a basic knowledge of a topic as a precursor to further research. Often, exploratory research is applied to lesser-known problems and phenomena.

8. **Longitudinal research**
   Longitudinal research focuses on how specific dimensions change over time without changing any variables. For example, a researcher may look at how employee satisfaction changes in the same company after one year, three years, and five years.

9. **Cross-sectional research**
   Cross-sectional research is the study of a group or sub-group at a time. Participants are usually selected based on certain sharing characteristics, such as age, gender, or income, and researchers examine similarities and differences between groups and within. Groups are often used to represent large populations. Similar to longitudinal research, researchers observe participants without changing variables.

NOTES 

10. Field research

Field research takes place wherever participants or subjects are "in place". This type of research requires onsite scrutiny and data collection. For example, a manufacturing plant may hire an environmental engineering firm to test the air quality in the plant to meet all health and safety requirements. Researchers will go to the plant to collect samples

11. Laboratory research

Laboratory research takes place in a controlled laboratory setting rather than in a field. Often, the study requires strict adherence to certain conditions, such as the removal of variables or time conditions. Laboratory research involves chemical experiments and drug research

12. Action research

Action research refers to the process of examining your actions, evaluating their effectiveness in bringing about the desired results, and choosing the course of action based on your results. Action research is commonly used in educational settings for teachers and principals to improve a kind of self-assessment and curriculum.

13. Policy research

Policy research is designed to examine the implications of current government or social policies or to assess the potential implications of the proposed approaches to the distribution or redistribution of resources.

1.10 MEANING OF HYPOTHESIS

Hypothesis (plural hypothesis) is a proposed explanation for a phenomenon. Logical speculation for hypothesis. These are logical strategies that need to be tested. Most researchers have developed logical hypotheses based on previous assumptions that cannot be adequately explained with accessible logical hypotheses.

Although the term "hypothesis" is in common use. Similarly, logical hypothesis is not the same as scientific hypothesis. The work hypothesis is a tentatively accepted hypothesis that is proposed for additional exploration in a cycle beginning with an informed assessment or observation.

Hypothesis is an assumption based on some evidence. This is the starting point for any research that turns research questions into expectations. It consists of components such as variables, population and the relationship between variables. The research hypothesis is a hypothesis used to test the relationship between two or more variables.

Characteristics of Hypothesis

Following are the characteristics of the hypothesis:

1. The theory ought to be clear and exact to believe it to be solid.
2. If the hypothesis is a social theory, at that point it ought to express the connection between factors.
3. The theory must be explicit and ought to have scope for leading more tests.

4. The method of clarification of the theory must be basic and it should likewise be perceived that the straightforwardness of the hypothesis isn't identified with its essentialness.

Sources of Hypothesis

Following are the sources of hypothesis:

- The resemblance between the phenomenon.
- Observations from past studies, present-day experiences and from the competitors.
- Scientific theories.
- General patterns that influence the thinking process of people.

Sources of Observation

1. The likeness between the wonder.
2. Observations from past investigations, present-day encounters and from the contenders.
3. Scientific hypothesis.
4. General designs that impact the considering cycle individuals.

Examples of Hypothesis

Following are the examples of hypothesis based on their types:

- Consumption of sugary drinks every day leads to obesity is an example of a simple hypothesis.
- All lilies have the same number of petals is an example of a null hypothesis.
- If a person gets 7 hours of sleep, then he will feel less fatigue than if he sleeps less.

Functions of Hypothesis

Following are the functions performed by the hypothesis:

- Hypothesis helps in making an observation and experiments possible.
- It becomes the start point for the investigation.
- Hypothesis helps in verifying the observations.
- It helps in directing the inquiries in the right directions.

How will Hypothesis help in Scientific Method?

Researchers use hypothesis to put down their thoughts directing how the experiment would take place. Following are the steps that are involved in the scientific method:

- Formation of question
- Doing background research
- Creation of hypothesis
- Designing an experiment
- Collection of data

NOTES

- Result analysis
- Summarizing the experiment
- Communicating the results

1.11 TYPES OF HYPOTHESES

There are six forms of the hypothesis and they are:

1. Simple hypothesis
2. Complex hypothesis
3. Directional hypothesis
4. Non-directional hypothesis
5. Null hypothesis
6. Associative and casual hypothesis

1. **Simple Hypothesis**
   It shows a connection between one ward variable and a solitary autonomous variable. For instance, If you eat more vegetables, you will get in shape quicker. Here, eating more vegetables is a free factor, while getting more fit is the needy variable.

2. **Complex Hypothesis**
   It shows the relationship between at least two ward factors and at least two autonomous factors. Eating more vegetables and natural products will help you lose weight. May have glowing skin, reduces the risk of many infections, for example, coronary heart disease, hypertension and some diseases

3. **Directional Hypothesis**
   It shows how an analyst is a scholar and focuses on a specific outcome. Relationships between factors can also predict its inclination. For example, four-year-olds who take the right diet over a five-year period have higher IQ levels than young people who do not eat legal meals. It shows the course of effect and impact.

4. **Non-directional Hypothesis**
   It is utilized when there is no theory included. It is an explanation that a relationship exists between two factors, without foreseeing the specific nature (course) of the relationship.

5. **Null Hypothesis**
   It gives the explanation which is in opposition to the theory. It's a negative assertion, and there is no connection between autonomous and subordinate factors. The image is indicated by "HO".

6. **Associative and Causal Hypothesis**
   Acquainted hypothesis happens when there is an adjustment in one variable bringing about an adjustment in the other variable. Though, the causal hypothesis proposes a circumstances and logical results connection between at least two factors.

NOTES 

1.12 PARAMETER OF GOOD HYPOTHESIS

A good hypothesis possesses the following certain attributes.

1. **Power of Prediction**
   The valuable quality of a good hypothesis is to make predictions for the future. It not only eliminates the current problematic situation but also predicts the future of what will happen in the coming period. Therefore, hypothesis is the best guide to research activities due to the power of hypothesis.
2. **Closest to observable things**
   The hypothesis must be closely related to the observable things. It does not trust Hawaiian palaces but is based on observation. Hypotheses are not made for things and things we do not notice. The validation of the hypothesis depends on the factors under consideration.
3. **Simplicity**
   A hypothesis should be very pathetic to every commoner, "the hypothesis would be simpler if the researcher had more focus on the problem," PV Young said. "A hypothesis should be as sharp as a razor blade," W-Ocean said. Therefore, a good hypothesis should be simple and have no complications.
4. **Clarity**
   A hypothesis must be conceptually clear. It should be clear from ambiguous information's. The terminology used in it must be clear and acceptable to everyone.
5. **Testability**
   A good hypothesis should be tested empirically. It should be stated and formulated after verification and deep observation. Thus testability is the primary feature of a good hypothesis.
6. **Relevant to Problem**
   If a hypothesis is relevant to a particular problem, it would be considered as good one. A hypothesis is guidance for the identification and solution of the problem, so it must be accordance to the problem.
7. **Specific**
   It should be formulated for a particular and specific problem. It should not include generalization. If generalization exists, then a hypothesis cannot reach to the correct conclusions.
8. **Relevant to available Techniques**
   Hypothesis must be relevant to the techniques which is available for testing. A researcher must know about the workable techniques before formulating a hypothesis.
9. **Fruitful for new Discoveries**
   It should be able to provide new suggestions and ways of knowledge. It must create new discoveries of knowledge J.S. Mill, one of the eminent researchers says that "Hypothesis is the best source of new knowledge it creates new ways of discoveries".

NOTES 

10. Consistency & Harmony

Internal harmony and stability are the hallmarks of a good hypothesis. It must be free from contradictions and conflicts. There should be a close relationship between the variables that depend on each other.

1.13 WHAT IS RESEARCH PROBLEM

The research problem refers to certain difficulties that the researcher experiences in a theoretical or practical situation and seeks to find a solution to it. Another definition of a research problem is a question sentence or statement that asks what the relationship is between two or more variables. Identification of a research problem is the first and most important step in the research process, usually a wide area selection. The broader topic is limited and confined to a specific sentence which is a statement of the problem.

In other words, a research problem is a specific problem, difficulty, conflict, or gap that you aim to solve in your research.

Purpose of research problem

Research problem serve the following purpose

- It presents the importance of research topic
- It helps the researcher place the problem in the specific context to properly define the parameters of the investigation
- It provides the framework that can help in presenting the results in the future

1.14 CHARACTERISTICS OF RESEARCH PROBLEM

- The variables in the problem must be clear
- It should be limited in scope and should be specific,
- It must have a goal
- It should be free from ethical constraints
- Good research problems must be researchable.
- The researcher should be able to state the research problem clearly and concisely
- The research problem should be able to generate research questions
- It should relate to one or more academic field of study
- It should be able to be researched within the time frame or the given budget
- Adequate data must be available or available to support a solution to a research problem and to formulate conclusions. Since research requires data, it is important during planning that researcher analyze in advance whether data related to the research problem can be obtained. If not, research should change the problem. For example, if your research problem deals with confidential or highly confidential data, you may fail to obtain the required data because they are limited, even if you decide to pursue your chosen research problem. Therefore, your research will fail to form conclusions about the problem.

NOTES 

- The research problem should be new that is not yet answered sufficiently by other researchers
- The research problem must base on the available research literature
- Good research problem should be grounded on solid theory or conceptual framework

1.15 TYPES OF RESEARCH PROBLEM

1. **Descriptive research problems**
   Detailed research issues 'What is it?' Questions, whose main purpose is to describe the state, condition or presence of a particular event. They try to represent what already exists in a group or population. Surveys and opinion polls are well suited for such studies as they require systematic consideration of social issues. When a study is basically designed to describe what is happening or what exists. Polls that describe only the proportion of people who have different opinions are primarily descriptive in nature. For example, if we wanted to know what percentage of the population would vote for a Democrat or a Republican in the next presidential election, we would only be interested in explaining something.
2. **Causal research problems**
   Causal research issues focus on identifying the scope and nature of cause-and-effect relationships. Such research issues can help assess the impact of some changes on existing regulations and policies. Thus, they identify patterns of relationships between different elements. When a study is designed to determine if one or more variables (eg, a program or treatment variable) cause or affect one or more outcome variables. If we conduct a referendum to find out whether the recent political advertising campaign has changed voter preferences, we must study whether the campaign (s) have changed the proportion of voters voting for Democratic or Republican (influence).
3. **Relational research problem**
   This research problem suggests that any relationship between the two variables needs to be investigated. The goal is to examine features or characteristics that are somehow connected. When a study is designed to look at the relationship between two or more variables. The poll, which compares the proportion of women who say they will vote for a Democratic or Republican candidate in the next presidential election, studies the relationship between gender and voting preference in particular.

1.16 WHAT ARE SOURCES OF RESEARCH PROBLEM?

1. **Interviews**
   Interview sessions are an important source of research issues. This method allows for formal discussions and informal interactions with individuals who can provide useful insights into research and make it more relevant to future research.

   Consider discussing with experts in the area you would like to investigate. These professionals can be health care providers, business leaders, teachers, social workers, lawyers and accountants, but a few examples can be cited.

NOTES 

By interacting with these experts, you will be able to identify real-world issues that are being overlooked or under-reported by researchers at the academy.

In addition, interview sessions give you the opportunity to gain some practical knowledge that will help you in designing and conducting your studies.

2. **Personal Experiences**
   Your daily experiences are a good source for a research problem.

   You need to think critically about your personal experiences about an issue that affects your family, your personal life or your community. The research problem that arises from personal experience can arise from any problem and from anywhere.

   For example, you can create a research problem from events that are not normal or immediately apparent from community relationships.

3. **Deductions from Theory**
   Deviation from theory refers to the conclusion that the researcher makes from the generalization of life in a society well known to the researcher.

   A researcher takes the deductions, puts them into an empirical framework, and then, based on a theory, comes up with a hypothesis that they suggest specific conclusions based on the research problem and the empirical results given.

   Observing research accounts related to whether or not a theory captures the state of a substance. Next is the systematic research, which evaluates whether empirical information confirms or refutes the hypothesis.

4. **Interdisciplinary Perspective**
   If you are considering an interdisciplinary perspective to identify the problem for research study, you should look at scholarship and academic moves from outside your main inquiry area.

   It is an intellectually involved process that requires reviewing relevant literature to find specific avenues of exploration for analysis.

   The advantage of using this approach to identify a research problem for your research paper assignment is that it gives you the opportunity to more easily understand complex issues.

5. **Relevant Literature**
   To create a research problem from the relevant literature, you should first review the research related to the area of your interest.

   Doing so will allow you to identify loopholes on the topic, making it easier to understand how well your area of interest is understood.

   The data collected from the relevant literature is relevant because it helps:

   - Fill existing gaps in knowledge based on specific research.
   - Determine if current studies can have implications on further research on the same issue.
   - See if it's possible to conduct a similar study in a different area or apply the same in a different context.

- Determine if the methods used in previous studies can be effective in solving future problems.

1.17 FEATURES OF GOOD RESEARCH PROBLEM

1. **Cover the Basics**
   These questions refer to the basic parts of your proposal. Although they may seem small, they do contribute to some common reasons for rejecting proposals.

   Some researchers think they can deceive reviewers by using smaller fonts or narrow margins to get a little more writing space. Otherwise, they are deceiving themselves into thinking that this strategy will work. Reviewers read several grants at once and see if your font or margins are different from other applications.

   Stick to the guidelines. Use the margins, spacing and fonts required for the fund. Provide all the helpful information they request. And follow the submission instructions, even if you have to give your grant to the post office.

   You'd be surprised how many researchers, if they come up with a really great idea, could make more money than the funder advertised to them. Although this is likely to happen, it is very rare.

   Make sure your budget is adequate for funding resources. This possibility may need to reduce the focus of your project, but you can apply for additional funding to build on the project in the future.

2. **Describe the Relevance**
   A funder wants to know how your project aligns with their mission and vision. They want to feel confident that your project will help them and the cause they support.

   To win over the funder, you want to clearly explain how your project matches their needs, outcomes, and financial backing.

   Your goals must match the funder's goals. Your project must aim to fulfill the need or solve the problem that the funder wants to address. In your proposal, clearly explain how your goals align to accomplish the same vision.

   Similar to the goals, you want your objectives to match the funder's objectives. If you find that your objectives are slightly different, you might be able to pivot the direction of your project. And if your project is a larger undertaking than the funder will support, you could consider reducing its scope.

3. **Explain the Approach**
   These questions will affect the meat of your proposal. In the first set of questions, you explain why your project is important. Here, you dive into how you'll finish that project.

   What is your approach to solving the problem or need?

   An important part of your proposal is describing how you will tackle the objectives of your project. Which methods will you use? When will you use them? Who will use them? Where will they be used? be specific. Provide more details than you

NOTES 

think. If your proposal gets too long, you can delete unnecessary information in subsequent drafts.

How do all the key elements of your approach work?

By explaining how your methods work, you can accomplish two important tasks. First, if the reviewer isn't familiar with the methods you use, you can teach them how they work. Second, you can show your reviewer that you've carefully thought through your methods. This way, you will highlight your knowledge and skills, giving your reviewer more confidence that your project will be a success.

What do you need to complete your vision?

As well as explaining why you need the funding, you also want to explain what you need to complete your project. Will you need to develop a new cell line? Will you need to create a survey? Will you need to work with a certain patient population?

4. **Highlight the Expertise**
While this is the last category, it is an important one. These themes should permeate your proposal, reiterating that your project—and you—will be successful.

How are you qualified to complete the project?

Your reviewer should have confidence that you are capable of completing the project. Do you have proper training? Do you have the necessary experience? Have you successfully completed projects of similar scope?

If you are a well-established researcher, funders can often find this information in your CV. However, if you are new to your field, you may need to step up your qualifications with some additional help. You will receive full training in the approaches used in your project. Hire employees who are experts in the technologies you use. Find associates who have a successful track record. These things will help your reviewer see that you are serious and dedicated.

Who will contribute to your project?

The funder will want to know everyone who will be involved in your project, what they will do and how they are qualified to do it.

Describe all employees and collaborators working on the project. Include letters of support and CVs for key personnel. If you will need to hire employees, prepare a description of what they will do and the qualifications they will need.

5. **How to identify a research problem?**
After you have chosen a specific topic for your academic paper, you need to state it as a clear research problem that identifies all of the issues you will be addressing. It is not always easy for the students to prepare it. In some fields, they may spend a lot of time thinking, exploring, and studying before getting a clear idea of how to answer research questions.

Some research paper topics are too broad to give researchable issues. For example, if you decide to study some social issues like child poverty, remember that they don't provide any researchable questions. These are too broad to address and take a lot of time and resources to become impractical so that your study lacks sufficient focus and depth.

6. **What is a statement of a research problem?**
   An adequate statement of your research problem plays an important role in the success of your academic paper and study. It's possible to generate a number of researchable issues from the same subject because there are many issues that may arise out of it. Your study should pursue only one in detail.

Basic characteristics of research problem

Reflecting on important issues or needs;

Basing on factual evidence (it's non-hypothetical);

Being manageable and relevant;

Suggesting a testable and meaningful hypothesis (avoiding useless answers).

Formulating your research problem with ease

Formulating your research problem allows you to articulate the purpose of your study to yourself and target readers. Focus your paper on providing relevant data to address this. A problem statement is an effective and essential tool for keeping you on track with research and evaluating it. How can you formulate a powerful research problem? Consider 5 ways to formulate a research problem:

Specify your research objectives;

Review its context or environment;

Explore its nature;

Determine variable relationships;

Anticipate the possible consequences of alternative approaches.

Specific research objectives

A clear statement that defines all objectives can help you conduct and develop effective and meaningful research. They have to be manageable to bring you success. Some goals will help you keep your studies relevant. This statement also helps professors evaluate the different methods you use to answer and address the questions in your research project.

Review the context of your research problem

It's necessary to work hard to define and test all kinds of environmental variables to make your project successful. Why do you need to do that? This step can help you define if the important findings of your study will deliver enough data to be worth considering. Identify specific environmental variables that may potentially affect your research and start formulating effective methods to control all of them.

Why explore the nature of your research problem?

Research problems may range from simple to complex, and everything depends on a range of variables and their relationships. Some of them can be directly relevant to specific research questions, while others are completely unimportant for your project.

Why should you understand their nature?

This knowledge enables you to develop effective solutions. To get a deep understanding of

NOTES 

all dimensions, think about focus groups and other relevant details to provide the necessary insight into a particular question.

Determine variable relationships

Scientific, social, and other studies often focus on creating a certain sequence of repeating behaviors over time. What does your project entail? Completing the entire process involves:

Identifying the variables that affect possible solutions to your research problem;

- Deciding on the extent to which you can use and control all of them for study purposes;
- Determining functional relationships between existing variables;
- Choose the variable that is most important to the solution of your research problem.
- During the formulation phase, it is essential to consider and generate as many possible approaches and variable relationships as possible.

What are the consequences of alternative approaches?

There are different consequences that each course of action or approach can bring, and that's why you need to anticipate them. Why communicate possible outcomes? It's a primary goal of any research process.

Structuring your research problem

Look at scientific papers to notice their research questions because they are crucial for determining the quality of answers, methods, and findings. Quantitative designs use deductive reasoning to state a testable hypothesis. Qualitative methods use inductive reasoning to make a strong statement of your future thesis.

Tips for defining your research problem

You need to prepare it during the initial phase of scientific process or study. For example, literature reviews, research, and study of past experiments can give you obscure areas of interest. Look at the area that brings up interesting results. Make sure it has search capability. Think about reviewing a successful experiment and try to disagree with its results, methodology, and tests, define the whole process, and re-test its hypothesis.

The importance of revising

Get useful feedback from teachers, students and others to successfully revise your research question. A final decision is always up to you. Feel free to decide which advice is helpful. To make this process easy, keep the following details in mind:

1. Consensus among readers that a research problem is too broad;
2. Suggest that you have a certain misunderstanding about the chosen matter;
3. Advice on narrowing down your subject or thinking of a better way to focus on it;

1.18 PRECAUTIONS TO KEEP IN MIND

Therefore, the researcher should keep the following precautions in mind while preparing the research report:

1. The length of the report should be kept in view of the fact that it should cover the topic long but it should be short enough to sustain the interest of the readers.
2. Reporting should not be dull. It should be such that maintains one's interest.
3. The report should have the characteristics of simplicity and avoidance of ambiguity.
4. The readers of the report are more interested in getting quick knowledge of the main findings and the report should provide ready availability of the findings with the help of charts, graphs and statistical tables.
5. The content of the report should be well thought out keeping in view the objective of the research problem.
6. Grammatical mistakes should be avoided and reports should be prepared strictly according to the techniques of report structuring. Writing like quotations, foot notes, use of proper punctuation marks and use of abbreviations in foot notes etc.
7. Logical analysis should be the basis for preparing a research report.
8. The report should also suggest policy implications related to the problem under consideration and help us in forecasting the future.
9. All technical data should be attached to the report.
10. Bibliography of various sources consulted for research study should be prepared and given in the report.
11. A good report should also contain a list of subjects and authors. This should be attached at the end of the report.
12. The report should be attractive, neat, typed or printed.
13. The calculated confidence limit should also be mentioned in the report and the various limitations experienced by the researcher in his study should be stated in the report.
14. A good report should also mention the purpose of the study, the nature of the problem and the analysis techniques used. All these things should be given in the form of introduction in the report.

What are research questions?

Research questions are defined as fundamental questions that facilitate a research project, a research study, a dissertation, a thesis or review. This allows researchers to narrow down the purpose of the study and ultimately collect relevant information to solve the research problem.

Asking appropriate research questions is the most important step in market research projects. You can use the insights you gain from your research questions to determine the course of study. These insights also play an essential role in conducting a survey, analyzing the data obtained and reporting the analyzed information.

1. **Open-ended research question**: Open-ended questions are widely used in qualitative research and are common most examples of research questions. This type of question forms the foundation of online qualitative research conducted using surveys and questionnaires. Open-ended questions capture open responses

NOTES 

from a research audience and open the door for text-based analysis on the data you receive.

2. **Multiple choice research question**: Researchers use multiple-choice research questions to capture single or multiple responses from your research audience. They typically use these market research questions when conducting poll-based research, where the audience needs to select multiple responses to one problem. It can also be used with single-select answers to limit the number of answers a respondent can choose.:
3. **Rank order scaling research question**: This is a ranking type question which provides multiple answer options. The participant selects the answers in order of preference. Researchers typically use these research questions to gauge a respondent's opinion on preferred brands or products. You can use the data from rank order questions to determine which product the respondent prefers, even if they enjoy multiple products. For example, someone might like chocolate, cake, and candy, but what do they like the most? Rank order scaling questions are perfect research questions to determine which dessert the respondent likes the most.
4. **Rating scale research question:** Rating scale research questions are used to capture responses based on a continuous scale, rather than individual points. This is often used in medical research visual analog scales or a pain scale, where patients need to rate their pain level.
5. **Semantic differential scale research question:** A semantic differential scale question quantifies the feelings and opinions of a respondent. This question type uses a multiple-point rating scale to understand better the respondent's feelings on a particular service, brand, organization, or product. The scale features polarized opinions on either end, with a neutral option in the middle
6. **Staple scale research question**: This is a unipolar research question with a +5 to -5 rating scale for the respondents to rate a single factor. These questions often involve offering the respondent an adjective or trait in conjunction with a brand or product. The respondent uses the scale to determine whether the attribute accurately or inaccurately describes the brand, product, or organization in question.

1.19 MEANING OF RESEARCH PROPOSAL

- A research proposal is a document that proposes a particular research project, usually in academia or science, intended to receive funding from an institution. A typical research proposal addresses several points:
- Your research proposal should set out the central issues or questions you want to address. It should outline the general area of study in which your research falls, referring to the current state of knowledge and any recent debates on the topic, as well as demonstrate the originality of your proposed research.
- The offer also gives you the opportunity to demonstrate that you have aptitude for postgraduate level research, by demonstrating that you have the ability to communicate complex ideas clearly, concisely and critically.

NOTES 

- In addition, the proposal also helps us match your research interest with a suitable supervisor. The proposal is an important part of your application upon which potential supervisors will decide whether your research is something they can support. You are here. You have a good idea that your company will benefit, but there is only one problem. Your great idea requires money, and it's up to you to convince your company why they should give you the money you need. To do this, you immediately decide to write a search proposal.
- So, let's see what a research proposal is. When someone is interested in obtaining support for research, they often write a research proposal. The purpose of these proposals is to make people believe that your ideas and projects matter. They try to explain how you can accomplish the project satisfactorily. A research proposal needs to tell people why the project is a good and/or necessary idea and that you understand what information and studies are already available. Keep in mind that the way you write a proposal is also important, as grammar, structure, and content can make the difference between accepting or rejecting a proposal.
- When conducting a proposal, a number of questions need to be answered so that you hope they will support your research, understanding the importance and reason for your work.

Following are some important questions to answer:

- What are you going to do?
- How much money do you need to complete your project?
- How long will it take?
- Why do you feel the project will help or benefit the sponsors?
- Why are you the one for the job?
- What are your qualifications?
- What will you do with the results?
- A research question(s) that the proposed research seeks to answer

The data & methods that will be used to answer the questions

The time and financial costs for the research

The prior research in the field

Potential benefits for the sponsoring institution

Research proposals are usually required when one plans to write a thesis, dissertation, or research paper. The format is similar to that of a research paper, with an introduction, a literature review, a methods section, and a conclusion.

RESEARCH PROPOSAL IMPORTANCE AND FUNCTION

✓	**Relevance**	Convince the reader that your project is original, interesting, and essential for a research field you're working in.

NOTES 

✓	**Context**	Demonstrate your familiarity with the research field. Show that you know its current state and have a deep understanding of the literature.
✓	**Approach**	Explain your methodology. Show that your data and methods are thought about well.
✓	**Feasibility**	Talk about the practical side of your project. Confirm that you're able to complete the research within the limits of the program or the institution you're applying to.

1.20 RESEARCH PLAN

STEP 1: Determine your area	The first and probably the easiest thing to do is to identify a general study topic or subject area to investigate.
STEP 2: Study literature	On the second stage, you need to read as much literature on the general topic as possible. Make notes and summarize each study's purpose and findings.
STEP 3: Find the gap in the literature	The purpose of the previous step is to determine what studies have already been done on the subject of your research proposal and then identify any obvious gaps in the literature. Find where you can add to the existing body of knowledge.
STEP 4: Make a purpose statement	The purpose of the research proposal is to sell your idea to the funding agency. On this stage, the task is to explain why you are investigating this topic, what you propose to do, and why others should be interested in your research. This is called a purpose statement.
STEP 5: Formulate a question & hypotheses	Next, you should craft a research question& hypotheses for your study. Research hypotheses determine what you will investigate and what you expect to find in your study. They are your supposed answers to the research question.
STEP 6: Write an introduction	The research proposal's introduction should include the components that you created on the previous stages: a problem statement, a summary of the literature (you can use a summary maker for that), a concise description of the gap in the literature, a purpose statement, & a research question.
STEP 7: Describe your methods	In your methods section, you should outline the procedures you plan to follow to complete the proposed study. The section generally includes: an explanation of the research design and some information on the data collection process.

NOTES 

STEP 8: Describe your research design	Outline the research design of your academic research proposal. You should describe two or three possible alternatives for each part of the design.
STEP 9: Describe your data collection procedures	In this section, describe how you are going to collect your data. Explain the scheme of analyzing the collected data and reporting the results.
STEP 10: Provide a timeline and budget	On the final stage, you need to give some information on the estimated budget and schedule of your research.

BASIC COMPONENT OF PROPOSAL

1. **Abstract/Summary**
   - The abstract is the most important component of the proposal. Spend time developing the best possible title. If the length is not mandated, it should be no longer than one half to one page maximum.
   - Use bolded subheadings. Include highlights in the topic sentence in each section of the proposal.
   - What will be done, by whom, how, over what period of time? What is the problem/need? Who will the outcomes benefit?
2. **Statement of Need**
   - What is the issue that you are addressing and why does it matter?
   - Why is what you propose necessary? What is the void in Knowledge?
   - Who benefits? Indicate the public good, not just the effect on campus.
   - Why hasn't this issue been addressed sufficiently in the past? Who else is working in this field, what have they done, and why isn't that enough? Demonstrate your knowledge of the field.
   - Provide convincing evidence that what you are proposing does not duplicate other work. Replication of someone else's work in a new environment or larger scale may be fundable.
3. **Project Activity, Methodology and Outcomes**
   - Why did you choose to address the issue in the manner that you have? Are there other approaches? If so, why aren't they appropriate to the situation?
   - What are the specific activities involved? Who will do them?
   - Present a timeline of activities. Tables and charts work best here. They crystallize data, break up pages of narrative, and convey extensive information well in a limited space.
   - What specific outcomes will be achieved? What will change?
   - Why are you/your organization the best one to do what you propose to do? Is it an extension of successful, innovative work or a pilot project you already completed?

NOTES 

4. **Evaluation**
   - Essential piece that should be both quantitative and qualitative, if feasible.
   - Outline clearly the methodology that you will use to assess the project's success.
5. **Dissemination**
   - The dissemination should be linked to your project goals and objectives. If you are trying to influence policy, your dissemination plan should target policy-makers, the media, and the affected population.
   - Describe your communication strategy be creative. Sending an article to a professional journal is one of many options. Consider submitting op-ed excerpts to newspapers and articles in more popular magazines; working with university relations to obtain newspaper coverage and interviews on local radio stations; engage in conference presentations, community outreach activities, presentations to policy-makers and community groups, such as the Chamber of Commerce; launch a web site or blog; convening work groups of your peers; making briefing papers, press releases, videos; And, enlist yourself in the Speakers Bureau.
6. **Budget and Continuation Funding**
   - Show your budget in table form and use a budget narrative to explain each item.
   - Include other sources of funding only if it is necessary to include them in the fund. The UMass policy does not allow the inclusion of in-kind or external contributions unless necessary, as this adds administrative burden and cost.
   - Indicate how the project will be funded or sustainable after the grant money is exhausted.
   - The Office of Grants and Contracts Administration (OGCA) provides all university policies covering all legal, financial, human resource and intellectual property issues.

Format of research proposal

What should be included in my research proposal?

Your proposal should include the following:

1. **Title**
   Your title should give a clear indication of your proposed research approach or key question
2. **Background and rationale**
   You should include:
   - The background and issues of your proposed research
   - Identify your discipline
   - A short literature review
   - A summary of key debates and developments in the field

3. **Research question(s)**
   You should formulate these clearly, giving an explanation as to what problems and issues are to be explored and why they are worth exploring
4. **Research methodology**
   - You should provide an outline of:
   - The theoretical resources to be drawn on
   - The research approach (theoretical framework)
   - The research methods appropriate for the proposed research
   - A discussion of advantages as well as limits of particular approaches and methods
5. **Plan of work & time schedule**
   - You should include an outline of the various stages and corresponding time lines for developing and implementing the research, including writing up your thesis.
   - For full-time study your research should be completed within three years, with writing up completed in the fourth year of registration.
   - For part-time study your research should be completed within six years, with writing up completed by the eighth year.
6. **Bibliography**
   You should include:
   - A list of references to key articles and texts discussed within your research proposal
   - A selection of sources appropriate to the proposed research

1.21 CHAPTER SUMMARY

Writing an effective research proposal is essential to acquire funding for your research. The introduction, being the first part of your proposal, must provide the funders a clear understanding of what you plan to do. A well written introduction will help make a compelling case for your research proposal.

To begin with, the introduction must set context for your research by mentioning what is known about the topic and what needs to be explored further. In the introduction, you can highlight how your research will contribute to the existing knowledge in your field and to overall scientific development.

The introduction must also contain a hypothesis that led to the development of the research design. You can come up with this hypothesis by asking yourself questions like:

What is the central research problem?

What is the topic of study related to that problem?

What methods should be used to analyze the research problem?

NOTES

Why is this research important, what is its significance, and how will its outcomes affect the funders and the society on the whole?

In the social sciences, the research problem establishes the means by which you must answer the "So What?" question. This question refers to a research problem surviving the relevancy test [the quality of a measurement procedure that provides repeatability and accuracy]. Note that answering the "So What?" question requires a commitment on your part to not only show that you have reviewed the literature, but that you have thoroughly considered the significance of the research problem and its implications applied to creating new knowledge and understanding.

1.22 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **Explain Rating scale Research Question?**
2. **What are the components of Research?**
3. **Explain Rank order Scaling Question?**
4. **Give example of open-ended research Question.**
5. **Elaborate the term "Research Proposal"?**

LONG ANSWER TYPE QUESTIONS

1. **What is the format of Research Proposal?**
2. **Describe the function of Research?**
3. **What are the features of good research statement?**
4. **Explain the importance of Research?**
5. **What precautions Researcher keep in mind while doing Research?**

1.23 MULTIPLE CHOICE QUESTIONS

1. **In "RESEARCH" "R" means**
   a. Role
   b. Retain
   c. Relly
   d. Round
2. **Which of the following is the Objective of the Research?**
   a. To become familiar with a phenomenon
   b. To test a hypothesis of a causal relationship between variables
   c. To determine the frequency with which something occurs or with it is associated with something else.
   d. All of the above
3. **Research is basically**
   a. A methodology of enquiry
   b. Search of truth
   c. A systematic exploration of facts

d. All of the above

4. The main purpose of research in education is to

a. Help in individual's personal growth
b. Increase the social prestige of an individual
c. Increase individual's market value of jobs
d. Help the individual to become an eminent educationist

5. Where is the objective observation used?

a. In conducting experiments
b. In research
c. In normal behaviour
d. In almost all the situations

6. A hypothesis is a

a. Tentative statement whose validity is still to be tested
b. Supposition which is based on the past experiences
c. Statement of fact
d. All of the above

7. What do you mean by an assumption?

a. It is a framework in which research work has to be done
b. It simplifies the logical process of arriving at the solution
c. It is a restrictive condition
d. None of the above

8. The advantage of sampling is

a. Time-saving
b. Capital-saving
c. Increased accuracy
d. Both 'A' and 'B

9. The advantages of random sampling is that

a. It is free from personal biases
b. It produces reasonably accurate results
c. It is an economical method of data. Collection
d. All of the above

10. The demerits of sampling methods is

a. Existence of sampling errors
b. Requirements of adequately trained personnel for sample survey
c. Non-uniformity in sample units
d. All of the above

♦♦♦♦♦

UNIT II

GENERALIZATION IN RESEARCH

STRUCTURE

NOTES 

2.1 LEARNING OBJECTIVE

After completing this chapter, you will get updated about theoretical foundation of Research:

- Students should understand a general definition of research design.
- Students should know why educational research is undertaken, and the audiences that profit from research studies.
- Students should be able to identify the overall process of designing a research study from its inception to its report.
- Students should be familiar with ethical issues in educational research, including those issues that arise in using quantitative and qualitative research.

2.2 INTRODUCTION

Research design is the kind of blueprint that you create before you actually do research. It is a systematically prepared outline describing how you plan to conduct your research. You may like to consider your research in terms of two aspects, namely the flawed aspect and the analytical aspect. The two aspects stay together in your mind whereas practically you can proceed your research in terms of one phase of data collection and another phase of data analysis.

The theoretical orientation and conceptual model in your mind help you decide what kind of data you will collect and to some extent how you will collect them. Later, when analyzing your data, your theoretical and conceptual understanding of social reality in general will guide you to classify the data and recognize patterns to explain and present your findings. Research is an ongoing process consisting of a series of steps, starting with identifying various concepts related to your research topic.

Once initiated, it continues through a set of regulated steps to its completion. It's about the steps you describe in your research design. We are going to discuss each of the ten broad stages that generally constitute the core elements of sociological research. For your task of completing a short research project, you can prepare a research design.

Contents of Research Design:

The most common aspects involved in research design include at least followings:

1. Statement of research objectives, i.e., why the research project is to be conducted.
2. Type of data needed.
3. Definition of population and sampling procedures to be followed.
4. Time, costs, and responsibility specification.
5. Methods, ways, and procedures used for collection of data.
6. Data analysis – tools or methods used to analyze data.
7. Probable output or research outcomes and possible actions to be taken based on those outcomes.

NOTES 

2.3 MEANING OF RESEARCH DESIGN

Research design refers to the framework of market research methods and techniques that are chosen by a researcher. The design that is chosen by the researchers allow them to utilise the methods that are suitable for the study and to set up their studies successfully in the future as well.

The design of a research can be either qualitative, quantitative, or mixed. Under these research designs, researchers can choose between different types of research methods; experimental studies, surveys, correlational studies, or quasi-experimental review studies. There are also sub-types of research methods namely experimental design, defining research problems, and descriptive studies. Research designs also include the elements of data collection, measurement of data with the respective tools, and the analysis of the data. As a rule of thumb, the research problem a company chooses to work on is the determining factor of the research design chosen by the researcher instead of the other way round. The market research study's design phase is the time when the researchers determine the tools to be used in the study and the way they are used. Good research usually ensures minimum levels of bias in the data collection method to improve both the internal and the external validity of the research. The desired outcome of an experimental research is to have a design that will result in the least amount of error in the study.

Elements of research design

a. **Selection of Research Problem:**
   As regards the selection of topic for research, anything that is social and empirical is a relevant problem for social research.

b. **Selection of Units of Analysis:**
   Determination of the units of analysis is a key factor in social research. In general, the purpose of the study dictates the selection of the appropriate unit of analysis. The objects or events or entities under investigation are referred to as units of analysis in social sciences.

c. **Choice of Variable:**
   Since a social scientist is primarily interested in studying the relationship between certain characteristics or properties of observed units, which are subject to variation over time or in both cases and times, it is necessary for a researcher to decide whether Which variables should be the focus of the research. The explanatory variables are known as the variables under focus. They are of two types dependent and independent. The former is a variable that the researcher is interested in explaining and predicting. The dependent variable is the presumed effect. The independent variable is the assumed cause.

   External variables are those that are not the direct focus of the research. They are of two types: controlled and uncontrolled. Controlled variables are kept constant or prevented from varying during observation. In addition to the above classification of variables, a typology of quantitative and qualitative variables is also made. Whereas a quantitative variable refers to values or categories consisting of numbers, qualitative variables represent certain properties, characteristics, or discrete categories.

d. Identification of Relationship:

In fact, many social researchers aim to develop and test relationships, in addition to familiarity with the description of a phenomenon or communities or groups, or the discovery of a situation or phenomenon. However, overall, research findings depend largely on the particular anticipated relationship. Therefore, the identification of the expected relationship and the guiding theoretical premises is of greater importance.

e. The Nature of Causal Relationship:

The affect the decisions on selection of topic in social sciences are:

(i) The structure and state of a discipline

(ii) Social problems

Causal relationships form the heart of scientific understanding. These are very necessary for the purposes of explanation and prediction. In order to establish causation, social scientists use three types of evidence: consistency, direction, and nonconformity.

Statistical association, such that a pattern of change in one variable is related to another variable, indicates that the former is causal. Causal relationships are determined in terms of strong and weak associations. Another criterion required to establish a causal relationship between events is that the direction of the effect should be from cause to effect. In other words, the cause must precede its effect.

The third criterion required to establish a causal relationship between events is non-spurious meaning that to link a causal relationship to an observed correlation there must be sufficient reason to believe that no hidden factors contributed to the spurious relationship. Have given. Ideally, the researcher should show that the relationship between the variables is stable.

f. Operationalization of Concepts:

Since concepts perform many important functions, clarity and accuracy in the use of concepts should be achieved by definitions that must have specific characteristics or properties of the phenomenon under investigation.

Concepts to exist operationally must be established through operational definitions that play a vital role in specifying the contextual meaning of concepts and providing a framework for their application. Briefly stated, operational definitions serve as a link between the conceptual theoretical level and the observational empirical level.

g. Formulation of Hypothesis:

To state the research questions in a precise way, to give a clear indication of what is to be observed and what kind of information will be collected, research questions should be stated in the form of hypotheses. Hypotheses are tentative generalizations that are expected but based on an unconfirmed relationship between two or more variables.

NOTES 

2.4 MEANING OF REASEARCH VALIDITY

Internal validity refers to the accuracy of data collection tools, procedures, and techniques. In other words, it is the accuracy of the internal design that needs to be controlled by the researcher. A wrong research design and technique may not produce accurate and valid results.

McLeod, S.A. (2007) states that internal validity shows that the observed effects in the study are due to manipulation of the independent variable and not some other factor. In other words, there is a causal relationship between the independent and dependent variables. While experimental design requires the researcher to be very careful in measuring the variables, external variables can affect the results of the research and can ruin the research.

External validity

External validity refers to the extent to which research results can be generalized to a population. Must be able to apply your research findings to a large audience. Some experiments, which are performed in a laboratory, cannot be generalized to natural settings. Experiments in natural settings can help improve the external validity of research. The goal of external validity is the far reach and scope of research, you cannot limit your research to the laboratory where you conducted the experiments.

Types of validity

Validity can also be divided into five types:

1. **Face Validity** is the most basic type of validity and it is associated with a highest level of subjectivity because it is not based on any scientific approach. In other words, in this case a test may be specified as valid by a researcher because it may seem as valid, without an in-depth scientific justification.

   Example: questionnaire design for a study that analyses the issues of employee performance can be assessed as valid because each individual question may seem to be addressing specific and relevant aspects of employee performance.

2. **Construct Validity** It is the most basic type of validity and is associated with the highest level of subjectivity because it is not based on any scientific point of view. In other words, in this case a test by a researcher can be designated as valid because it may seem valid without deep scientific justification.

   Example: Questionnaire design for a study that analyzes employee performance issues may be considered valid because each individual question can address specific and relevant aspects of employee performance.

3. **Criterion-Related Validity** Includes comparison of test results with results. This specific type of validity correlates the results of the assessment with another criterion of evaluation.

   Example: The nature of customer perception of a specific company's brand image can be assessed through the organization of focus groups. The same issue can be assessed by creating a questionnaire for the brand's current and potential customers to answer. The higher the level of correlation between the focus group and the questionnaire findings, the higher the level of criterion-related validity.

4. **Formative Validity** Refers to an assessment of the effectiveness of a measurement in terms of providing information that can be used to improve specific aspects of the event.

   Example: If the measure is able to identify specific weaknesses of the organizational culture, such as employee-manager communication barriers, when developing initiatives to increase the level of organizational culture's effectiveness, the measure's initial level of validity is assessed as sufficient. can go.

5. **Sampling Validity** (similar to content validity) ensures that the area of coverage of the measure within the research area is vast. No measure is able to cover all items and elements within the phenomenon, therefore, important items and elements are selected using a specific pattern of sampling method depending on aims and objectives of the study.

   Example: when assessing a leadership style exercised in a specific organization, assessment of decision-making style would not suffice, and other issues related to leadership style such as organizational culture, personality of leaders, the nature of the industry etc. need to be taken into account as well.

What are the threats to Internal Validity?

Factors influencing internal validity can come in many forms, and it is important that these are controlled for as much as possible during the course of research to minimize their impact on validity. The term history refers to effects that are not related to treatment that may result in changes in performance over time. It can refer to events in the participant's life that have led to a change in their mood, etc. Instrumental bias refers to a change in the measuring instrument over time that may change the result. This is often evident in behavioral observations where the experimenter's practice and experience affect their ability to notice certain things and change their parameters. A main threat to internal validity is the test effect. Often participants may become tired or bored during the experiment, and previous trials may affect their performance. In experimental studies this is often counterbalanced so that participants receive tasks in a different order to reduce their effect on validity.

So why is validity important?

If the results of a study are not considered valid then they are meaningless to our study. If it does not measure what we want to measure then the results cannot be used to answer the research question, which is the main objective of the study. These results cannot be used to generalize any conclusions and are a waste of time and effort. It is important to remember that just because a study is valid in one instance does not mean it is valid to measure something else.

2.5 MEANING OF RELIABILITY

Research reliability refers to whether research methods can reproduce the same results multiple times. If your research methods can produce consistent results, then the methods are likely reliable and not influenced by external factors. This valuable information can help you determine if your research methods are accurately gathering data you can use to support studies, reviews and experiments in your field.

NOTES 

Reliability refers to whether or not you get the same answer by using an instrument to measure something more than once. In simple terms, research reliability is the degree to which research method produces stable and consistent results.

A specific measure is considered to be reliable if its application on the same object of measurement number of times produces the same results. Reliability is a measure of the stability or consistency of test scores. You can also think of it as the ability for a test or research findings to be repeatable. For example, a medical thermometer is a reliable tool that would measure the correct temperature each time it is used. In the same way, a reliable math test will accurately measure mathematical knowledge for every student who takes it and reliable research findings can be replicated over and over.

Of course, it's not quite as simple as saying you *think* a test is reliable. There are many statistical tools you can use to measure reliability. For example:

- **Kuder-Richardson 20:** a measure of internal reliability for a binary test (i.e. one with right or wrong answers).
- **Cronbach's alpha:** measures internal reliability for tests with multiple possible answers.

How do you determine reliability in research?

To determine if your research methods are producing reliable results, you must perform the same task multiple times or in multiple ways. Typically, this involves changing some aspect of the research assessment while maintaining control of the research. For example, this could mean using the same test on different groups of people or using different tests on the same group of people. Both methods maintain control by keeping one element exactly the same and changing other elements to ensure other factors don't influence the research results.

Types of reliability

Depending on the type of research you're doing, you can choose between a few reliability assessments. The most common ways to check for reliability in research are:

1. **Test-retest reliability**
   The test-retest reliability method in research involves giving a group of people the same test more than once over a set period of time. In this assessment, the research method and sample group remain the same, but change when you administer the method to the group. If the test results are the same each time you give it to the sample group, it shows that your research method is potentially reliable and not influenced by external factors, such as the mood of the sample group or the day of the week.

   Example: Give a group of college students a survey about their satisfaction with their school's parking lots on Monday and again on Friday, then compare the results to check the test-retest reliability.

2. **Parallel forms reliability**
   When using parallel forms of reliability to assess your research, you can give the same group of people several different types of tests to determine whether

the results remain the same when using different research methods or not. The principle behind this evaluation is that consistent results across research methods ensure that each method is looking for the same information from the group and that the group is behaving the same way for each test. This means that the methods are likely to be reliable, because if they were not, participants in the sample group could behave differently and change the results.

Example: In marketing, you may interview customers about a new product, observe them using the product and give them a survey about how easy the product is to use and compare these results as a parallel forms reliability test.

3. **Inter-rater reliability**
   With inter-rater reliability testing, you can have multiple people perform assessments on a sample group and compare their results to avoid influencing factors such as one evaluator's personal bias, mood, or human error. If most of the results from different evaluators are the same, it is likely that the research method is reliable and can produce usable research because evaluators have collected similar data from the group. This is useful for research methods such as observation, interview and survey where each evaluator may have different criteria but still end up with similar research results.

   Example: Multiple behavioral specialists may observe a group of children playing to determine their social and emotional development and then compare notes to check for inter-rater reliability.

4. **Internal consistency reliability**
   There are two common ways to check for internal consistency reliability in your research, which usually involves making sure that your internal research methods or parts of research methods provide similar results. One of those techniques is split-half reliability, and you can ensure this by using a research method, such as a survey or test, by splitting the test in half, distributing the two halves separately into a sample group, and comparing the results. that the method can produce continuously. Result. If the results are consistent, the results of the research method are likely to be reliable.

   The other internal compatibility test checks for average inter-item reliability. With this evaluation, you manage multiple test items to sample groups, such as the reliability test of parallel variants, and calculate the correlation between the results of each method. With this information, you calculate the average and use the number to determine whether the results are reliable.

   Example:You may give a company's cleaning department a questionnaire about which cleaning products work the best, but you split it in half and give each half to the department separately and calculate the correlation to test for split-half reliability.

Tips for testing the reliability of research methods

As you do research and review the results, consider the following tips for testing the reliability of your research methods and ensuring you have consistency in your work:

NOTES 

- **Plan ahead.** Planning is a key step for most scientific experiments, so try to plan your research methods and studies in advance to ensure you and your team are prepared. You may plan for a space to conduct research with your sample group, how you can distribute testing materials or criteria and how to describe the purpose of the research to participants.
- **Make note of the environment.** If you're conducting research with the same sample group multiple times, it's often a good idea to make a note of what the environment is like when the group undergoes testing. This is because certain factors, like whether it's raining, the room is cold or someone is coughing, can influence the group's willingness to participate fully.
- **Consider the participants.** As you create your research materials, remember to consider how your sample group might respond to and understand the materials you present to them. For example, a group of children may need a simple set of survey questions read to them, while a group of adults could likely read more complicated questions themselves.
- **Review results thoroughly.** While comparing the results of your research, review the results thoroughly to make sure you catch any errors and accurately determine the reliability of the results. You may even ask a colleague to examine the results with you and offer their opinion on the reliability of the data gathered by your research methods.
- **Think about the type of research.** Different types of research may benefit from certain reliability tests more than others because each field of research measures different things. In marketing, you may regularly use various focus groups to determine a product's appeal, while a sociologist might observe behavior and compare notes regularly to get various professional opinions on a matter.

How does reliability affect research?

The term reliability in psychological research refers to the consistency of a research study or measuring test. For example, if a person weighs themselves during the course of a day, they would expect to see a similar reading. ... If a test is reliable, it should show a high positive correlation.

What does reliability mean and why is it important?

Reliability refers to the degree to which scores from a particular test are consistent from one use of the test to the next. ... Reliability is a very important piece of validity evidence. A test score could have high reliability and be valid for one purpose, but not for another purpose.

What is the purpose of reliability?

The goal of reliability theory is to estimate errors in measurement and to suggest ways of improving tests so that errors are minimized. The central assumption of reliability theory is that measurement errors are essentially random.

Why do we need reliability testing?

Why is it important to choose measures with good reliability? Having good test re-test reliability signifies the internal validity of a test and ensures that the measurements obtained in one sitting are both representative and stable over time.

Why is reliability test used?

Reliability testing is performed to ensure that the software is reliable, it satisfies the purpose for which it is made, for a specified amount of time in a given environment and is capable of rendering a fault-free operation.

What is the importance of reliability in assessment?

There is an important relationship between reliability and validity. An assessment that has very low reliability will also have low validity; clearly, a measurement with very poor accuracy or consistency is unlikely to be fit for its purpose.

Tips for improving research

Researchers use the results of assessments to improve the reliability of their tests and studies. Here are some tips you can use to improve the reliability of your own psychology resources:

1. **Decide on a measurement technique**
   Assessing the reliability of a test requires a defined measurement technique. When deciding on the type of measurement to use, you can consider existing methods or create your own. Researchers often choose existing methods that other researchers have used because it saves them the time and effort it takes to develop their own. Others, however, prefer to create their own measurement techniques that more accurately reflect the purpose and goal of their work or test a new process. For example, determine whether you want to use methods such as inter-rater, test-retest, or other techniques.
2. **Measure your research consistently**
   Psychology researchers who make lasting contributions to the field often develop studies and testing procedures that undergo rigorous and consistent assessments before their peers accept them as valuable. Consider establishing a routine for assessing the reliability of your resources. Assessing your research after each use in different environments, for example, can help you find any potential drawbacks and resolve them quickly to improve reliability.
3. **Remain attentive to the testing environment**
   External factors, such as the test or research environment, can affect the results, which can also affect reliability. For example, working or testing in areas with distractions or high or low temperatures can affect a person's ability to concentrate and use study resources. Stressful situations can also skew data. Paying attention to these circumstances can help you determine how they affect the reliability of your psychology test or study.

2.6 DIFFERENCE BETWEEN VALIDITY AND RELIABILITY

VALIDITY	RELIABILITY
Validity implies the extent to which the research instrument measures, what it is intended to measure.	Reliability refers to the degree to which assessment tool produces consistent results, when repeated measurements are made.
It refers to the ability of the instrument/test to measure what it is supposed to measure	It refers to the reproducibility of the results when repeated measurements are done

NOTES

It relates to the correct applicability of the instrument/test/procedure in a needed situation	It relates to the extent to which an experiment, test or any procedure gives the same result on repeated trials.
Can relate to question of 'Does it measure what it is supposed to measure'?	Can relate to question, 'How representative is the measurement'?
Answers, 'Is it the right instrument/test for what I need to measure?'	Answers, 'Can the results obtained be replicated if the test is repeated?'
Validity looks at accuracy	Reliability looks at repeatability/consistency
Validity mainly focuses on the outcome	Reliability mainly focuses on maintaining consistent result
Influencing factors for validity are: process, purpose, theory matters, logical implications, etc.	Influencing factors for reliability are: test length, test score variability, heterogeneity, etc.
Validity has more analysis and is harder to achieve.	Reliability is comparatively easier and yields faster results.
There cannot be validity without reliability	There can be reliability without validity.
Even if validity of an instrument is poor (for certain test), it can have high reliability (for other tests)	When reliability/repeatability is poor, validity may also be poor. Thus, usefulness of a test/experiments are negligible.
If the results are not valid, the test is of no use at all	If the results cannot be replicated, the test is of little use
Examples of different types of validity are: Face validity Construct validity Content validity Criterion validity Concurrent validity Convergent validity External validity Internal validity etc.	Examples of different types of reliability are: Test-retest reliability Parallel forms reliability Intra rater reliability Internal reliability External reliability etc.
Face validity is when the tool appears to be measuring what it is supposed to measure with the content of test matching instructional objectives.	Test-retest reliability is a measure of reliability obtained by administering the same test twice over a period of time to a group of individuals.
Construct validity seeks the implications between a theoretical concept and a specific measuring device. It includes constructs like concepts, ideas, theories, etc.	Parallel forms reliability is a measure of reliability obtained by administering different versions of an assessment tool (both versions must contain items that probe the same construct, skill, knowledge base, etc.) to the same group of individuals.

Content validity is qualitative measure where the actual content matches the measurement which is a logical method of measurement.	Intra rater reliability is a measure in which the same assessment is completed by the same rater on two or more occasions.
Criterion validity is the measure where there is correlation with the standards and the assessment tool and yields a standard outcome.	Internal consistency reliability is a measure of reliability used to evaluate the degree to which different test items that probe the same construct produce similar results.

2.7 MEANING OF RESEARCH PLAN

A research plan is pivotal to a research project because it identifies and helps define your focus, method, and goals while also outlining the research project from start to finish.

A research plan is a short document, which sets out initial thoughts on a research project in a logical and concise manner. It is a concept paper, which may be shared, in confidence, with peers and potential collaborators. Several iterations of a research plan may be necessary before it may be considered as complete. A research plan in laboratory medicine includes the considered opinion of its author in a research area of his/her choice. It is supported by evidence from the scientific and/ or medical literature. **It may be constructed in the following format:**

- The research questions
- The hypotheses
- Aims and objectives
- Research design

A research plan is not a formal research proposal, although it may well be the foundation document from which a detailed research proposal may be developed. Having a coherent research plan may help to make the process of writing a research proposal easier and quicker.

This type of plan is often necessary to:

- Apply for grants or internal company funding.
- Discover possible research partners or business partners.
- Take your research from an idea into reality.
- It will also control the entire journey of the research project through every stage by defining crucial research questions and the hypothesis (theory) that you'll strive to prove or disprove.
- The contents of a thorough research plan should include a hypothesis, methodology, and more.

There is some variation between academic and commercial research, but these are common elements:

- **Hypothesis:** the problem you are trying to solve and the basis for a theoretical solution. For example, if I reduce my intake of calories, I'll lose weight.

NOTES

- **Research questions:** research questions help guide your investigation into particular issues. If you were looking into the potential impact of outsourcing production, you might ask something like: how would outsourcing impact our production costs?
- **Research method:** the method you'll use to get the data for your research. For example, a case study, survey, interviews, a clinical trial, or user tests.
- **Definitions:** a glossary for the research plan, explaining the terminology that you use throughout the document.
- **Conceptual frameworks:** a conceptual framework helps illustrate what you think you'll discover with your research. In a sense, it's a visual representation of a more complex hypothesis.

2.8 STEPS OF RESEARCH PLAN

Step 1: Identify and develop your topic

Selecting a topic can be the most challenging part of a research assignment. Since this is the very first step in writing a paper, it is vital that it be done correctly. Here are some tips for selecting a topic:

- Select a subject within the parameters set by the assignment. Sometimes your instructor will give you clear guidelines as to what you can and can't write about. Failure to operate within these guidelines may result in your proposed paper being deemed unacceptable by your instructor.
- Select a topic of your personal interest and learn more about it. If you're writing about something that interests you, researching and writing for a paper will be more enjoyable.
- Select the topic for which you can get a manageable amount of information. Do a preliminary search of information sources to determine whether existing sources will meet your needs. If you get too much information, you may need to narrow your subject; If you find too few, you may need to broaden your topic.

Your instructor reads hundreds of research papers each year, and many of them are on the same topic (topics in the news at the time, controversial issues, topics for which there is sufficient and readily available information). Stand out from your classmates by choosing an interesting and off-the-beaten-path topic.

Once you have identified your topic, it may help to state it in the form of a question. For example, if you are interested in learning about the obesity epidemic in the US population, you could ask the question "What are the causes of obesity in America?" By presenting your topic in the form of a question, you can more easily identify the main concepts or keywords used in your research.

Step 2: Do a preliminary search for information

Before seriously starting your research, do a preliminary search to determine if there is enough information for your needs and to determine the context of your research. Look

up your keywords in the appropriate headings in the library's reference collections (such as encyclopedias and dictionaries) and in other sources such as our book lists, periodical databases, and Internet search engines. Additional background information can be found in your lecture notes, textbooks, and reserved readings. You may find it necessary to adjust the focus of your subject in light of the resources available to you.

Step 3: Locate materials

Now that the direction of your research is clear to you, you can begin to explore material on your topic. There are several places you can look for information:

- If you're looking for books, do a topic search in Aleph Catalog. A keyword search may be performed if the topic search does not provide enough information. Print or write the citation information (author, title, etc.) and the item's location (call number and archive). Pay attention to the state of circulation. When you find the book on the shelf, look at the books located nearby; Similar objects are always placed in the same area. The Aleph Catalog also indexes the library's audio-visual holdings.
- Use the library's electronic periodical database to find magazine and newspaper articles. Choose the most appropriate database and format for your particular topic; Ask the librarian at the reference desk if you need help figuring out which database best fits your needs. Many articles in the database are available in full-text format.

  Use search engines (**Google**, **Yahoo**, etc.) and subject directories to locate materials on the Internet. Check the **Internet Resources** section of the NHCC Library web site for helpful subject links.

Step 4: Evaluate your sources

Our instructor expects that you will provide credible, truthful, and reliable information and you have every right to expect that the sources you use are providing the same. This step is especially important when using Internet resources, many of which are regarded as less than reliable.

Step 5: Make notes

Consult the resources you choose and note down the information that will be useful to your paper. Be sure to document all sources you consult, even if there is a chance that you may not use that particular source. The author, title, publisher, URL and other information will be needed later when creating a bibliography.

Step 6: Write your paper

Start by organizing the information you've gathered. The next step is rough drafts, in which you get your ideas down on paper in an unfinished fashion. This step will help you organize your thoughts and determine what your final paper will be like. After that, you'll revise the draft as many times as you deem necessary to create the final product for going to your instructor.

NOTES 

Step 7: Cite your sources properly

Give credit where credit is due; cite your sources.

Citing or documenting the sources used in your research serves two purposes: it gives proper credit to the authors of the materials used, and it allows those who are reading your work to duplicate your research and locate the sources that you have listed as references. The **MLA** and the **APA** Styles are two popular citation formats.

Step 8: Proofread

The final step in the process is to proofread the paper you have created. Read through the text and check for any errors in spelling, grammar, and punctuation. Make sure the sources you used are cited properly. Make sure the message that you want to get across to the reader has been thoroughly stated.

2.9 MEANING OF RESEARCH DESIGN

Research design is the framework of research methods and techniques chosen by a researcher. The design allows researchers to improve research methods that are appropriate to the subject matter and set their studies up for success.

The design of a research topic explains the type of research (experimental, survey research, co relational, quasi-experimental, review) and its sub-types (experimental design, research problem, descriptive case-study).

There are three main types of design for research: data collection, measurement, and analysis. Research design refers to the framework of market research methods and techniques that are selected by a researcher. The design chosen by the researchers allows them to use methods that are appropriate for the study and also to successfully establish their studies in the future.

The design of a research can be either qualitative, quantitative or mixed. Under these research designs, researchers can choose between a variety of research methods; Experimental studies, surveys, correlational studies, or quasi-experimental review studies. There are also sub-types of research methods such as experimental design, defining research problems, and descriptive studies. Research design also includes elements of data collection, measurement of data with related equipment, and analysis of data.

As a rule of thumb, the research problem a company chooses to work on is the determining factor in the research design chosen by the researcher rather than the other way around. The design phase of a market research study is the time when researchers determine the tools to be used in the study and the way they are used. Good research usually ensures a minimum level of bias in the data collection methodology to improve both the internal and external validity of the research. The desired outcome of an experimental research is to have a design that results in the least amount of error in the study.

The type of research problem an organization is facing will determine the research design and not vice versa. The design phase of a study determines which tools to use and how they are used.

NOTES

Influential research usually produces minimal bias in the data and increases confidence in the accuracy of the collected data. A design that produces the minimum margin of error in experimental research is generally considered to have the desired result. Required elements are:

- Accurate purpose statement
- Techniques to be implemented for collecting and analyzing research
- The method applied for analyzing collected details
- Type of research methodology
- Probable objections for research
- Settings for the research study
- Timeline
- Measurement of analysis

Characteristics of research design

Proper research design prepares your study for success. Successful research studies provide insights that are accurate and unbiased. You need to create a survey that sums up all of the main features of a design. There are four major features:

- **Neutrality**: When you set up your study, you may have to make assumptions about the data you expect to collect. Estimated results in research should be free of bias and neutral. Understand the opinions about the final assessed scores and the conclusions of several individuals and consider those who agree with the results derived.
- **Reliability**: With research conducted regularly, the researcher involved expects similar results every time. Your design should indicate how to formulate research questions to ensure the standard of results. You will only be able to reach the expected results if your design is reliable.
- **Validity**: There are many measuring instruments available. However, only the right measuring instruments are those which help a researcher to get the results as per the research objective. The questionnaire developed from this design would then be valid.
- **Generalization**: The result of your design should be applicable to the population, not just a restricted sample. A generalized design means that your survey can be performed on any segment of the population with equal accuracy.

The above factors affect the way respondents answer research questions and therefore all of the above characteristics must be balanced in a good design.

A researcher must have a clear understanding of the different types of research design in order to choose which model to apply for a study. Just like with research, your study design can be broadly classified into quantitative and qualitative.

- **Qualitative:** Qualitative research Determines relationships between observations based on collected data and mathematical calculations. Theories relating to

NOTES 

naturally existing phenomena can be proved or disproved using statistical methods. Researchers rely on qualitative research methods that conclude "why" a particular theory as well as "what" respondents have to say about it

- **Quantitative:** Quantitative research is for cases where statistical inferences are necessary to gather actionable insights. The numbers provide a better perspective for making important business decisions. Quantitative research methods are essential for the growth of any organization. Insights drawn from hard numerical data and analysis prove to be highly effective while making decisions related to the future of the business.

2.10 TYPES OF RESEARCH DESIGN

You can further break down the types of research design into five categories:

1. **Descriptive research design:** In a descriptive design, a researcher is solely interested in describing the situation or case under his research study. It is a principles-based design methodology created by collecting, analyzing and presenting aggregated data. It allows a researcher to provide insight into the why and how of research. Descriptive design helps others better understand the need for research. If the description of the problem is not clear, you can do exploratory research.
2. **Experimental research design:** Experimental research Establishes a relationship between cause and effect of a situation. It is a causal design where one looks at the effect caused by the independent variable on the dependent variable. For example, one monitors the effect of an independent variable such as price on a dependent variable such as customer satisfaction or brand loyalty. It is a highly practical research method as it contributes to solving a problem.

   The independent variable is manipulated to monitor the change in the dependent variable. It is often used in the social sciences to observe human behavior by analyzing two groups. Researchers can have participants change their actions and study how those around them react to gain a better understanding of social psychology.
3. **Correlational research design:** Correlational research is a non-experimental research Technique that helps researchers to establish a relationship between two closely related variables. This type of research requires two separate groups. There are no assumptions made when evaluating the relationship between two different variables, and statistical analysis techniques calculate the relationship between them.

   A correlation coefficient quantifies the relationship between two variables, with a value between -1 and +1. If the correlation coefficient is towards +1, it indicates a positive relationship between the variables and -1 means a negative relationship between the two variables.
4. **Diagnostic research design:** In diagnostic design, the researcher is looking to evaluate the underlying cause of a specific topic or phenomenon. This method helps one learn more about the factors that create troublesome situations.

This design has three parts of the research:

- Inception of the issue
- Diagnosis of the issue
- Solution for the issue

5. **Explanatory research design:** Explanatory design uses a researcher's ideas and thoughts on a subject to further explore their theories. The research explains unexplored aspects of a subject and details about what, how, and why of research questions.

Main Goals of Research Design

The main goal of research design is for a researcher to ensure that the conclusions they come to are reasonable. It means that the research has to confirm or disprove the hypothesis. Another objective of research design is to broaden the researcher's understanding of the topic and make them more aware of different places, groups and settings. Finally, research design allows the researcher to get an accurate understanding of the topic they are working on, and be able to explain the topic to others.

Basic Purposes of Research Design:

a. To provide answers to the research questions,

b. To control variance. Indeed, these research purposes are achieved by the researcher himself, not by the research design.

As far as the first objective is concerned, research is designed in such a way that an objective, accurate, valid and economical solution to the problem given to the researcher is achieved to the maximum extent possible. Since scientific research begins with a provisional conjecture in the form of a hypothesis, the main objective of the design is to provide the research with a valid test of the hypothesis based on empirical evidence obtained by the researcher, using the least amount of funding, manpower and time and the maximum likelihood of it being approved by other investigators engaged in the given area of investigation.

How and where, by providing a blueprint of sorts for the variation of hypothesis, assuming a relationship between two or more variables based on empirical facts, and by guiding the process of observation in the context of determining facts related to the research problem. Look for them and how many observations to make, research design becomes indispensable on the part of any researcher in scientific investigation.

In addition, it also indicates whether the variables of research are to be manipulated or selected, what specific values of the selected variables are to be manipulated or used in scientific investigation, how a conceptual variable is to be transformed into observable facts. can be converted.

The research design also makes a specification of the method to be adopted for manipulation of the independent variable and measurement of the dependent variable, as well as suggesting the methods by which the data collected for the research is to be analyzed and the level of statistical analysis. is to be determined. research status.

NOTES

"The design of an experiment and its analysis are interrelated. In fact, it is often said that one should not conduct an experiment without knowing how to analyze it." This statement from Rieken and Boruch applies not only to experimental design, but also holds well for all kinds of research designs.

The second objective of research is to control for the effects of potentially relevant independent variables on the behavior of research subjects. It facilitates the process of obtaining answers to only relevant questions in the research study and enables the investigator to control for experimental, outlier and error variations related to the particular research problem being studied.

If these variables are not controlled for, the validity of the research findings will be affected. In the real world, any observed phenomenon of behavior is influenced by a multiplicity of facts and events. Behavior, being "a real-world phenomenon involving explicit or covert responses to an action or situation by one or more actors" and action being "any adjacent sequence of acts directed by a goal" is a set of events in both behavior and action. complexity is involved. Each of these can be used as an independent variable.

Of course, taking an independent look at a variable depends on the interest of the researcher or the nature of the research problem. For example, job satisfaction, educational achievement, personal output, restriction of birth rate and other similar effects can be explained on the basis of influence of many related or unrelated facts and events.

But it is not possible to include each of these variables in a single research undertaking. In contrast, a researcher should confine himself to only a finite number of variables that are used as more clearly relevant variables in a given research. If they are active variables, their values are intentionally altered and thus manipulated to control them.

2.11 FEATURES OF GOOD RESEARCH DESIGN

Designing a thesis, especially in the social sciences, is very complex because the selection and design of a method or methods of reasoning was not always a guarantee of a good result. As a blueprint, the research design can be only temporary and useful, providing a series of guiding positions to position the researcher in the right direction.

Although each design has its own strengths and weaknesses as well as the prospect of a complete research design being difficult, a good research design often has distinctive features such as flexibility, suitability, efficiency, financially sound, etc. A design that minimizes bias and maximizes the reliability of the data is considered as a good design.

Similarly, the design giving the smallest experimental error is considered as the best design and the design giving maximum information covering different aspects of a problem is considered as the most efficient design as it is suitable for the research problem. Therefore, whether a design is considered good also depends on the purpose of the research problem and the nature of the problem under investigation.

A single design can never serve the purpose of all types of research problems because what appears appropriate in one case may be lacking in one regard or the other in terms of other research problems. A good research design should always satisfy the following four conditions; Objectivity, reliability, validity and generalizability of the findings.

a. **Objectivity:**
Findings are said to be objective when they relate to the method of data collection and the scoring of responses. Objectivity with respect to the process can be assessed by the degree of agreement between the final scores assigned to different persons by more than one independent supervisor. The greater the agreement between observers, the more objective the observation, recording and evaluation of responses. Therefore, a good research design should allow objectively objective measurement instruments in which each observer visualizing performance comes to the same conclusion.

b. **Reliability:**
The question of the credibility of knowledge is usually raised when the presence of a problem creates a demand in the knower not only for something greater than what it is supposed to, but also for something for which it is in a particular situation and perhaps Would be useful in other similar situations, Credible knowledge means any claim that is proven to be reliable for a given purpose.

c. **Validity:**
Validity implies self-consistency or absence of self-contradiction. It is identified with formal truth or self-consistency. A valid reasoning conforms to the rules of correct reasoning. It is that type of reasoning where conclusions automatically follow from the premises legitimately.

d. **Generalizability:**
The degree of generalizability is known in terms of the replicability and reproducibility of the findings in spite of different measures and settings respectively. That becomes necessary to determine the sequence of events is that change occurs only after the independent variable is activated. In other words, the independent variable comes before the dependent variable.

Type of the investigation

Causality Research Design: A causal study is an inquiry to understand the cause of one or more problems. A correlation study: Is an inquiry to find out the key variables linked to the problem. A causal study question: Does cigarette smoking cause cancer? A correlation study question: Are cigarette smoking and cancer associated? Or Is cigarette smoking, consuming alcohol, and chewing tobacco related to cancer? If so, which of these contributes most to the variance in the dependent variable?

2.12 CHAPTER SUMMARY

When researchers measure a construct that they assume to be consistent across time, then the scores they obtain should also be consistent across time. **Test-retest reliability** is the extent to which this is actually the case. For example, intelligence is generally thought to be consistent across time. A person who is highly intelligent today will be highly intelligent next week. This means that any good measure of intelligence should produce roughly the same scores for this individual next week as it does today. Clearly, a measure that produces highly inconsistent scores over time cannot be a very good measure of a construct that is supposed to be consistent.

NOTES 

Assessing test-retest reliability requires using the measure on a group of people at one time, using it again on the *same* group of people at a later time, and then looking at **test-retest correlation** between the two sets of scores. This is typically done by graphing the data in a scatter plot and computing the correlation coefficient. When a measure has good test-retest reliability and internal consistency, researchers should be more confident that the scores represent what they are supposed to. There has to be more to it, however, because a measure can be extremely reliable but have no validity whatsoever. As an absurd example, imagine someone who believes that people's index finger length reflects their self-esteem and therefore tries to measure self-esteem by holding a ruler up to people's index fingers. Although this measure would have extremely good test-retest reliability, it would have absolutely no validity. The fact that one person's index finger is a centimeter longer than another's would indicate nothing about which one had higher self-esteem.

2.13 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **How do you determine reliability in research?**
2. **Give tips for testing the reliability.**
3. **What is the purpose of reliability?**
4. **Write the meaning of research design?**
5. **How does reliability affect research?**

LONG ANSWER TYPE QUESTIONS

1. **What do you mean by research plan? Explain the steps of research plan.**
2. **Explain the types of validity?**
3. **Differentiate between Validity and Reliability?**
4. **What does reliability mean? Why it is important.**
5. **What is the meaning of research design and its type?**

2.14 MULTIPLE CHOICE QUESTIONS

1. **A research proposal**
   a. Should be detailed.
   b. Should be given to others for review and comments.
   c. Sets out the rationale for a research study.
   d. All the above
2. **Research hypotheses are**
   a. Formulated prior to a review of the literature.
   b. Statements of predicted relationships between variables.
   c. Such that they cannot be confirmed or refuted.
   d. Statements of no relationships between variables.
3. **The research participants are described in detail in which section of the research proposal?**
   a. Introduction.

b. Research Methodology.
c. Data Analysis.
d. Conclusion.

4. **The final research report is NOT**
   a. Basis for decision making.
   b. Tangible evidence of a research project.
   c. Future secondary data.
   d. A Research Proposal.

5. **_____research is based on the measurement of quantity or amount.**
   a. Qualitative
   b. Descriptive
   c. Quantitative
   d. Numerical

6. **_____ describes the present state of affairs as it exists without having any control over variables.**
   a. Analytical research
   b. Descriptive research
   c. Applied research
   d. Distinctive research

7. **The reliability of the entire system is called _____**
   a. Partial reliability
   b. Isolated reliability
   c. Closed reliability
   d. System reliability

8. **System reliability for components kept in parallel _____ as the number of components increases.**
   a. Increases
   b. Decreases
   c. Remains unchanged
   d. Cannot be determined

9. **The life-test sample plans that are terminated when a pre-assigned number of failures occur in the sample is _____**
   a. Failure-terminated
   b. Time-terminated
   c. Operation-terminated
   d. Sequential

10. **Which of the following phrase should be avoided in a research proposal?**
    a. I hope to
    b. The intention is to complete the study by
    c. This research draws on the work of
    d. The research seeks to

♦♦♦♦♦

UNIT III

DATA COLLECTION

STRUCTURE

NOTES

3.1 LEARNING OBJECTIVE

After completing this chapter, you will get updated about theoretical foundation of Research:

- Students should be able to define the meaning of a variable, and to be able to identify independent, dependent, and mediating variables.
- Students should be able to distinguish between categorical and continuous measures.
- Students should be able to define theory use in quantitative research.
- Students should be able to design a good quantitative purpose statement and good quantitative research questions and hypotheses.
- Students should be able to define a central phenomenon in qualitative research.

3.2 INTRODUCTION

In the beginning it is very important to understand that the modern concept of marketing revolves around the customer. Customer satisfaction is the main objective of marketing. To achieve this goal, marketing research is carried out.

Collecting information about entire populations often costs too much or is nearly impossible. Instead, we use a population sample. A sample should have the same characteristics as the population it represents. Most statisticians use a variety of random sampling methods in an attempt to achieve this goal. This section will describe some of the most common methods. There are many different methods of random sampling. In each form of random sampling, each member of the population has an equal chance of being initially selected for the sample. There are pros and cons of each method.

Sampling data should be done very carefully. Recklessly collecting data can have disastrous consequences. Surveys sent to households and then returned can be very biased (they may be in favor of a certain group). It is better for the person conducting the survey to select sample respondents. When you analyze data, it is important to be aware of sampling errors and non-sampling errors. The actual process of sampling causes sampling errors. For example, the sample may not be large enough. Factors not related to the sampling process led to non-sampling errors. A faulty counting device can cause a non-sampling error.

In fact, a sample will never be an accurate representative of the population, so there will always be some sampling error. As a rule, the larger the sample, the smaller the sampling error.

In statistics, sampling bias is created when a sample is collected from a population and some members of the population are not as likely to be selected as others (remember, each member of the population has the same probability of being selected). Is). should be). When there is a sampling bias, false conclusions can be drawn about the population that is being studied.

3.3 MEANING OF MARKETING RESEARCH

Marketing research is a process of collecting, analyzing and reporting data related to any

NOTES 

problem in the marketing field. The whole process involves activities related to data. Data is raw information. Webster's Dictionary defines data as: "facts, figures, or information either historical or calculated, or derived by experiment."

Marketing research serves the purpose of 'Intelligence Wing of Marketing Management'. Its scope is much wider as compared to market research. It deals with systematically and objectively collection of market information, analysis and evaluation of relevant data and use of such data for the benefit of the organization.

It is a careful and objective study of different areas of marketing activities. What, when, where and how to sell the final products and services are four questions that the marketing research wing provides answers to.

Adequate, reliable, relevant and timely data is essential to solve any marketing problem. The bulk of the research budget, effort and time is put into collecting the data. The data, being raw information, may not provide a clear indication or implication. They have to be analyzed and interpreted to get meaningful implications. Only the information developed from the data can be used for decision making or strategy formulation. Marketing research uses two types of data – primary data and secondary data. Both data have their uses and limitations. Also, different methods are used to collect both types of data.

Data can be collected from two sources which are internal and external sources. Data collected from internal sources is called primary data while data collected from external sources is called secondary data.

Marketing Research V/S Market Research:

Marketing research is a broader term including market research. Marketing research is concerned with all the major functions of marketing. Market research is primarily concerned with knowing the capacity of the market to absorb a particular product. Marketing research is not only concerned with the jurisdiction of the market but also covers nature of the market, product analysis, sales analysis, time, place and media of advertising, personal selling and marketing intermediaries and their relationships etc.

Objectives of Marketing Research:

Marketing research is undertaken for attaining the following objectives:

1. **To Provide Basis for Proper Planning:**
   Marketing and sales forecast research provides sound basis for the formulation of all marketing plans, policies, programmers and procedures.
2. **To Reduce Marketing Costs:**
   Marketing research provides ways and means to reduce marketing costs like selling, advertisement and distribution etc.
3. **To Find Out New Markets for The Product:**
   Marketing research aims at exploring new markets for the product and maintaining the existing ones.
4. **To Determine Proper Price Policy:**
   Marketing research is considered helpful in the formulation of proper price policy with regard to the products.

NOTES

5. **To Study in Detail Likes and Dislikes of the Consumers:**
   Marketing research tries to find out what the consumers, (the men and women who constitute the market) think and want. It keeps us in touch with the consumers, minds and to study their likes and dislikes.

6. **To Know The Market Competition:**
   Marketing research also aims at knowing the quantum of competition prevalent in the market about the product in question. The company may need reliable information about competitor's moves and strategies which are of immense significance for further planning.

7. **To Study The External Forces and Their Impact:**
   Marketing research provides valuable information by studying the effect of external forces on the organization. External forces may include conditions developing in foreign markets, government, policies and regulations, consumer income and spending habits, new products entering the market, and their influence on a company's products.

   Pro. Gillies rightly states that, "The basic objective of marketing research is to provide management with such information as to lead to a more complete understanding of the distribution habits and attitudes of current and potential buyers and users and their reactions to products, packing, sales and Advertising Methods.

3.4 SOURCES OF DATA

a. **Sources of primary data**
   The data collected for the first time is called primary data. The methods used in collecting primary data are survey, observation and experiment. Generally, not all of these methods are used in the same project, as they have both good and bad aspects. The question which method should be selected depends upon the nature, time and cost. Or the method should be selected according to the nature, time and cost. Primary data are those details, which are directly and completely related to the problem. Primary data is basic information and is considered as the basic input for analysis and solution of any problem related to marketing activities. Primary data is collected from relevant respondents. They are not readily available, requiring rigorous efforts for their collection and analysis. The success of marketing research depends on the quality and quantity of primary data. In fact, no research project can be complete without primary data.

   Characteristics of Primary Data:

   1. Primary data are original data.
   2. Primary data are expensive.
   3. Collection of primary data takes considerable time and efforts.
   4. They are collected with reference to problem on hand.
   5. They are collected deliberately from relevant respondents.

NOTES 

6. Specific methods (like survey methods, observation methods, experimental method, etc.) and tools (like printed forms, questionnaire, camera, etc.) are used for collecting primary data.
7. They constitute a basic input in the research project.
8. They are required be furnished, processed, or analyzed before they are used.

Survey: Collecting data through interviews of the people is called survey method. Data can be collected through the means of individuals, telephones, mails etc.

Persons/individuals: Data can be collected by taking interviews from the different person/individuals. This method is more flexible than the telephone and mail interview. During the interview time, if the person being interviewed gives incomplete answer, it can be made clear asking repeatedly to complete the answer.

Telephone: Survey can be done through telephone. As different personalities can be contacted through telephone anywhere from center, this medium save cost and time. This medium is quicker than others for prompt survey.

Mail: Data can be collected through mail. In this method, questionnaire is sent to potential respondents. They also send the answers back through mail. This medium is less expensive than the personal interview and becomes more useful for national survey.

Observation: Collecting data by observing activities of persons is called observation method. Observation may be personal or mechanical. Complete and accurate data can be collected through observation method.

Personal observation: This method is more useful to collect data about sellers' performance and their priority given to the brand.

Mechanical observation: Mechanical observation can be done in various forms. For instance, scanner can be used in retail stores for keeping purchase record. Similarly, camera can be used to keep person's reaction in video form.

Experimental method: Primary data can be collected through experimental method. Experimental works are done in lab and field for collection of primary data.

Laboratory experiment: The testing or trying out in lab is called laboratory experiment. Laboratory is used to taste/examine the components of marketing strategy.

Field experiment: The other method used to understand the consumers' reaction is field experiment. This is also like a laboratory, but it is done remaining in real situation. Test marketing is a field experiment.

Advantages of primary data

Now let us discuss briefly the advantages of Primary data

- **More Accurate**: Primary data is researched and developed by individuals who pay personal attention to each question they intend to survey. People often trust themselves rather than rely on the data of others. Also, the people working in

it can also be assessed. Hence making the data more valid and accurate. Also, it is more reliable than secondary data.

- **Updated information:** The data that is generated is first-hand data. No other person's data is used to develop information that makes the data updated and people rely on information that is more updated and more recent. Primary data is usually generated through a questionnaire or personal contact, thus the information obtained is valid and updated.
- **More Control over data**: Since the person conducting the survey can manage the data through questionnaires or any other design, he/she has control over the entire survey. He can manipulate or modify the questionnaire to make it more meaningful. Experts also sometimes face difficulty because a target group may not easily know or understand the purpose of the survey, thus a little manipulation can help them get the right response.
- **Privacy is maintained:** The expert handling all the survey work also maintains the confidentiality of the data. It is very clear that while some individuals maintain the entire survey work without leaking the views most of them confidentiality is maintained. Also, the feedback they receive is always private to the surveyors.
- **Targeted problem is dealt with:** People who are engaged in the collection of data prepare questionnaires and sometimes interview the target group to get the data. Also the problem is resolved so that it can be brought to the limelight after proper feedback and it can be resolved. In this way the program can be made productive and the problems can also be handled easily
- **Understanding of data is better:** Through various designs and methods the surveyed data is made simple and easy to understand so that the person interested in the data can easily understand it at a glance. Also, it becomes more effective if the feedback received is accurate and valid.

Disadvantages of primary data

- **Time-consuming process:** The organizer of the survey and the method used can take a lot of time to collect the data from the raw sources. In secondary data, we collect information from other sources. So, it takes less time. Since it takes time, sometimes it delays the resolution of the surrounding problem.
- **Costly:** The survey conducted is time consuming as well as costly. For collection of data, experts have to visit and use equipment which can cost a lot. Also, after receiving the feedback proper documentation is required which is again required to take care of and involve high cost.
- **Require more labor:** In case of primary data the manpower requirement is high as only one person cannot conduct the survey himself or collect the data alone. Also, the number of men required is high and they have to be paid after the work is done.

NOTES 

- **The questionnaire must be easy and understandable:** The questionnaire prepared should be easy to understand only then the researchers can get correct and valid response. Researchers have to create the set of sample questionnaires in such a way or use a method or technique that can help people to interpret it easily if the response generated will not be wrong or wrong.
- **Feedback may be faulty:** We have already learned that if the technology used by researchers is not proper or accurate then the feedback that is generated will also be faulty or incorrect. Thus, appropriate action and maintenance should be done so that the feedback data produced should be authentic.
- **An experienced person is needed for the analysis:** The method, technique and analysis of data gathering should be done by an expert as only an expert can make the whole research meaningful by providing real facts and information. The analysis is mostly done according to the problem found by the researcher or expert.

b. Meaning of secondary data

The data once used is called secondary data. It becomes much easier to collect secondary data as compared to primary data. Secondary data can be collected from multiple sources. Secondary data, on the other hand, are published data. They are readily available. They can be used directly without processing or analysis. They are collected rather than generated. Secondary data are those details that have been collected for a purpose other than the specific research problem. They are also known as recorded data.

They are published data. They have been collected by others for their contemporary problems. Sometimes, they are not useful. They complement the primary data. They support primary data. The extent to which secondary data is used for marketing research depends on suitability, accuracy and timing. Secondary data is used to increase the sampling size of research studies and is also chosen for the efficiency and speed that comes with using an already existing resource. Secondary data facilitates large research projects, in which many research groups working in tandem collect secondary data. The main researcher is then allowed to focus on primary research or particular areas of interest.

Characteristics of secondary data

1. Secondary data are published data, not original data, for the research on the hand.
2. They give the latest information
3. They can be easily collected from various internal and external sources.
4. They are relatively cheaper; they need less efforts, time, and money.
5. They have been collected by other people for their own problems and situation in the past.
6. They are used as a supplementary to primary data. Mostly, they are used for defining and understanding problems.

7. The use of secondary data is optional. Research can be conducted even without the use of this type of data.
8. They can be used without processing; no need to analyze them before they are used. They can be used directly.
9. Relevance, accuracy, and timing are the main problems related to secondary data.

Advantages of secondary data

- **Ease of access:** Access to secondary data sources is very easy. The Internet has changed the way secondary research works. Nowadays you have so much information available with just a click of the mouse.
- **Low cost or free:** Most secondary sources are absolutely free to use or at very low cost. It not only saves your money but also your efforts. Compared to primary research where you have to design and conduct the entire primary study process from the very beginning, secondary research allows you to collect data without putting any money on the table.
- **Time-saving:** As the above advantage suggests, you can perform secondary research in time. Sometimes it is a matter of a few Google searches to find a source of data.

Allow you to generate new insights from previous analysis: Reanalyzing old data can bring unexpected new understandings and points of view or even new relevant conclusions.

- **Longitudinal analysis**: Secondary data allows you to do a longitudinal analysis which means that the studies are spread over a larger period. This can help you determine different trends. In addition, you can find secondary data from several years ago to a few hours ago. This allows you to compare data over time.
- **Anyone can collect the data**: Secondary data research can be performed by people that aren't familiar with the different data collection methods. Practically, anyone can collect it.
- **A huge amount of secondary data with a wide variety of sources**: It is the richest type of data available to you in a wide variety of sources and topics.

Disadvantages of secondary data

- **Might be not specific to your needs**: Secondary data is not specific to the needs of the researcher because it was collected in the past for some other reason. Therefore, secondary data may be unreliable for your current needs. Secondary data sources can give you massive amounts of information, but quantity doesn't always mean suitability.
- **You have no control over data quality**: The secondary data might lack quality. The source of the information may be questionable, especially when you gather the data via the Internet. As you relying on secondary data for your data-driven decision-making, you must evaluate the reliability of the information by finding out how the information was collected and analyzed.

NOTES

- **Biasness**: Since secondary data is collected by someone other than you, the data is usually biased in favor of the person who collected it. It may not meet your needs as a researcher or marketer.
- **Not timely**: Secondary data is collected in the past which means it might be out-of-date. This issue can be crucial in many different situations.
- **You are not the owner of the information:** Generally, secondary data is not collected specifically for your company. Instead, it is available to many companies and people either for free or for a little fee. So, this is not exactly a "competitive advantage" for you. Your current and potential competitors also have access to the data.

The main sources of secondary data

Library: Library is the best source for collection of secondary data. All kinds of books, all publications, research-oriented deeds, researched publications, useful materials, magazines, newspapers official publication etc. can be found in libraries. Secondary data can be easily collected from such sources. Central Library, Keshar Library, British Council, American Library etc. are the major libraries of Nepal.

1. **Government:** Government publications are also important sources for the collection of secondary data. Business organizations must compulsorily submit their annual reports of income-statement, balance sheet, cash flow statement etc. to government bodies. Such reports and statements are also sources of secondary data. In addition, various government bodies update and publish government tax records, birth registration, house sale or purchase, marriage registration, registration of domestic animals, social class, per capita income, etc. Therefore, such government publications are also important sources for data collection.
2. **Trade, professional and business associations:** Trade, professional and business associations also report their activities through a variety of publications. Some business organizations have their own libraries. for example; The American Marketing Association has its own library containing more than four thousand books. Publications of organizations like SAFTA, WTO etc. can be very useful for international marketing experts.
3. **Private business firm:** Private business firms collect important data. For example, R. L. Polk and Donnelley Marketing publish city and telephone directory. They cover almost the addresses, phone no. estimated income, purchasing habit etc. in them of almost every American. Such data become very useful for the marketing experts.
4. **Advertising media:** Magazines, newspapers, radio, and television provide useful information for homeowners and business organizations. For example, Sales and Marketing Management Magazine publishes a 'Purchasing Power Survey' each year. This report provides information on demographics, retail sales, revenue etc.
5. **University research organization:** Research organizations are formed in large universities. Such organizations conduct and publish research locally, nationally and internationally.

NOTES

3.5 SOURCES OF INFORMATION

Refined and cleansed data is called information. This information becomes useful. Information can be collected from several sources. The main sources are as follows:

1. **Marketing Research System**
   The systematic research done to solve the problems related to the market is called marketing research method. While researching marketing, there is a thorough study and analysis using various methods about goods, price, place, distribution, promotion, consumers, sales, competition etc. Such research and studies are very important sources of information.
2. **Marketing Intelligence System**
   The methodology of collecting information about the marketing environment on a daily basis is called marketing intelligence system. It collects and reports the day-to-day changes in the marketing environment. Vendors, intermediaries, marketing information centers, experts or specialists, private agencies etc. are formal sources of marketing intelligence system whereas magazines, newspapers, trade magazines, interactions with customers, interactions with managers and employees etc. are informal sources of marketing intelligence. Huh. System
3. **Internal Record System**
   The records maintained by business organizations to organize various internal activities are called internal records system. Internal records are an important and readily available source of information. Main internal records are customer related records, sales records, annual reports etc.
4. **Marketing Decision Support System (MDSS)**
   A decision support system is a process that allows a manager to interact with data and methods, analyze and interpret information. Data Bank, Method Bank and Model Bank are components of the decision support system.

3.6 PROBLEMS OF SECONDARY SOURCE OF DATA

In research, the collection of data and secondary sources of information are as important as the primary sources. There are many reasons for this, in many cases primary data is not available and hence the researcher uses secondary sources. In other research the researcher knows that the secondary sources are as reliable as the primary sources and therefore uses secondary sources.

Secondary sources are very helpful in conducting research but there are some problems associated with the use of these sources. The real and most fundamental issue always lies with the validity and reliability of the source from which the data is taken. Experiments like primary sources are very reliable and valid as compared to secondary sources. As far as possible these problems can be overcome to some extent.

Validity and reliability

Validity and reliability in research are very important concerns and cannot be taken lightly. Few secondary sources are as reliable as primary sources such as the census, which covers the entire population. Other sources may not be as reliable and should be used only if no other

NOTES

data is available. Valid means that the data represents original and correct findings and has been collected using scientific methods. When using secondary sources of information, it should be thoroughly researched that the material is genuine and authentic.

Personal bias

Secondary sources are more prone to bias than primary sources. Some secondary sources such as personal records may be highly biased and they may not be. Personal diaries and other records such as newspapers, mass media products can be biased. Newspapers, magazines and websites do not use rigorous and well controlled methods in documentation. Most of the time such writings are opinion based and they are far from facts. In these publications the authors may distort facts to make the situation appear better or worse.

- **Availability of data**
  Availability of data is another issue in using secondary sources. You need to work hard to get highly rigorous, scientific and valid data from secondary sources as such data is hardly available in secondary sources. Secondary sources are generally preferred in research because of their ease of availability, if data is difficult to collect using secondary sources, then the researcher should not use it.
- **Format of data**
  Before using the data in secondary sources in research, its nature should also be seen. The format of the data may be completely different and the researcher may not use it in his/her research. Using any other format in data collection that is not related to your research format may give biased and invalid results.
- **Quality of data**
  Data quality is related to its accuracy and accuracy comes with rigor in collecting data. It depends on the source you are using in your research; Books and magazines can provide you with quality data. There may be some secondary sources that may not provide high quality data. Again, newspapers and magazines cannot provide good data for research, they should be avoided.

Obsolete data

Sometimes secondary sources are available for use in research but they are very old. Old data cannot be used in research. You cannot use a book written 20 years ago, the data in that book will be valid and reliable at the time it was written but it is obsolete considering the present circumstances. Libraries are full of books that contain data related to your research but you'll need to check the publication date to know if you can access it. As a university scholar you should know how old data your university allows you to use in research. In most cases, no more than 5 years of data can be used in research. Only historical data can be used forever because it represents history that cannot be researched by other means.

3.7 MEANING OF SAMPLING

Sampling Helps a lot in research. It is one of the most important factors that determine the accuracy of your research/survey results. If anything goes wrong with your sample it will be directly reflected in the final result. There are a number of techniques that help us to collect samples depending on the need and situation. This blog post tries to explain some of those techniques.

NOTES

To get started, let's take a look at some basic terminology.

- **Population**
- **Sample**
- **Sampling**

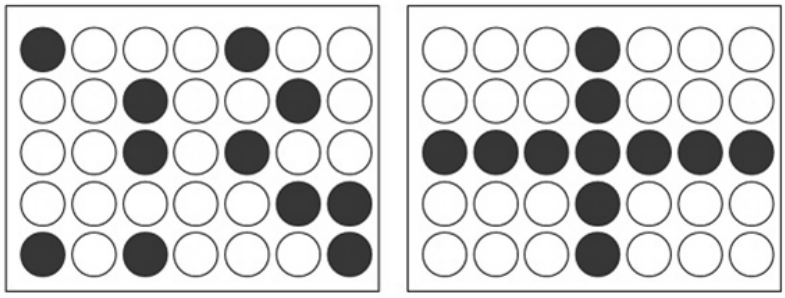
Population is a collection of elements that have some or the other characteristics in common. The number of elements in a population is the size of the population.

The sample is a subset of the population. The process of selecting a sample is known as sampling. The number of elements in the sample is the sample size.

Sampling

There are lot of sampling techniques which are grouped into two categories as:

- Probability Sampling
- Non- Probability Sampling



Probability Sampling Vs Non-Probability Sampling

The difference lies between the above two is whether the sample selection is based on randomization or not. With randomization, every element gets equal chance to be picked up and to be part of sample for study.

3.8 PROBABILITY SAMPLING

This Sampling technique uses randomization to make sure that every element of the population gets an equal chance to be part of the selected sample. It's alternatively known as random sampling.

- Simple Random Sampling
- Stratified Sampling
- Systematic Sampling
- Cluster Sampling
- Multi Stage Sampling
- **Simple Random Sampling**
  Every element has an equal chance of getting selected to be the part sample. It is used when we don't have any kind of prior information about the target population.

  For example: Random selection of 20 students from class of 50 student. Each student has equal chance of getting selected. Here probability of selection is 1/50

NOTES 

- **Stratified Sampling**
  This technique divides the elements of the population into small subgroups (strata) based on the similarity in such a way that the elements within the group are homogeneous and heterogeneous among the other subgroups formed. And then the elements are randomly selected from each of these strata. We need to have prior information about the population to create subgroups.
- **Cluster Sampling**
  Our entire population is divided into clusters or sections and then the clusters are randomly selected. All the elements of the cluster are used for sampling. Clusters are identified using details such as age, sex, location etc.

  Cluster sampling can be done in following ways:

  a. Single Stage Cluster Sampling

  Entire cluster is selected randomly for sampling.

  b. Two Stage Cluster Sampling

  Here first we randomly select clusters and then from those selected clusters we randomly select elements for sampling

  Systematic clustring

  Here the selection of elements is systematic and not random except the first element. Elements of a sample are chosen at regular intervals of population. All the elements are put together in a sequence first where each element has the equal chance of being selected.

  For a sample of size n, we divide our population of size N into subgroups of k elements.

  We select our first element randomly from the first subgroup of k elements.

  To select other elements of sample, perform following:

  We know number of elements in each group is k ie N/n

  So if our first element is n1 then

  Second element is n1+k ie n2

  Third element n2+k ie n3 and so on..

  Taking an example of N=20, n=5

  No of elements in each of the subgroups is N/n ie 20/5 =4= k

  Now, randomly select first element from the first subgroup.

  If we select n1= 3

  n2 = n1+k = 3+4 = 7

  n3 = n2+k = 7+4 = 11
- **Multi stage sampling**
  It is a combination of one or more of the methods described above. The population is divided into several groups and then these groups are divided and grouped into

NOTES 

different sub-groups (levels) on the basis of similarity. One or more groups can be selected at random from each level. This process continues until the cluster can no longer be partitioned. For example, a country can be divided into states, cities, urban and rural, and all regions with similar characteristics can be grouped together to form a single stratum.

3.9 NON-PROBABILITY SAMPLING

It does not depend on randomization. This technique is more dependent on the researcher's ability to select the elements for the sample. Sampling results can be biased and it becomes difficult for all elements of the population to be part of the sample equally. This type of sampling is also known as non-random sampling.

- Convenience Sampling
- Purposive Sampling
- Quota Sampling
- Referral /Snowball Sampling
- **Convenience Sampling**
  Here samples are selected based on availability. This method is used when the availability of samples is scarce and also expensive. So samples are selected on the basis of convenience. For example: Researchers prefer it during the initial stages of survey research, as it is quick and easy to produce results.

  Non-probability sampling examples

  Here are three simple examples of non-probability sampling to understand the subject better.

  1. An example of convenience sampling would be using student volunteers known to the researcher. Researchers can send the survey to students belonging to a particular school, college, or university, and act as a sample.
  2. In an organization, for studying the career goals of 500 employees, technically, the sample selected should have proportionate numbers of males and females. Which means there should be 250 males and 250 females? Since this is unlikely, the researcher selects the groups or strata using quota sampling.
  3. Researchers also use this type of sampling to conduct research involving a particular illness in patients or a rare disease. Researchers can seek help from subjects to refer to other subjects suffering from the same ailment to form a subjective sample to carry out the study.

  When to use non-probability sampling?

  a. Use this type of sampling to indicate if a particular trait or characteristic exists in a population.

  b. Researchers widely use the non-probability sampling method when they aim at conducting qualitative research, pilot studies, or exploratory research.

NOTES

c. Researchers use it when they have limited time to conduct research or have budget constraints.

d. When the researcher needs to observe whether a particular issue needs in-depth analysis, he applies this method.

e. Use it when you do not intend to generate results that will generalize the entire population.

- **Purposive sampling**
  It is based on the intent or purpose of the study. Only those elements will be selected from the population which are best suited for the purpose of our study.

  For example: If we want to understand the thought process of the people who are interested in pursuing master's degree then the selection criteria would be "Are you interested for masters...?"

- **Quota sampling**
  This type of sampling depends on some pre-determined standard. It selects a representative sample from the population. The ratio of characteristics/ characteristics in the sample should be the same as in the population. Elements are selected until an exact proportion of certain types of data is obtained or enough data has been collected in the different categories.

  For example: If our population consists of 45% females and 55% males then our sample should represent the same percentage of males and females.

- **Snowball sampling**
  This technique is used in the situations where the population is completely unknown and rare. Therefore, we will take the help from the first element which we select for the population and ask him to recommend other elements who will fit the description of the sample needed. So, this referral technique goes on, increasing the size of population like a snowball.

  For example: It's used in situations of highly sensitive topics like HIV Aids where people will not openly discuss and participate in surveys to share information about HIV Aids.

  Not all the victims will respond to the questions asked so researchers can contact people they know or volunteers to get in touch with the victims and collect information. Helps in situations where we do not have the access to sufficient people with the characteristics we are seeking. It starts with finding people to study.

3.10 REASON FOR SAMPLING INSTEAD OF CENSUS

The primary advantage of using sampling instead of census is efficiency. Suppose someone wants to know what is the average opinion of Congress among individuals 18-24 (that is, they want to know what is the approval rating of Congress in this demographic). According to the US Census, in 2010, there were over 30 million individuals in that age range located within the United States.

Going to each of these 30 million people and asking for their opinion, while it would certainly give very accurate results (assuming no one lies), would be quite costly in terms of

time and resources. Furthermore, given that a single individual's individual response would have little effect on the overall result, the return on investment of resources in collecting this census would be very small.

However, using a truly random and appropriately sized sample allows one to approximate the desired data within an acceptable margin of error, while significantly reducing time and resource expenditure. Thus, the person above may wish to choose a random sample of 10,000 individuals, or perhaps 100 from each congressional district. However, it should be emphasized that a non-random sample can lead to huge differences between the sample statistic and the population parameter.

As an example, suppose the person above chooses 500 people between the ages of 18 and 24 in each state from a list of registered Democrats. Given that the political affiliations of those surveyed may differ from those provided by the "average" member of the population, this sample can be said to be unbiased, and thus not an accurate representation of the population as a whole.

Census and sample survey are essentially concerned with the statistical collection of data in various fields and areas related to the particular subject matter or enquiry. These data collection exercises are carried out on a cross-section of the target population. The information obtained from population studies can later be used for various purposes. Let us discuss the census and sample

Census method is also known as full enumeration survey method. In this method each object in the universe is selected for data collection. The selected data may constitute a particular place, group of people or a specific locality which is the complete set of objects and who are of interest in a particular situation. This method is most commonly used by the government in respect of national population, housing census, agricultural census etc., where extensive knowledge about these areas is required.

3.11 CENSUS METHOD

The process used in the census method includes the statistical compilation of all units or members of the target population under the survey. In this case, population relates to the entire set of observations connected to a particular study. For instance, if students of a university have to give feedback on teaching faculty, the former will be held as the population of that study.

Census Method of Data Collection

Census method refers to the complete enumeration of a universe. A universe may be a place, a group of people or a specific locality through which we collect the data. Census method is necessary in some cases like population census, Agriculture Census, animal census etc. for gaining vast knowledge. But in contrary this & method is not applicable as well as needed to some social problems because it is costly and time consuming. It is difficult to study the whole universe because financially aid requires for it to complete the study. For this purpose, we use sampling method to pick up a simple from the whole universe. Census method is perplexed and take more time in data collection.

NOTES 

Suitability of Census Method

The census method is suitable only in the following cases.

1. Where the universe is not vast.
2. Where there is enough time to collect data.
3. Where higher degree of accuracy is required.
4. Where there is enough availability of finance.

Advantages of census method

Intensive Study

Data collection through census method gives opportunity to the investigator to have an intensive study about a problem study about a problem. The investigator gathers a lot of knowledge through this method.

Higher Degree of Accuracy

In this method there would be higher degree of accuracy in data. No other method is accurate like census method when the universe is small.

Suitable for Heterogeneous Units

This method is also applicable for units having heterogeneity or difference.

Indispensable in Some Cases

In certain cases this method is very important and suitable to be used for data collection. Without this method the study of a universe remains uncompleted.

3.12 SAMPLE METHOD

The sampling method selects different sample entities from the target population. This method involves the statistical analysis of an already determined number of observations that is obtained from a large set of populations. A variety of sampling methods can be used; These can be simple random sampling or systematic sampling, cluster sampling or stratified sampling, etc., among others.

Limitations of census method

- The expenditure incurred during the census is much higher because of the sheer size of the population. Also, data is collected from each unit of a sample population, which requires additional costing.
- Owing to the huge volume of data that is collated, a greater number of the workforce (as well as man-hours) is required for completion.
- **Costly Method:** Census method is a very costly method of data collection.
- **Time Consuming:** Census method consumes more time and labor to complete data collecting tasks.
- **Unsuitability:** Census method is not applicable or suitable if the universe is large. This method is suitable only for a small universe.
- **Chance Of Errors:** There is a comparatively higher chance of statistical errors in this method.

NOTES

Advantages of sample method

- In the sampling method, the number of units used is quite small. It helps to get results very quickly.
- The sampling method has a much lower cost than the census method as these tests are done on a limited sample.
- It has a greater scope than the census method as it serves as an alternative in cases where the latter becomes impractical. For example, if a manufacturer wanted to test its range of toasters and other kitchen appliances, it would apply a sampling method, not a census method.
- The nature of sampling method is such that it can be employed to check the results from the census method. Furthermore, because of its small sample size, the method is useful for cross-checking the reliability of one's own results. A small sample can be taken from the results generated, and that sample has to be tested.
- **Accuracy and Reliability:** Census method confirms a higher degree of accuracy than other techniques. The Census method provides complete information because each and every item is investigated carefully. Therefore, it is a very reliable method of data collection.
- **Suitability:** Census method is effective if the universe is small.
- **Intensive Study:** Census method examines each unit completely and gathers important data for intensive study.
- **Indispensable:** Census method is most reliable in certain cases where other methods cannot provide reliable and accurate results.
- **Heterogeneous Units**: This method is also applicable to examine heterogeneous units.

3.13 SAMPLE SURVEY

A sample survey is a type of method that is used for collecting data from or about the members of a population so that inferences about the entire population can be obtained from a subset, or sample, of the population members. A sample survey provides an estimate of the average length of stays for surgical and nonsurgical discharges would be calculated and compared. A well-defined sample survey will support inference from the sample that is scientifically valid about the population.

Sample surveys are a methodology that focuses on selecting a set of individuals capable of representing the target population. The basic idea behind the concept of sample surveys is to gather the information that will boost data collection while doing so within a specific time frame. This maximizes the effectiveness of research processes by making the end result and analysis actionable.

For example: A footwear brand decides to conduct a pricing model study for a line of shoe designs launched as teenage sportswear, using conjoint analysis. This is an attempt to revive the brand from declining customer demand due to overcharging.

NOTES

The study is targeted at teenage customers of the brand. However, surveying all the customers within that age group would not be practically possible. The brand requires a sample of individuals that are willing and capable of delivering significant value additions to the research by providing an accurate overview of the price points or range that is deemed fit and will provide an impetus to brand sales. So, the brand uses a random number generator to select people to be included in the sample. This ensures that every member who is a part of the target population has an equal chance of being included in the sample of survey participants and eliminates any bias that may lead to window dressing in the survey results.

The sample, upon selection, provides their authentic responses to multiple price models using criteria such as comfort, quality, size, color coding and other such relevant characteristics that impact customer choices. The input so provided gets summarized by using appropriate data analysis and statistical tools, to be used by multiple stakeholders and users for directing follow up actions. The quality of research is projected by how well the responses provided by the sample assist in boosting brand footwear sales.

What is the need for sample surveys?

It is neither efficient nor feasible to implement surveys that collect data from the entire target population. This becomes even more difficult when the population is high. Each aspect of data collection, from distribution to analysis and compilation, becomes more cumbersome.

Organizations belonging to any industry are part of a dynamic environment which motivates them to take quick decisions as per the changing circumstances. Such decisions should be driven by real market knowledge that provides direction and guidance to invest resources in the right sectors.

Sample surveys drive organizational functions by focusing on a particular group of highly representative individuals. The process of selection and screening of such individuals should be carefully planned and implemented in order to generate qualitative results for such surveys. The researcher needs to ensure the competency of the selected respondent by aligning the sample information with the characteristics of the target population.

Sample selection

Sample selection is the most integral part of your overall sample survey. The method you choose to select your sample will affect the validity and quality of your answers.

Sample selection can be done manually or by using several techniques adopted by data scientists. Researchers choose sample selection methods that help them filter out useful candidates who lack the relevant knowledge base to provide important insights.

The idea behind choosing an appropriate selection mechanism is to eliminate any distortion, misrepresentation or bias in the survey results. The selection of a non-representative sample brings in high sampling error which is by no means useful for organizations seeking to maintain a competitive market level. The disadvantages of improper sample selection are:

- Wastage of resources invested in ideating and conducting the research.
- Loss of personnel time.

- Inaccurate analysis.
- Lack of directional decision making.
- Dissatisfied stakeholders among others.

To optimize you selection procedure, keep certain basic pointers in mind:

1. Equal representation: Ensure that each sub-group has an equal share in your sample volume. This way, no single group has a majority sway over the final results.
2. Know your respondents: Organizations must possess updated information about their respondents to be confident about their eligibility as a qualified respondent. The sample frames used to build research samples must supply current demographics of the respondent.
3. Substantial sample size: Process the right balance between including excessively large samples and samples that are too small to be significant. More the number of suitable individuals in your sample, more cohesive will be your survey.

Advantages of sample survey

- **Low cost of sampling:** The cost will be quite high if the data of the sample survey is collected for the entire population. The cost will be lower if data collected for sample surveys is for a sample of population which is a big advantage.
- **Less time-consuming in sampling:** A sample survey takes less time. A sample survey consumes less time than a census technique.
- **Scope of sampling is high:** A sample survey makes it possible to arrive at generalizations by studying the variables within a relatively small proportion of the population.
- **Accuracy of data is high:** Drawing a sample and computing the desired descriptive statistics, A sample survey makes it possible to determine the stability of the obtained sample value. A sample survey permits a high degree of accuracy due to a limited area of operations.
- **Organization of convenience:** Organizational problems are very few in sample surveys. The sample is of small size, vast facilities are not required in it. The sample survey is therefore economical in respect of resources. The study of samples in sample surveys involves less space and equipment.

Limitations of sample survey

- **Chances of bias:** A sample survey involves biased selection and leads to incorrect conclusions. Bias selection occurs when the method of selection of the sample employed is faulty. Properly chosen comparatively small samples may be more reliable than poorly chosen large samples.
- **Difficulties in selecting a truly representative sample:** Difficulties in selecting a truly representative sample yield the most reliable and accurate results only if they are representative of the whole group. Sample selection is difficult when the events under study are complex in nature. It is difficult to select good samples for survey.

NOTES 

- **Inadequate knowledge of the subject:** Sampling method requires adequate subject knowledge in the sampling technique. Sampling involves calculation of error for statistical analysis and survey. When the researcher lacks specific knowledge in sampling, they make serious mistakes in sample survey.
- **The changeability of units:** If the units of the population are not homogeneous, the sampling technique would be unscientific. In this sampling method, although the number of cases is small, the survey is not always easy to stick to the selected cases. The units of the sample can be widely dispersed.

3.14 SAMPLING PROCESS

1. **Defining the Target Population:**
   Defining a population of interest for commercial research is the first step in the sampling process. In general, the target population is defined in terms of element, sample unit, range and time frame. The definition should be in line with the objectives of the research study. For example, if a kitchen appliance firm wanted to conduct a survey to find out the demand for its micro-ovens, it would consider the population to be 'all women over the age of 20 who cook (assuming that there are very few men'). cooking)'. However, this definition is very broad and will include every household in the country in the population that is to be covered by the survey.

   Therefore, the definition can be further refined and defined at the sample unit level as all women above 20 years of age, who cook and whose monthly household income is more than Rs.20,000. This reduces the size of the target population and makes research more focused. The definition of population can be further refined by specifying the area from which the researcher has to take his sample, i.e., the house located in Hyderabad.

   A well-defined population makes it less likely to include respondents who do not fit the company's research objective. For example, if the population is defined as all women over the age of 20, the researcher may take the opinion of a large number of women who cannot afford to buy a micro-oven.

2. **Specifying the Sampling Frame:**
   Once the definition of a population is clear, a researcher must decide on a sample frame. A sample frame is a list of elements from which a sample can be drawn. Continuing with the micro-oven former, an ideal sample frame would be a database that would include all households whose monthly income exceeds Rs 20,000. However, in practice it is difficult to obtain a wide sampling frame that exactly fits the needs of a particular research. In general, researchers use readily available sampling frames such as telephone directories and lists of credit card and mobile phone users.

   Various private players provide developed databases with different demographic and economic variables. Sometimes, maps and aerial photographs are also used as sample frames. Whatever the case may be, an ideal sampling frame is one that is the entire population and lists the names of its elements only once.

NOTES

A sample frame error occurs when the sample frame does not accurately represent the total population or when some elements of the population are missing in the sample frame—another defect in the representation is lost. A telephone directory can be represented by names/households that have two or more connections.

3. **Specifying the Sampling Unit:**
   A sampling unit is a basic unit consisting of a single element or group of elements of the population to be sampled. In this case, a household becomes a sample unit and all women over the age of 20 living in that particular household become the sample element. If it is possible to identify the exact target audience of business research, each individual element would be a sample unit.

   This will present the case of the primary sampling unit. However, a convenient and better means of sampling would be to select households as a sampling unit and interview all women above the age of 20 who cook. This will present the case of the secondary sampling unit.

4. **Selection of the Sampling Method:**
   The sampling method outlines the manner in which the sampling units are to be selected. The choice of sampling method is influenced by the objectives of the business research, availability of financial resources, time constraints and the nature of the problem to be investigated. All sampling methods can be grouped under two different heads, namely, probability and non-probability sampling.

5. **Determination of Sample Size:**
   Sample size plays an important role in the sampling process. There are different ways of classifying the techniques used in determining sample size. A couple that is of primary importance and deserves attention is whether the technique deals with fixed or sequential sampling and whether its logic is based on traditional or Bayesian methods.

   In non-probability sampling procedures, allocation of budget, rules of thumb and number of subgroups to be analyzed, significance of the decision, number of variables, nature of analysis, incidence rate and completion rate play a major role in determining sample size., In the case of probability sampling, however, formulas are used to calculate the sample size after specifying the level of acceptable error and the level of confidence. The details of the various techniques used to determine sample size will be explained at the end of the chapter.

6. **Specifying the Sampling Plan:**
   In this phase, the specifications and decisions regarding the implementation of the research process are outlined. Suppose, a city has block sampling units and houses are the sampling elements. This step outlines the modalities of sample planning in identifying homes based on specified characteristics. This includes issues such as how the interviewer will systematically sample homes. What should the interviewer do when the house is vacant? What is the re-contact process for missing respondents? All these and many other questions need to be answered for the smooth conduct of the research process. These are guidelines that will help the researcher at every stage of the process.

NOTES 

Since the interviewers and their co-workers will be on field duty most of the time, a proper specification of sample plans will make their job easier and they won't have to go back to their superiors if they face operational problems.

7. **Selecting the Sample:**
   This is the final step in the sampling process, where the actual selection of the sample elements is carried out. At this stage, it is necessary that the interviewers stick to the rules outlined for the smooth implementation of the business research. This step involves implementing the sampling plan to select the sampling plan to select a sample required for the survey.

3.15 SAMPLE SIZE DETERMINATION

What is 'sample size'?

'Sample size' is a market research term used to define the number of persons involved to conduct the research. Researchers choose their sample based on demographics, such as age, gender or physical location.

Samples may be ambiguous or conspicuous. For example, you might want to know what people in the 18-25 age group think about your product. Or, you may only need your sample to live in the United States, which gives you a wider range of populations. The sample size is the total number of individuals in a particular sample.

Why do you need to determine sample size?

Let's say you are a market researcher in the US and want to send a survey or questionnaire. The purpose of the survey is to understand the sentiments of the audience towards the new cell phone you are launching. You want to know what people in the US think about the new product to predict the success or failure of the phone ahead of its launch.

Hypothetically, you choose the population of New York, which is 8.49 million. You use a sample size determination formula to select a sample of 500 individuals who fit the consumer panel's requirement. You can use feedback to help determine how your audience will react to the new product.

However, knowing how to determine a sample size requires much more than just throwing your survey at as many people as possible. If your sample size is too large, it can be a waste of resources, time and money. A sample size that is too small does not allow you to obtain maximum insight, leading to inconclusive results.

How is a sample size determined?

Determining the right sample size for your survey is one of the most common questions researchers ask when they begin a market research study. Luckily, sample size determination isn't as hard to calculate as you might remember from an old high school statistics class.

Before you can calculate your sample size, make sure you have these things in place:

- **Goals and objectives:** What do you hope to do with the survey? Are you planning on projecting the results onto a whole demographic or population? Do you want to see how a specific group thinks? Are you trying to make a big decision or just set a direction? If you're going to be projecting your survey results on a larger

NOTES

population, the sample size is critical. You'll want to make sure that it's balanced and reflects the community as a whole. If you're trying to get a feel for preferences, then the sample size isn't as critical.

For example, you're surveying homeowners across the US on the cost of cooling their homes in the summer. A homeowner in the South probably spends a lot more money, cooling their home in the humid heat than someone in Denver, where the climate is drier and cooler. For the most accurate results, you'll need to get responses from people in all US areas and environments. If you only collect responses from one extreme, such as the warm South, your results will be skewed.

a. **Precision level:** How close do you want the results of the survey to be to the true price if everyone answered? Then, if this survey will determine how you›re going to spend millions of dollars, your sample size determination needs to be accurate. The more accurate you need to be, the larger the sample you want, and the more accurate your sample needs to represent the overall population. If your population is small, say, 200 people, you might want to survey the entire population, rather than just cut it out with a sample.

b. **Confidence level?** T A sign of confidence from a risk perspective. How much risk are you willing to take? This is where your confidence interval numbers become important. How confident do you want to be - 98% confident, 95% confident? Understand that the confidence percentage you choose has a big impact on the number of completions you will need for accuracy.

   This can increase the duration of the survey and the number of responses you need, which means the cost of your survey increases. Knowing the actual number and quantity behind the percentage can help you understand more about your sample size needs versus survey costs. For example, you want to be 99% confident. After using the sample size determination formula, you find that you need to collect an additional 1000 respondents. This, in turn, means that you will pay for the samples or keep your survey running for a week or two. You have to determine whether the increased accuracy is more important than the cost.

- **Population variability:** What variability exists in your population? In other words, how similar or different are the populations? If you're surveying consumers on a broad topic, you can have lots of variations. You will need a large sample size to get the most accurate picture of the population. However, if you are surveying a population with similar characteristics, your variability will be lower, and you may be sampling fewer people. More variability equals more samples, and less variability equals less samples. If you are not sure, you can start with 50% variability.
- **Response rate:** You want everyone to answer your survey. Unfortunately, every survey comes with targeted respondents who either never open the study or leave halfway through. Your response rate will depend on how engaged your population is with your product, service organization or brand. The higher the response rate, the higher the level of engagement with your population. Your base sample size is the number of responses you get to a successful survey.

NOTES 

- **Consider Your audience:** In addition to the variability within your population, you need to make sure that your sample does not include people who would not benefit from the results. One of the biggest mistakes you can make in sample size determination is forgetting to consider your actual audience. You don't want to send a survey to a group of homeowners asking them about the quality of local apartment amenities.
- **Focus on your survey's objectives:** You can start with general demographics and characteristics, but can you narrow down those characteristics even further? Narrowing your audience makes it easier to get more accurate results from a smaller sample size. For example, you want to know how people will react to new automobile technology. Your current population includes anyone who has a car in a particular market. However, you know that your target audience is people who drive cars less than five years old. You can exclude anyone with an older vehicle from your sample because they are unlikely to buy your product.

3.16 SAMPLING ERROR

A sampling error is a statistical error that occurs when an analyst does not select a sample that represents the entire population of data. Consequently, the results found in the sample do not represent the results that would be obtained from the entire population.

Sampling is the analysis done by selecting a number of observations from a large population. The method of selection can generate both sampling errors and non-sampling errors.

Sampling error occurs when the sample used in the study is not representative of the entire population. Sampling errors are frequent, and thus, researchers always calculate the margin of error when making final results as a statistical exercise. The margin of error is the amount of error allowed for an incorrect calculation to represent the difference between the sample and the actual population.

What are the most common sampling errors in market research?
Here are the top four market research errors while sampling:

- **Population specification error:** Population specification error occurs when researchers do not know exactly who to survey. For example, imagine a research study about baby apparel. Who is the right person to conduct the survey? It can be either the parent, only the mother or the child. Parents make the buying decisions, but children can influence their choices.
- **Sample frame error:** Sampling frame errors arise when researchers incorrectly target subpopulations when selecting samples. For example, choosing a sampling frame from a telephone white page book may result in incorrect inclusion as people shift their cities. False exclusion is when people prefer to un-list their numbers. Wealthy families may have more than one connection, thus multiple inclusions.
- **Selection error:** A selection error occurs when respondents self-select themselves to participate in the study. Only the interested ones respond. You can control selection errors by going the extra step to request responses from the entire sample. Pre-survey planning, follow-ups, and a neat and clean survey design will boost

respondents' participation rate. Also, try methods like CATI surveys and in-person interviews to maximize responses

Controlling your sampling error

Statistical theories help researchers measure the sample size and the likelihood of sampling errors in a population. The size of the sample considered from the population mainly determines the size of the sampling error. Large sample sizes suffer low rates of errors. To understand and evaluate the margin of error, researchers use a metric known as the margin of error. Typically, a confidence level of 95% is considered the desired confidence level.

What are the steps to reduce sampling errors?

Sampling errors are easy to identify. Here are a few simple steps to reduce sampling error:

- **Increase sample size:** A larger sample size results in a more accurate result because the study gets closer to the actual population size.
- **Divide the population into groups:** Test groups according to their size in the population instead of a random sample. For example, if people of a specific demographic make up 20% of the population, make sure that your study is made up of this variable.
- **Know your population:** Study your population and understand its demographic mix. Know what demographics use your product and service and ensure you only target the sample that matters.

Types of sampling error

There are different categories of sampling errors.

1. **Population-Specific Error**
   A population-specific error occurs when a researcher doesn't understand who to survey.
2. **Selection Error**
   Selection error occurs when the survey is self-selected, or when only those participants who are interested in the survey respond to the questions. Researchers can attempt to overcome selection error by finding ways to encourage participation.
3. **Sample Frame Error**
   A sample frame error occurs when a sample is selected from the wrong population data.
4. **Non-response Error**
   A non-response error occurs when a useful response is not obtained from the surveys because researchers were unable to contact potential respondents (or potential respondents refused to respond).
5. **Eliminating Sampling Errors**
   The prevalence of sampling errors can be reduced by increasing the sample size. As the sample size increases, the sample gets closer to the actual population, reducing the potential for deviation from the actual population. Consider that the average of a sample of 10 varies more than the average of a sample of 100. Steps can also be taken to ensure that the sample adequately represents the entire population.

NOTES

Researchers can try to reduce sampling errors by replicating their study. This can be accomplished by taking the same measurement repeatedly, using multiple subjects or multiple groups, or by conducting multiple studies.

Random sampling is an additional method to reduce the occurrence of sampling errors. Random sampling establishes a systematic approach to sample selection. For example, instead of randomly selecting participants to be interviewed, a researcher might choose those whose names appear first, 10th, 20th, 30th, 40th, and so on in the list.

Examples of Sampling Errors

- Let's say XYZ Company offers a subscription-based service that allows consumers to pay a monthly fee to stream video and other types of programming via an Internet connection.
- The firm wants to survey homeowners who watch at least 10 hours of programming via the Internet per week and who pay for an existing video streaming service. XYZ wants to determine what percentage of the population is interested in a low-priced subscription service. If XYZ does not think carefully about the sampling process, a variety of sampling errors can occur.
- If XYZ Company does not understand the specific types of consumers that should be included in the sample, A population Specification error will occur. For example, if XYZ makes up a population of people ages 15 to 25, many of those consumers do not make a purchase decision about a video streaming service because they cannot work full-time. On the other hand, if XYZ puts together a sample of working adults who make purchase decisions, consumers in this group may not watch 10 hours of video programming each week.
- Selection error also causes distortions in the sampling results. A common example is a survey that only relies on a small fraction of people to respond promptly. If XYZ attempts to follow up with consumers who do not respond initially, the survey results may change. Furthermore, if XYZ excludes consumers who do not respond promptly, the sample results may not reflect the preferences of the entire population.

3.17 CHAPTER SUMMARY

When you conduct research about a group of people, it's rarely possible to collect data from every person in that group. Instead, you select a sample. The sample is the group of individuals who will actually participate in the research.

Sampling inspection plans for routine inspections are often single sampling plans. Both attribute and variables sampling plans intended for routine inspection assume that physical sampling is done correctly and no errors are present in testing or measuring the variables of interest.

The evaluation of the risks to the producer and consumer for such routine sampling plans can be done using their Operating Characteristic (OC) curves. Both the producer and consumer must fully aware of the risk or chances of good quality batches getting rejected as well as poor quality batches are wrongly accepted as good. It is necessary to control

NOTES

these risks with the appropriate choice of the sample size and set the acceptance criterion accordingly.

It is also important to recognize that the routine plans may fail in the presence of excessive measurement or inspection errors. Routine sampling plans can be adjusted for measurement uncertainty and then the risks can be evaluated. The OC curve again serves as the appropriate tool for making this risk assessment.

With the advancement of software technology, it is easy to evaluate the underlying risks quantitatively using online web tools. A number of such tools and examples are presented in this document.

3.18 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **What is marketing research?**
2. **What do you mean by the term sampling?**
3. **What is probability sampling?**
4. **What is sample method?**
5. **What is sample survey?**

LONG ANSWER TYPE QUESTIONS

1. **What is sampling error and explain its type?**
2. **What is the reason for sampling instead of census?**
3. **What are the advantages and disadvantages of probability sampling?**
4. **How sample size is determined?**
5. **What is secondary data and explain its sources?**

3.19 MULTIPLE CHOICE QUESTIONS

1. **Which of the following are known as the types of research data?**
   a. Organised data and unorganised data
   b. Qualitative data and quantitative data
   c. Processed data and unprocessed data
   d. None of the above
2. **Which of the following statements is true about the collection of data?**
   a. The data that is collected from the place of origin is known as primary data
   b. The data that is collected from the place of origin is known as secondary data
   c. The data that is collected from the place of origin is known as tertiary data
   d. None of the above
3. **Which of the following statements is true about the source of data?**
   a. The source of data that is collected and compiled by others is known as secondary data

NOTES 

b. The source of data that is collected and compiled by others is known as tertiary data
c. The source of data that is collected and compiled by others is known as primary data
d. None of the above

4. **Which of the following statements is true about data in research?**
   a. The data used for research is quantitative
   b. The data used for research can be qualitative but never quantitative
   c. The data used for research can be both quantitative and qualitative
   d. The data used for research can be quantitative but never qualitative

5. **Of the following sampling methods, which is a probability method?**
   a. Judgment
   b. Quota
   c. Simple random
   d. Convenience

6. **Which among the following is the benefit of using simple random sampling?**
   a. The results are always representative.
   b. Interviewers can choose respondents freely.
   c. Informants can refuse to participate.
   d. We can calculate the accuracy of the results.

7. **Increasing the sample size has the following effect upon the sampling error?**
   a. It increases the sampling error
   b. It reduces the sampling error
   c. It has no effect on the sampling error
   d. All of the above

8. **Which of the following is not a type of non-probability sampling?**
   a. Quota sampling
   b. Convenience sampling
   c. Snowball sampling
   d. Stratified random sampling

9. **Sample is regarded as a subset of?**
   a. Data
   b. Set
   c. Distribution
   d. Population

10. **The distribution that is formed by all possible values of a statistics is known as:**
    a. Hyper geometric distribution
    b. Normal distribution
    c. Sampling distribution
    d. Binomial distribution

♦♦♦♦♦

UNIT IV

QUALITATIVE RESEARCH

STRUCTURE

NOTES 

4.1 LEARNING OBJECTIVE

- Identify and discuss the role and importance of research in the social sciences.
- Identify and discuss the issues and concepts salient to the research process.
- Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
- Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

4.2 INTRODUCTION

Quantitative research is a method for data collection and for scientific and non-scientific research. Its goal is to describe the area being researched. Research should be done using multiple methods, but quantitative research tends to be used the most often, because it is **simple and undemanding**.

You can think of the **quantitative method** as data collection that is focused on large numbers of respondents. These respondents most often answer questions through questionnaires, which are then processed and statistically evaluated.

Quantitative methods emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. Quantitative research focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon.

Your goal in conducting quantitative research study is to determine the relationship between one thing [an independent variable] and another [a dependent or outcome variable] within a population. Quantitative research designs are either **descriptive** [subjects usually measured once] or **experimental** [subjects measured before and after a treatment]. A descriptive study establishes only associations between variables; an experimental study establishes causality.

Quantitative research deals in numbers, logic, and an objective stance. Quantitative research focuses on numeric and unchanging data and detailed, convergent reasoning rather than divergent reasoning [i.e., the generation of a variety of ideas about a research problem in a spontaneous, free-flowing manner].

4.3 MEANING OF QUANTITATIVE RESEARCH

Quantitative research is defined as the systematic investigation of phenomena by collecting quantitative data and performing statistical, mathematical or computational techniques. Quantitative research collects information from existing and potential customers using sampling methods and sending out online surveys, online surveys, questionnaires, etc., the results of which can be represented as numerical. After careful understanding of these numbers to predict the future of a product or service and make changes accordingly.

An example of quantitative research is a survey done to understand how long a doctor takes to care for a patient when a patient walks into the hospital. A patient satisfaction survey

template can be administered to ask questions such as how long it takes a doctor to see a patient, how often a patient visits the hospital, and other such questions.

How do we collect quantitative data?

To collect quantitative data, the first step involves developing operational definitions of the abstract concept you wish to study. For example, if you want to study the feelings (abstract perception) that your product is eliciting in consumers, you can quantify this variable and make it observable (for example consumers' feelings while using the product). Self-report of feelings). Thus, the operational definition of the concept under study usually helps to provide you with a direction in which you can study your area of interest.

Since quantitative research relies on objectivity, detail, and is sometimes investigative, data collection is usually done by employing structured methods. These methods are performed on large samples. These samples typically represent the population of interest in the study to which the results will be generalized.

There are two methods through which you can conduct quantitative research, they are:

- Primary Quantitative Research Methods
- Secondary Quantitative Research Methods

Primary Quantitative Research

This research method is most widely employed for conducting market research. Here, the researcher collects data directly from the sample based on the data collected from previous researches. In this section, we will understand the types of quantitative design, several methods of collecting data from primary sources and data analysis under quantitative.

Secondary Quantitative Research Methods

Secondary quantitative research is also known as desk research. In this research method, researchers use pre-existing data also known as secondary data. This existing data is then summarized and organized to increase the overall efficacy of the research. This research method involves collecting data from internet, government documents or resources, libraries and other research done etc. Secondary quantitative research is usually done to validate data collected from primary quantitative research. It also helps to strengthen or refute data that has already been collected. A popular method of secondary quantitative research is called meta-analysis. A meta-analysis is a statistical study that usually combines the results of various other scientific studies. So, in a way, it is a summary of the already existing data on a particular event.

4.4 CHARACTERISTICS OF QUANTITATIVE RESEARCH

Some distinctive characteristics of quantitative research are:

- **Structured tools:** Structured tools such as surveys, polls, or questionnaires are used to gather quantitative data. Using such structure methods helps in collecting in-depth and actionable data from the survey respondents.
- **Sample size:** Quantitative research is conducted on a significant sample size that represents the target market. Appropriate sampling methods have to be used when deriving the sample to fortify the research objective

NOTES

- **Close-ended questions:** Closed-ended questions are created per the objective of the research. These questions help collect quantitative data and hence, are extensively used in quantitative research.
- **Prior studies:** Various factors related to the research topic are studied before collecting feedback from respondents.
- **Quantitative data:** Usually, quantitative data is represented by tables, charts, graphs, or any other non-numerical form. This makes it easy to understand the data that has been collected as well as prove the validity of the market research.
- **Generalization of results:** Results of this research method can be generalized to an entire population to take appropriate actions for improvement.

Quantitative research example

If an organization wants to conduct a Customer Satisfaction (CSAT) survey, the Customer Satisfaction Survey template can be used. Through this survey, an organization can collect quantitative data and metrics on the goodwill of the brand or organization in the mind of the customer based on several parameters such as product quality, pricing, customer experience, etc. This data can be collected by asking Net Promoter Score (NPS) questions, Matrix Table Questions, etc. which provide data in the form of numbers which can be analyzed and worked on.

4.5 ADVANTAGES OF QUANTITATIVE RESEARCH

Collect reliable and accurate data: As data is collected, analyzed, and presented in numbers, the results obtained will be extremely reliable. Numbers do not lie. They offer an honest picture of the conducted research without discrepancies and is also extremely accurate. In situations where a researcher predicts conflict, quantitative research is conducted.

- **Quick data collection:** A quantitative research is done with a group of respondents who represent the population. A survey or any other quantitative research methodology applied to these respondents and involving data, conducting and analyzing the results is fairly straightforward and less time consuming.
- **Wider scope of data analysis:** Due to the statistics, this research method provides a wide scope of data collection.
- **Eliminate bias:** This research method offers no scope for personal comments or biasing of results. The results achieved are numerical and are thus, fair in most cases.

4.6 TECHNIQUES AND TYPES OF QUANTITATIVE RESEARCH

There are multiple types of primary quantitative research. They can be distinguished into the four following distinctive methods, which are:

1. **Survey Research:**
   Survey research is the most fundamental tool for all quantitative outcome research methodologies and studies. Surveys used to ask questions from a sample of respondents using various forms such as online polling, online surveys, paper

NOTES

questionnaires, web-blocking surveys, etc. Every small and big organization intends to understand what their customers think about their products and services, how well the new features are running in the market and other such details.

By conducting survey research, an organization can ask multiple survey questions, collect data from a pool of customers, and analyze this collected data to produce numerical results. It is the first step towards collecting data for any research.

This type of research can be conducted with a specific target audience group and also can be conducted across multiple groups along with comparative analysis. A prerequisite for this type of research is that the sample of respondents must have randomly selected members. This way, a researcher can easily maintain the accuracy of the obtained results as a huge variety of respondents will be addressed using random selection. Traditionally, survey research was conducted face-to-face or via phone calls but with the progress made by online mediums such as email or social media, survey research has spread to online mediums as well.

Traditionally, survey research was conducted face-to-face or via phone calls but with the progress made by online mediums such as email or social media, survey research has spread to online mediums as well.

There are two types of surveys, either of which can be chosen based on the time in-hand and the kind of data required:

a. **Cross-sectional surveys:** Cross-sectional surveys are observational surveys conducted in situations where the researcher intends to collect data from a sample of the target population at a given point in time. Researchers can evaluate different variables at a particular point in time. Data collected using this type of survey are those that show similarity in all variables except those that are considered for research. Throughout the survey, this one variable will remain constant.

   - Cross-sectional surveys are popular with retail, SMEs, healthcare industries. Information is garnered without modifying any parameters in the variable ecosystem.
   - Using a cross-sectional survey research method, multiple samples can be analyzed and compared.
   - Multiple variables can be evaluated using this type of survey research.
   - The only disadvantage of cross-sectional surveys is that the cause-effect relationship of variables cannot be established as it usually evaluates variables at a particular time and not across a continuous time frame.

b. **Longitudinal surveys:** Longitudinal surveys There are also observational surveys, but unlike cross-sectional surveys, longitudinal surveys are conducted over different time periods to observe changes in respondent behavior and thought-processes. This time period can be days, months, years or even decades. For example, a researcher planning to analyze changes in the shopping habits of adolescents over the age of 5 would conduct a longitudinal survey.

NOTES

- In cross-sectional surveys, the same variables were evaluated at a given point in time, and in longitudinal surveys, different variables can be analyzed at different intervals of time.
- Longitudinal surveys are extensively used in the field of medicine and applied sciences. Apart from these two fields, they are also used to observe a change in the market trend, analyze customer satisfaction, or gain feedback on products/services.
- In situations where the sequence of events is highly essential, longitudinal surveys are used.
- Researchers say that when there are research subjects that need to be thoroughly inspected before concluding, they rely on longitudinal surveys.

2. **Correlational research:**
Comparison between two entities is immutable. Correlation research is conducted to establish the relationship between two closely knit entities and how one affects the other and what are the ultimately observed changes. This research method is designed to value naturally occurring relationships, and at least two separate groups are needed for this quantitative research method to operate successfully. A relationship should be established between two groups or entities, without assuming different aspects.

Researchers use this quantitative research design to correlate two or more variables using mathematical analysis methods. The patterns, relationships and trends among variables are inferred as they exist in their original set up. The effect of one of these variables on the other is seen along with how it changes the relationship between the two variables. Researchers manipulate a single variable to obtain the desired result.

Ideally, it is advised not to make conclusions merely based on correlational research. This is because it is not mandatory that if two variables are in sync that they are interrelated.

Example of Correlational Research Questions:

The relationship between stress and depression. The equation between fame and money. The relation between activities in a third-grade class and its students.

3. **Causal-comparative research:**
This research method mainly depends on the factor of comparison. Also called quasi-experimental research, this quantitative research method is used by researchers to eliminate a cause-effect equation between two or more variables, where one variable is dependent on another independent variable. The independent variable is established but not manipulated, and its effect on the dependent variable is observed. These variables or groups must be formed as they exist in the natural set up. Since the dependent and independent variables will always be present in a group, it is advised that the conclusions be carefully established taking into account all the factors.

NOTES

Cause-comparison research is not limited to statistical analysis of two variables, but extends to analyzing how different variables or groups change under the influence of the same change. This research is done regardless of the type of relationship that exists between two or more variables. Statistical analysis is used to clearly present the results obtained using this quantitative research method.

Example of Causal-Comparative Research Questions:

The impact of drugs on a teenager. The effect of good education on a freshman. The effect of substantial food provision in the villages of Africa.

Experimental research:

Also known as true experimentation, this research method relies on a theory. Experimental research, as the name suggests, is usually based on one or more principles. This theory has not been proven in the past and is only a guess. In experimental research, analysis is done to prove or disprove the statement. This research method is used in the natural sciences. Traditional research methods are more effective than modern techniques.

- Experimental research can have several theories. A theory is a statement that can be verified or refuted.
- After establishing the statement, an attempt is made to understand whether it is valid or invalid. This type of quantitative research method is mainly used in the natural or social sciences because there are many statements that need to be proved true or false.
- Traditional research methods are more effective than modern techniques.
- Systematic learning programs help children who have difficulty coping with the curriculum.
- Having a nursing staff responsible for sick parents is a blessing.

4.7 DATA COLLECTION METHODOLOGIES

The second major step in primary quantitative research is data collection. Data collection can be divided into sampling methods and data collection with the use of surveys and polls.

Data collection methodologies: Sampling methods

There are two main sampling methods for quantitative research: Probability and non-probability sampling.

Probability sampling

A theory of probability is used to filter individuals from a population and create samples in probability sampling. Participants of a sample are chosen random selection processes. Each member of the target audience has an equal opportunity to be selected in the sample.

There are four main types of probability sampling:

- **Simple random sampling:** As the name indicates, simple random sampling is nothing but a random selection of elements for a sample. This sampling technique is implemented where the target population is considerably large.

NOTES

- **Stratified random sampling:** In the stratified random sampling method, a large population is divided into groups (strata), and members of a sample are chosen randomly from these strata. The various segregated strata should ideally not overlap one another.
- **Cluster sampling:** Cluster sampling is a probability sampling method using which the main segment is divided into clusters, usually using geographic and demographic segmentation parameters.
- **Systematic sampling:** Systematic sampling is a technique where the starting point of the sample is chosen randomly, and all the other elements are chosen using a fixed interval. This interval is calculated by dividing the population size by the target sample size.

Non probability sampling

Non-probability sampling is where the knowledge and experience of the researcher is used to create samples. Because of the involvement of the researcher, not all members of the target population have an equal chance of being selected to be part of the sample

There are five non-probability sampling models:

- **Convenience sampling:** In convenience sampling, elements of a sample are chosen only due to one prime reason: their proximity to the researcher. These samples are quick and easy to implement as there is no other parameter of selection involved.
- **Consecutive sampling:** Consecutive sampling is quite similar to convenience sampling, except for the fact that researchers can choose a single element or a group of samples and conduct research consecutively over a significant period and then perform the same process with other samples.
- **Quota sampling:** Using quota sampling, researchers can select elements using their knowledge of target traits and personalities to form strata. Members of various strata can then be chosen to be a part of the sample as per the researcher's understanding.
- **Snowball sampling:** Snowball sampling is conducted with target audiences, which are difficult to contact and get information. It is popular in cases where the target audience for research is rare to put together.
- **Judgmental sampling:** Judgmental sampling is a non-probability sampling method where samples are created only based on the researcher's experience and skill.

4.8 DATA ANALYSIS TECHNIQUES

The third aspect of primary quantitative research design is data analysis. After the collection of the raw data, this data needs to be analyzed in order to draw statistical conclusions from this research. It is important to link the results to the purpose of the research and establish the statistical relevance of the results.

It is important to consider aspects of research that were not considered for the data collection process and report the difference between what was planned versus what was actually performed.

It is then necessary to select accurate statistical analysis methods such as SWOT, combined, cross-tabulation etc. to analyze the quantitative data.

- **SWOT analysis:** SWOT Analysis stands for the acronym of Strengths, Weakness, Opportunities, and Threat analysis. Organizations use this statistical analysis technique to evaluate their performance internally and externally to develop effective strategies for improvement.
- **Conjoint Analysis:** Conjoint Analysis is a market analysis method to learn how individuals make complicated purchasing decisions. Trade-offs are involved in the daily activities of an individual, and these reflect their ability to decide from a complex list of product/service options.
- **Cross-tabulation:** Cross-tabulation is one of the preliminary statistical market analysis methods which establishes relationships, patterns, and trends within the various parameters of the research study.
- **TURF Analysis:** TURF Analysis, an acronym for Totally Unduplicated Reach and Frequency Analysis, is executed in situations where the reach of a favorable communication source is to be analyzed along with the frequency of this communication. It is used for understanding the potential of a target market. Inferential statistics methods such as confidence interval, margin of error, etc. can then be used to provide results.

4.9 MEANING OF QUALITATIVE RESEARCH

- Qualitative research is defined as a market research methodology that focuses on obtaining data through open-ended and conversational communication.
- This method involves not only the "what" of what people think but also the "why". For example, consider a convenience store that wants to improve its patronage. From a systematic observation it is concluded that the number of men who visit this store is more. A good way to determine why women weren't coming to the store is to conduct an in-depth interview of potential customers in the category.
- Qualitative research involves collecting and analyzing non-numerical data (eg, text, video or audio) to understand concepts, ideas, or experiences. It can be used to gather deeper insight into a problem or generate new ideas for research.
- Qualitative research is the opposite of quantitative research, which involves collecting and analyzing numerical data for statistical analysis.
- Qualitative research is commonly used in the humanities and social sciences in subjects such as anthropology, sociology, education, health sciences, history, etc.

Qualitative data analysis

Qualitative data can take the form of texts, photos, videos and audio. For example, you might be working with interview transcripts, survey responses, fieldnotes, or recordings from natural settings.

NOTES 

Most types of qualitative data analysis share the same five steps:

1. **Prepare and organize your data.** This may mean transcribing interviews or typing up fieldnotes.
2. **Review and explore your data.** Examine the data for patterns or repeated ideas that emerge.
3. **Develop a data coding system.** Based on your initial ideas, establish a set of codes that you can apply to categorize your data.
4. **Assign codes to the data.** For example, in qualitative survey analysis, this may mean going through each participant's responses and tagging them with codes in a spreadsheet. As you go through your data, you can create new codes to add to your system if necessary.
5. **Identify recurring themes.** Link codes together into cohesive, overarching themes.

4.10 ADVANTAGES OF QUALITATIVE RESEARCH

Qualitative research often tries to preserve the voice and perspective of participants and can be adjusted as new research questions arise. Qualitative research is good for:

- **Flexibility** The data collection and analysis process can be adapted as new ideas or patterns emerge. They are not rigidly decided beforehand.
- **Natural settings** Data collection occurs in real-world contexts or in naturalistic ways.
- **Meaningful insights** Detailed descriptions of people's experiences, feelings and perceptions can be used in designing, testing or improving systems or products.
- **Generation of new ideas** Open-ended responses mean that researchers can uncover novel problems or opportunities that they wouldn't have thought of otherwise.

For example, after successfully interviewing female customers, visiting nearby stores and malls and selecting them through random sampling, it was discovered that the store did not have enough goods for women and hence the number of women visiting the store Only man can understand. Interacting with them and understanding why they didn't go to the store because there were more men's products than women.

Qualitative research is based on the disciplines of social sciences such as psychology, sociology and anthropology. Therefore, qualitative research methods allow for deeper and further investigation and inquiry based on the responses of the respondents, where the interviewer/ researcher also tries to understand their motivations and feelings. Understanding how your audience makes decisions can help draw conclusions in market research.

4.11 TYPES OF QUALITATIVE RESEARCH

Qualitative research methods are designed in such a way that helps to reveal the behavior and perception of the target audience in the context of a particular topic. A variety of qualitative research methods such as in-depth interviews, focus groups, ethnographic research, content analysis, case study research is commonly used. The results of qualitative methods are more descriptive and conclusions can be drawn easily from the data obtained.

NOTES

Qualitative research methods originated in the social and behavioral sciences. Today our world is more complex and it is difficult to understand what people think and understand. Online qualitative research methodologies are easier to understand as it is more communicative and descriptive.

The following are qualitative research methods that are frequently used. Also, read about qualitative research examples.

1. **One-on-one interview:**
   Conducting in-depth interviews is one of the most common qualitative research methods. It is a personal interview which is done with one respondent at a time. It is purely a conversational method and invites opportunities to get in-depth details from the respondent.

   One of the advantages of this method is it provides a great opportunity to collect accurate data on what people believe and what their motivations are. If the researcher has good experience, then asking the right questions can help him to collect meaningful data. If they need more information, researchers should ask follow-up questions that help them collect more information.

   These interviews can be done face-to-face or over the phone and can usually last from half an hour to two hours or so. When the in-depth interview is conducted face-to-face it gives a better opportunity to read the body language of the respondents and match the responses.

2. **Focus groups:**
   A focus group is one of the commonly used qualitative research methods used in data collection. Focus groups usually consist of a limited number of respondents (6-10) from your target market.

   The main objective of a focus group is to find answers to the questions "why", "what" and "how". One benefit of focus groups is that you don't have to interact with the group in person. Nowadays an online survey can be sent to focus groups on various devices and responses can be collected at the click of a button.

   Focus groups are an expensive method compared to other online qualitative research methods. Usually, they are used to explain complex processes. This method is very useful when it comes to market research on new products and testing new concepts.

3. **Ethnographic research:**
   Ethnographic research is the most intensive observational method that studies people in their naturally occurring environments.

   This method requires researchers to adapt to the environment of the target audience which can be anywhere from an organization to a city or a remote location. Geographical constraints can be an issue when collecting data here.

   The purpose of this research design is to understand the cultures, challenges, motivations and settings that occur. Instead of relying on interviews and discussions, you experience natural settings for the first time.

   This type of research method can last from a few days to a few years, as it involves in-depth observation and data gathering on those grounds. It is a challenging and

NOTES 

time-consuming method and completely depends on the expertise of the researcher to be able to analyze, observe and estimate the data.

4. **Case study research:**
   Case study methodology has evolved over the years and has developed into a valuable quality research method. As the name suggests it is used to explain an organization or institution.

   This type of research method is used in many fields like education, social science and so on. This method may seem difficult to operate, however, it is one of the simplest ways to conduct research as it involves a deep dive and in-depth understanding of data collection methods and estimating the data.

5. **Record keeping:**
   This method makes use of the already existing reliable documents and similar sources of information as the data source. This data can be used in new research. This is similar to going to a library. There one can go over books and other reference material to collect relevant data that can likely be used in the research.

6. **Process of observation:**
   - Qualitative observation is a process of research that uses subjective methods to collect systematic information or data. Since, the research is the process of using subjective methods to collect information or data focused on qualitative observation. Qualitative observation is mainly used to equate quality differences
   - Qualitative overview deals with the 5 major sensory organs and their functioning – sight, smell, touch, taste and hearing. It does not include measurements or numbers but instead includes features.

4.12 QUALITATIVE DATA RESEARCH ANALYSIS

a. **Qualitative data collection**
   Qualitative data collection allows non-numerical data to be collected and helps us find out how decisions are made and provide us with detailed insights. The data collected to reach such conclusions must be holistic, rich and nuanced and must be concluded through careful analysis.

   Whatever method the researcher chooses to collect qualitative data, one aspect that is very clear is that the process will generate large amounts of data. In addition to the variety of methods available, there are also different ways of collecting and recording data.

   For example, if qualitative data is collected through a focus group or face-to-face discussion, there will be handwritten notes or video-recorded tapes. If there are recordings they should be written down and before the process of data analysis begins.

   As a rough guide, it may take an experienced researcher 8-10 hours to transcribe a recording of an interview, which can generate about 20-30 pages of dialogue. Many researchers prefer to maintain separate folders to keep recordings collected from different focus groups. This helps them to segment the collected data.

If there are ongoing notes, also known as field notes, they are helpful in maintaining observations, environmental references, nonverbal cues, etc. These filed notes are helpful and can be compared when transcribing audio recorded data. Such notes are usually informal but should be as secure as a video recording or audio tape.

b. Qualitative data analysis

Qualitative data analysis such as notes, videos, audio recordings, images and text documents. One of the most commonly used methods for qualitative data analysis is text analysis.

Text analysis is a data analysis method that is different from all other qualitative research methods, where researchers analyze the social lives of participants in a research study and decode words, actions, etc.

There are also images that have been used in this research study and the researchers analyze the context in which the images are used and draw conclusions from them. In the past decade, text analysis has gained the highest popularity through what is shared on social media platforms.

CHARACTERISTICS OF QUALITATIVE RESEARCH METHOD

1. Qualitative research methods usually collect data at the sight, where the participants are experiencing issues or problems. These are real-time data and rarely bring the participants out of the geographic locations to collect information.
2. Qualitative researchers typically gather multiple forms of data, such as interviews, observations, and documents, rather than rely on a single data source.
3. This type of research method works towards solving complex issues by breaking down into meaningful inferences that is easily readable and understood by all.
4. Since it's a more communicative method, people can build their trust on the researcher and the information thus obtained is raw and unadulterated.

When to use qualitative research

Researchers make use of qualitative research techniques when they need to capture accurate, in-depth insights. It is very useful to capture "factual data". Here are some examples of when to use qualitative research.

- Developing a new product or generating an idea.
- Studying your product/brand or service to strengthen your marketing strategy.
- To understand your strengths and weaknesses.
- Understanding purchase behavior.
- To study the reactions of your audience to marketing campaigns and other communications.
- Exploring market demographics, segments, and customer groups.
- Gathering perception data of a brand, company, or product.

NOTES 

4.13 DIFFERENCE BETWEEN QUALITATIVE RESEARCH AND QUANTITATIVE RESEARCH

Qualitative Research	Quantitative Research
A method for developing a better understanding of human and social sciences, in understanding human behavior and personalities better	It is the method used to generate numerical data by using a lot of techniques such as logical, statistical and mathematical techniques
It employees a subjective approach	It employees an objective approach
It is generally expressed using words	It is expressed using the graphs and numbers
It has open-ended questions	It has multiple choice questions
The qualitative research needs only a few respondents	The quantitative research requires many respondents
The data collection methods involved are interviews, focus groups, literature review, ethnography	The data collection methods involved are experiments, surveys, and observations expressed in numbers
Qualitative research is holistic in nature	Quantitative Research is particularistic in nature
The reasoning used to synthesis data in this research is inductive	The reasoning used to synthesis data in this research is deductive
This method involves a process-oriented inquiry	This method does not involve a process-oriented inquiry
It develops the initial understanding of data	It recommends a final course of action
The data taken in the Qualitative research method is pretty verbal	The data taken in this method is pretty measurable
The objective of this research method is to engage and discover various ideas	The main objective of Quantitative research is to examine the cause and effect between the variables
It is one of the exploratory research type methods	It is a conclusive research type method

4.14 MEANING OF HYPOTHESIS TESTING

Hypothesis is an assumption that is made on the basis of some evidence. It is the starting point of any investigation that turns research questions into predictions. It includes components such as variables, population and relationship between variables. A research hypothesis is a hypothesis used to test the relationship between two or more variables.

NOTES

Characteristics of Hypothesis

Following are the characteristics of hypothesis:

The hypothesis should be clear and precise to consider it to be reliable.

- If the hypothesis is a relational hypothesis, then it should be stating the relationship between variables.
- The hypothesis must be specific and should have scope for conducting more tests.
- The way of explanation of the hypothesis must and it should also be understood that the simplicity of the hypothesis is not related to its significance.

Examples of Hypothesis

Following are the examples of hypothesis based on their types:

- Consumption of sugary drinks every day leads to obesity is an example of a simple hypothesis.
- All lilies have the same number of petals is an example of a null hypothesis.
- If a person gets 7 hours of sleep, then he will feel less fatigue than if he sleeps less.

Functions of Hypothesis

Following are the functions performed by the hypothesis:

- Hypothesis helps in making an observation and experiments possible.
- It becomes the start point for the investigation.
- Hypothesis helps in verifying the observations.
- It helps in directing the inquiries in the right directions.

Hypothesis testing is a formal procedure for investigating our ideas about the world using statistics. Scientists to test specific predictions, called hypotheses that arise from theories, most often use it.

There are 5 main steps in hypothesis testing:

1. State your research hypothesis as a null hypothesis (H_o) and alternate hypothesis (Ha or H1).
2. Collect data in a way designed to test the hypothesis.
3. Perform an appropriate statistical test.
4. Decide whether to reject or fail to reject your null hypothesis.
5. Present the findings in your results and discussion section.

Though the specific details might vary the procedure you will use when testing a hypothesis will always follow some version of these steps.

Step 1: State your null and alternate hypothesis

After developing your initial research hypothesis (the prediction that you want to investigate), it is important to restate it as a null (H_o) and alternate (H_a) hypothesis so that you can test it mathematically.

NOTES 

The **alternate hypothesis** is usually your initial hypothesis that predicts a relationship between variables. The **null hypothesis** is a prediction of no relationship between the variables you are interested in.

Step 2: Collect data

For a statistical test to be valid, it is important to perform sampling and collect data in a way that is designed to test your hypothesis. If your data are not representative, then you cannot make statistical inferences about the population you are interested in.

Step 3: Perform a statistical test

A variety of statistical tests are available, but they are all based on a comparison of within-group variance (how spread the data is within a category) versus within-group variance (how different categories are from each other).

If the between-group variance is large enough that there is little or no overlap between groups, your statistical test will show this by showing low-values. This means that it is unlikely that the differences between these groups came about by chance.

Alternatively, if there is high-group variance and low-group variance, your statistical test will reflect that with a higher-value. This means that it is likely that any difference you measure between groups is due to coincidence.

Step 4: Decide whether to reject or fail to reject your null hypothesis

Based on the result of your statistical test, you must decide whether to reject your null hypothesis.

In most cases you will use the p-value generated by your statistical test to guide your decision. And in most cases, your predetermined significance level for rejecting the null hypothesis would be 0.05—that is, when there is less than a 5% chance that you would see these results if the null hypothesis were true.

In some cases, researchers choose a more conservative level of significance, such as 0.01 (1%). This minimizes the risk of erroneously rejecting the null hypothesis (Type I error).

Step 5: Present your findings

The results of hypothesis testing will be presented in the results and discussion sections of your research paper.

The Results section should give you a brief summary of the data and the results of your statistical test (for example, the estimated difference between the group means and the associated p-value). In the discussion, you can discuss whether your initial hypothesis was supported by your results.

In the formal language of hypothesis testing, we speak of rejecting or failing to reject the null hypothesis. You will probably be asked to do this in your statistics assignment.

However, we rarely talk in this way when presenting research results in an academic paper. Instead, we go back to our alternative hypothesis (in this case, the hypothesis that men are taller than women on average) and state that the result of our test was consistent with or inconsistent with the alternative hypothesis.

NOTES 

4.15 TYPE I AND TYPE II ERROR

Statistics, Type I error is a false positive conclusion, whereas Type II error is a false negative conclusion.

Statistical decision-making always involves uncertainties, so the risks of making these errors are unavoidable hypothesis testing.

The probability of making a type I error is the significance level or alpha (□), while the probability of making a type II error is beta (□). These risks can be minimized by carefully planning your study design.

Type I error

A Type I error means rejecting the null hypothesis when it's actually true. It means concluding that results are **statistically significant** when, in reality, they came about purely by chance or because of unrelated factors.

The risk of committing this error is the significance level (alpha or α) you choose. That's a value that you set at the beginning of your study to assess the statistical probability of obtaining your results (p value).

The significance level is usually set at 0.05 or 5%. This means that your results only have a 5% chance of occurring, or less, if the null hypothesis is actually true.

If the *p* value of your test is lower than the significance level, it means your results are statistically significant and consistent with the alternative hypothesis. If your *p* value is higher than the significance level, then your results are considered statistically non-significant.

Type II error

A Type II error means not rejecting the null hypothesis when it's actually false. This is not quite the same as "accepting" the null hypothesis, because hypothesis testing can only tell you whether to reject the null hypothesis.

Instead, a Type II error means failing to conclude there was an effect when there actually was. In reality, your study may not have had enough **statistical power** to detect an effect of a certain size.

Power is the extent to which a test can correctly detect a real effect when there is one. A power level of 80% or higher is usually considered acceptable.

The risk of a Type II error is inversely related to the statistical power of a study. The higher the statistical power, the lower the probability of making a Type II error.

4.16 MEANING OF MEAN

In statistics, called the arithmetic mean (AM) or average, is the ratio of the sum of all observations to the total number of observations. The arithmetic mean can also inform or model concepts outside the data. In the physical sense, the arithmetic mean can be thought of as the center of gravity. From the mean of a data set, we can think of the mean distance of data points from the mean as the standard deviation. The square of the standard deviation (ie the variance) corresponds to the moment of inertia in the physical model.

NOTES

Let's say, for example, you want to know the weather of Shimla. On the internet you will find temperature for many days, temperature data of past and present temperature data and also future temperature forecast. Wouldn't this all be very confusing?

Instead of this long list of data, mathematicians decided to use representative values that could take into account a wider range of data. Instead of weather for each particular day, we use terms like mean (arithmetic mean), median and mode to describe the weather in a month or so.

There are several types of representative values that are used by Mathematicians in data handling, namely;

- Arithmetic Mean (Average)
- Range
- Median
- Mode

Out of the four above, *mean, median* and *mode* are types of *average*

What is Arithmetic Mean?

Arithmetic mean represents a number that is obtained by dividing the sum of the elements of a set by the number of values in the set. So, you can use the layman term Average, or be a little bit fancier and use the word "Arithmetic mean" your call, take your pick -they both mean the same. The arithmetic mean may be either

- Simple Arithmetic Mean
- Weighted Arithmetic Mean

Arithmetic Mean Formula

If any data set consisting of the values b1, b2, b3, …., bn then the arithmetic mean B is defined as:

B = (Sum of all observations)/ (Total number of observation)

= 1/n ∑i=1nbi=b1+b2+b3+…. + bnn

If these n observations have corresponding frequencies, the arithmetic mean is computed using the formula

x

= x1f1+x2f2+……+xnfnN

and

using Sigma notation

= ∑i=1nxifiN

where $N = f_1 + f_2 + \ldots\ldots\ldots + f_n$.

The above formula can also be used to find the weighted arithmetic mean by taking f_1, f_2, …., f_n as the weights of x_1, x_2, ….., x_n.

NOTES

When the frequencies divided by N are replaced by probabilities p1, p2, ……, pn we get the formula for the expected value of a discrete random variable.

X = x1p1 + x2p2 +……. + xnpn. or

using Sigma notation = $\sum i=1nxipi$

Properties of Arithmetic Mean

Some important properties of the arithmetic mean are as follows:

- The sum of deviations of the items from their arithmetic mean is always zero, i.e. $\sum(x - X) = 0$.
- The sum of the squared deviations of the items from Arithmetic Mean (A.M) is minimum, which is less than the sum of the squared deviations of the items from any other values.
- If each item in the arithmetic series is substituted by the mean, then the sum of these replacements will be equal to the sum of the specific items.

Arithmetic Mean of Ungrouped Data

For ungrouped data, we can easily find the arithmetic mean by adding all the given values in a data set and dividing it by a number of values.

Mean, $\bar{x}$ = Sum of all values/Number of values

Example: Find the arithmetic mean of 4, 8, 12, 16, 20.

Solution: Given, 4, 8, 12, 16, 20 is the set of values.

Sum of values = 4+ 8+12+16+20 = 60

Number of values = 5

Mean = 60/5 = 12

Arithmetic Mean of Ungrouped Data

If x_1, x_2, x_3 ,……,x_n be the observations with the frequencies f_1, f_2, f_3 ,……,f_n, then the arithmetic mean is given by:

$\bar{x} = (x_1f_1+x_2f_2+……+x_nf_n) / \sum f_i$

where $\sum f_i$ is the summation of all the frequencies.

Let us understand the arithmetic mean of ungrouped data with the help of an example.

Example: Find the mean of given distribution:

X	10	20	30	40	50
F	3	2	4	5	1

Solution: Let us find the value of x_if_i and $\sum f_i$, for all the values of x and f respectively.

Xi	Fi	xifi
10	3	10 x 3 = 30

NOTES

20	2	20 x 2 = 40
30	4	30 x 4 = 120
40	5	40 x 5 = 200
50	1	50 x 1 = 50
Total	∑fi = 15	∑xifi = 440

Hence, the required mean is:

$\bar{x}$ = 440/15 = 29.33

Merits of arithmetic mean

- The arithmetic mean is simple to understand and easy to calculate.
- It is influenced by the value of every item in the series.
- A.M is rigidly defined.
- It has the capability of further algebraic treatment.
- It is a measured value and not based on the position in the series.

Demerits of arithmetic mean

- It is changed by extreme items such as very small and very large items.
- It can rarely be identified by inspection.
- In some cases, A.M. does not represent the original item. For example, the average number of patients admitted to a hospital is 10.7 per day.
- The arithmetic mean is not suitable in extremely asymmetrical distributions.

Representative Values of Data

We regularly see the use of representative value in our daily lives. When you ask about a car's mileage, you are asking for a representative value of the distance traveled for the amount of fuel consumed. This does not mean that the temperature in Shimla is consistently in a representative value, but overall, it is equal to the average value. Here the average represents a number that expresses a central or specific value in a set of data, calculated by the sum of the values divided by the number of values.

4.17 MEANING OF STANDARD DEVIATION

The standard deviation is a statistic that measures the spread of a dataset relative to its mean and is calculated as the square root of the variance. The standard deviation is calculated as the square root of the variance by determining the deviation of each data point relative to the mean.

If the data points are greater than the mean, there is a high deviation within the data set; Thus, the more the data is spread, the higher the standard deviation.

Calculating the Standard Deviation

Standard deviation is calculated as follows:

NOTES

1. The mean value is calculated by adding all the data points and dividing them by the number of data points.
2. The variance for each data point is calculated by subtracting the mean from the value of the data point. Each of those resulting values is then squared and the results summed. The result is then divided by the number of data points less one.
3. The square root of the variance—results from no. 2—is then used to find the standard deviation.

Using the Standard Deviation

Standard deviation is a particularly useful tool in investment and trading strategies because it helps measure market and security volatility and predicts performance trends. As it relates to investments, for example, an Index fund is likely to have a lower standard deviation than its benchmark index, because the fund aims to replicate the index.

On the other hand, one can expect an aggressive growth fund to have a high standard deviation from its relative stock index, as their portfolio managers make aggressive bets to generate above-average returns.

A lower standard deviation is not necessarily better. It all depends on the investor's willingness to invest and take the risk. When dealing with the amount of divergence in their portfolios, investors should consider their tolerance for volatility and their overall investment objectives. More aggressive investors may be comfortable with an investment strategy that opts for vehicles with higher-than-average volatility, while more conservative investors may not.

Standard deviation is one of the major fundamental risk measures used by analysts, portfolio managers, advisors. Investment firms report the standard deviation of their mutual funds and other products. A large spread shows how much the return on the fund is deviating from the expected normal return. Because it is easy to understand, this data is regularly reported to end customers and investors.

Advantages of standard deviation

The main advantages of standard deviation can be expressed as follows:

1. **Rigidly Defined**
   Standard deviation is rigidly defined measure and its value is always fixed.
2. **Best Measure**
   Standard deviation is based on all the items in the series. So, it is the best measure of dispersion.
3. **Less Affected**
   Standard deviation is least affected by the sampling fluctuations than other measures (mean deviation and quartile deviation).
4. **Suitable for Algebraic Operation**
   Standard deviation can be used for mathematical operations and algebraic treatments. It is also applicable in statistical analysis.

NOTES 

Disadvantages of standard deviation

Some of the major disadvantages of standard deviation can be expressed as follows:

1. **Complex Method**
   Standard deviation is complex to compute and difficult to understand as compared to other measures of dispersion.
2. **High Effect**
   Standard deviation is highly affected by the extreme values in the series.
3. **Standard deviation**
   Cannot be obtained for open end class frequency distribution.

4.18 MEANING OF T-TEST

A t-test is a statistical test that is used to compare the means of two groups. It is often used in hypothesis testing to determine whether a process or treatment actually has an effect on the population of interest, or whether two groups are different from one another.

When to use a T-test

A t-test can only be used when comparing the means of two groups (a.k.a. pair wise comparison). If you want to compare more than two groups, or if you want to do multiple pair wise comparisons, use an ANOVA test or a post-hoc test.

The t-test is a parametric test of difference, meaning that it makes the same assumptions about your data as other parametric tests. The t-test assumes your data:

1. are independent
2. are (approximately) normally distributed.
3. have a similar amount of variance within each group being compared (a.k.a. homogeneity of variance)

If your data do not fit these assumptions, you can try a nonparametric alternative to the t-test, such as the Wilcox on Signed-Rank test for data with unequal variances.

What type of T-test should I use?

When choosing a t-test, you will need to consider two things: whether the groups being compared come from a single population or two different populations, and whether you want to test the difference in a specific direction.

One-sample, two-sample, or paired t-test?

- If the groups come from a single population (e.g., measuring before and after an experimental treatment), perform a **paired T-test**.
- If the groups come from two different populations (e.g., two different species, or people from two separate cities), perform a **two-sample T-test** (a.k.a. **independent T-test**).
- If there is one group being compared against a standard value (e.g., comparing the acidity of a liquid to a neutral pH of 7), perform a **one-sample T-test**.

NOTES

One-tailed or two-tailed T-test?

- If you only care whether the two populations are different from one another, perform a **two-tailed T-test**.
- If you want to know whether one population mean is greater than or less than the other, perform a **one-tailed T-test.**

Performing a T-test

The t-test estimates the true difference between two group means using the ratio of the difference in group means over the pooled standard error of both groups. You can calculate it manually using a formula, or use statistical analysis software.

T-test formula

The formula for the two-sample t-test (a.k.a. the student's t-test) is shown below.

$$t = \frac{\overline{x}_1 - \overline{x}_2}{\sqrt{(s^2(\frac{1}{n_1} + \frac{1}{n_2}))}}$$

In this formula, t is the value, x1andx2 are the means of the two groups being compared, s2 is the plus standard error of the two groups, and n1andn2 is the number of observations in each group.

Large-value shows that the difference between group means is greater than the pooled standard error, indicating a more significant difference between groups.

You can also compare your calculated-values against values in a key price chart to determine whether your value is incidentally higher than expected. If so, you can reject the null hypothesis and conclude that the two groups are indeed different.

T-test function in statistical software

Most statistical software (R, SPSS, etc.) include a T-test function. This built-in function will take your raw data and calculate the -value. It will then be compared with the critical value, and the ape-value will be calculated. That way you can quickly see if your groups are statistically different.

What variables do you need for a dependent T-test?

You need one dependent variable that is measured on an interval or ratio. You also need one categorical variable that has only two related groups.

What is meant by "related groups"?

A dependent t-test is an example of a "within-subjects" or "repeated measures" statistical test. This indicates that the same participants are tested more than once. Thus, in the dependent t-test, "related group" indicates that the same number of participants are present in both groups. The reason it is possible for each group to have the same number of participants is because each participant has been measured on the same dependent variable on two occasions. For example, you may have measured the performance of 10 participants in a spelling test (dependent variable) before and after a new form of computerized learning to improve spelling. You'll want to know if computer training has improved their spelling

NOTES 

performance. Here, we can use a dependent t-test as we have two related groups. The first related group consists of (before) participants at the beginning of the computerized spelling training and the second related group has the same participants, but now at the end of the computerized training.

4.19 THE ANOVA TEST

An **ANOVA** test is a way to find out if survey or experiment results are significant. In other words, they help you to figure out if you need to reject the null hypothesis or accept the alternate hypothesis.

Basically, **you're testing groups to see if there's a difference between them.** Examples of when you might want to test different groups:

- A group of psychiatric patients are trying three different therapies: counseling, medication and biofeedback. You want to see if one therapy is better than the others.
- A manufacturer has two different processes to make light bulbs. They want to know if one process is better than the other.
- Students from different colleges take the same exam. You want to see if one college outperforms the other.

What is Analysis of Variance (ANOVA)?

Analysis of variance (ANOVA) is an analysis tool used in statistics to divide an overall variability found within a data set into two parts: systematic factors and random factors. Systematic factors have a statistical effect on a given data set, whereas random factors do not. Analysts use the ANOVA test to determine the effect of independent variables on the dependent variable in regression studies.

T-and-test methods developed in the 20th century were used for statistical analysis until 1918, when Ronald Fischer created the analysis of variance method.

ANOVA is also called Fisher analysis of variance, and is an extension of t- and z-tests. The term became famous after it appeared in Fisher's book "Statistical Methods for Research Workers" in 1925.

What Does the Analysis of Variance Reveal?

ANOVA testing is the initial step in analyzing the factors affecting a given data set. Once testing is over, an analyst performs additional testing on methodological factors that make a measurable contribution to the inconsistency of the data set. The analyst uses the ANOVA test results in the F-test to generate additional data that aligns with the proposed regression model.

The ANOVA test allows the comparison of more than two groups at the same time to determine whether a relationship exists between them. The result of the ANOVA formula, the F statistic (also known as the F-ratio), allows the analysis of multiple groups of data to determine the variability between samples and samples.

NOTES

If no true difference exists between the tested groups, which is called the null hypothesis, then the F-ratio statistic of the ANOVA will result in a result close to 1. F is the distribution of all possible values of the figure. It is actually a set of distribution functions, consisting of two distinct numbers, called fraction degrees of freedom and denominator degrees of freedom.

Example of How to Use ANOVA

A researcher might, for example, test students from multiple colleges to see if students from one of the colleges consistently outperform students from the other colleges. In a business application, an R&D researcher might test two different processes of creating a product to see if one process is better than the other in terms of cost efficiency.

The type of ANOVA test used depends on a number of factors. It is applied when data needs to be experimental. Analysis of variance is employed if there is no access to statistical software resulting in computing ANOVA by hand. It is simple to use and best suited for small samples. With many experimental designs, the sample sizes have to be the same for the various factor level combinations.

ANOVA is helpful for testing three or more variables. It is similar to multiple two-sample t-tests. However, it results in fewer type I errors and is appropriate for a range of issues. ANOVA groups differences by comparing the means of each group and includes spreading out the variance into diverse sources. It is employed with subjects, test groups, between groups and within groups.

What Does "One-Way" or "Two-Way Mean?

One-way or **two-way** refers to the number of independent variables (IVs) in your Analysis of Variance test.

- One-way has one independent variable (with 2 levels). For example: *brand of cereal,*
- Two-way has two independent variables (it can have multiple levels). For example: *brand of cereal, calories.*

What are "Groups" or "Levels"?

Groups or levels are different groups within the same independent variable. In the example above, your levels for "Brands of Cereal" might be Lucky Charms, Raisin Bran, Cornflakes -- three levels in total. Your level for "calories" could be: sweet, unsweetened - two levels in total.

Let's say you are studying whether an alcohol support group and individual counseling combined is the most effective treatment for reducing alcohol consumption. You can divide study participants into three groups or levels:

- Medication only,
- Medication and counseling,
- Counseling only.

Your dependent variable would be the number of alcoholic beverages consumed per day.

NOTES 

If your groups or levels have a hierarchical structure (each level has unique subgroups), then use a nested ANOVA for the analysis.

What Does "Replication" Mean?

It's whether you are replicating (i.e. duplicating) your test(s) with multiple groups. With a two-way ANOVA *with replication,* you have two groups and individuals within that group are doing more than one thing (i.e. two groups of students from two colleges taking two tests). If you only have one group taking two tests, you would use **without replication.**

Types of Tests.

There are two main types: one-way and two-way. Two-way tests can be with or without replication.

- One-way ANOVA between groups: used when you want to test **two groups** to see if there's a difference between them.
- Two-way ANOVA without replication: used when you have **one group** and you're **double-testing** that same group. For example, you're testing one set of individuals before and after they take a medication to see if it works or not.
- Two-way ANOVA with replication: **Two groups**, and the members of those groups are **doing more than one thing**. For example, two groups of patients from different hospitals trying two different therapies.

One Way ANOVA

A one-way ANOVA is used to compare two means from two independent (unrelated) groups using the F-distribution. The null hypothesis for the test is that the two means are equal. Therefore, a significant result means that the two means are unequal.

Examples of when to use a one-way ANOVA

Situation 1: You have a group of individuals randomly split into smaller groups and completing different tasks. For example, you might be studying the effects of tea on weight loss and form three groups: green tea, black tea, and no tea.

Situation 2: Similar to situation 1, but in this case the individuals are split into groups based on an attribute they possess. For example, you might be studying leg strength of people according to weight. You could split participants into weight categories (obese, overweight and normal) and measure their leg strength on a weight machine.

Limitations of the One Way ANOVA

A one-way ANOVA will tell you that at least two groups were different from each other. But **it won't tell you which groups were different.** If your test returns a significant f-statistic, you may need to run an ad hoc test (like the Least Significant Difference test) to tell you exactly which groups had a difference in means.

What Is the Correlation Coefficient?

The correlation coefficient is a statistical measure of the strength of the relationship between the relative movements of two variables. Values range between -1.0 and 1.0. A calculated number greater than 1.0 or less than -1.0 means that there was an error in the

correlation measurement. A correlation of -1.0 indicates a perfect negative correlation, while a correlation of 1.0 indicates a perfect positive correlation. A correlation of 0.0 indicates no linear relationship between the speed of the two variables.

Correlation statistics can be used in finance and investing. For example, a correlation coefficient can be calculated to determine the level of correlation between the price of crude oil and the stock price of an oil producing company, such as Exxon Mobil Corporation. Since oil companies make more profits as oil prices rise, the relationship between the two variables is highly positive.

What Is Meant by the Correlation Coefficient?

The correlation coefficient describes how one variable moves in relation to another. A positive correlation indicates that the two move in the same direction, with a +1.0 correlation when they move in tandem. A negative correlation coefficient tells you that they instead move in opposite directions. A correlation of zero suggests no correlation at all.

How Do You Calculate the Correlation Coefficient?

The correlation coefficient is calculated by first determining the covariance of the variables and then dividing that quantity by the product of those variables' standard deviations.

How Is the Correlation Coefficient Used in Investing?

Correlation coefficients are a widely used statistical measure in investing. They play a very important role in areas such as portfolio structuring, quantitative trading and performance appraisal. For example, some portfolio managers will monitor the correlation coefficients of individual assets in their portfolios to ensure that the overall volatility of their portfolios remains within acceptable limits.

Similarly, analysts will sometimes use the correlation coefficient to predict how a particular asset will be affected by a change in an external factor, such as the price of a commodity or the interest rate.

Correlation coefficients are indicators of the strength of the linear relationship between two different variables, x and y. A linear correlation coefficient that is greater than zero indicates a positive relationship. A value that is less than zero indicates a negative relationship. Finally, a value of zero indicates no relationship between the two variables x and y.

4.20 CHAPTER SUMMARY

Hypothesis Testing is a **form of inferential statistics that allows us to draw conclusions about an entire population based on a representative sample** in most cases, it is simply impossible to observe the entire population to understand its properties. The only alternative is to collect a random sample and then use statistics to analyze it

When performing Hypothesis Testing, firstly, a hypothesis must be formulated. An example of a hypothesis is "there is a correlation between height and gender in a population," or "there is a difference between two groups of a population."

Usually, the thesis to be demonstrated is called the **Alternative Hypothesis** (HA), and its

NOTES 

opposite is the **Null Hypothesis** (H0). In practice, the Null Hypothesis states that there is nothing new happening in the population.

Hypothesis testing is used to make decisions about the values of parameters. Parameters, you'll recall, are factors that determine the shape of a probability distribution. The Normal probability distribution, for example, has two parameters. The mean determines the center, and the standard deviation determines the spread. The binomial distribution also has two. The sample size, n, and the probability of success on a single trial, p. In our discussion we focused on hypotheses on just two parameters: the mean (of a normal) and p (of a binomial).

The One-Tailed test, also called a directional test, considers a critical region of data that would result in the null hypothesis being rejected if the test sample falls into it, inevitably meaning the acceptance of the alternate hypothesis.

In a one-tailed test, the critical distribution area is one-sided, meaning the test sample is either greater or lesser than a specific value.

In two tails, the test sample is checked to be greater or less than a range of values in a Two-Tailed test, implying that the critical distribution area is two-sided.

If the sample falls within this range, the alternate hypothesis will be accepted, and the null hypothesis will be rejected.

4.21 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **What is hypothesis testing?**
2. **What is mean and explain its properties?**
3. **Explain the ANOVA?**
4. **What is T test?**
5. **Explain data analysis techniques?**

LONG ANSWER TYPE QUESTIONS

1. **Differentiate between Qualitative research and quantitative research?**
2. **What is standard deviation. Explain its advantages and disadvantages?**
3. **Discuss type I and type II error?**
4. **Elaborate techniques and types of quantitative research?**
5. **Explain data collection methodologies?**

4.22 MULTIPLE CHOICE QUESTIONS

1. **Which research paradigm is based on the pragmatic view of reality?**
   a. Quantitative research
   b. Qualitative research
   c. Mixed research
   d. None of the above

NOTES

2. **Which research paradigm is <u>least concerned</u> about generalizing its findings?**
   a. Quantitative research
   b. Qualitative research
   c. Mixed research
   d. None of the above

3. **Which of the following best describes quantitative research?**
   a. The collection of non-numerical data
   b. An attempt to confirm the researcher's hypotheses
   c. Research that is exploratory
   d. Research that attempts to generate a new theory

4. **A condition or characteristic that can take on different values or categories is called ___.**
   a. a constant
   b. a variable
   c. a cause-and-effect relationship
   d. a descriptive relationship

5. **A variable that is presumed to cause a change in another variable is called a(n):**
   a. Categorical variable
   b. Dependent variable
   c. Independent variable
   d. Intervening variable

6. **A statement made about a population for testing purpose is called?**
   a. Statistic
   b. Hypothesis
   c. Level of Significance
   d. Test-Statistic

7. **If the assumed hypothesis is tested for rejection considering it to be true is called?**
   a. Null Hypothesis
   b. Statistical Hypothesis
   c. Simple Hypothesis
   d. Composite Hypothesis

8. **A statement whose validity is tested on the basis of a sample is called?**
   a. Null Hypothesis
   b. Statistical Hypothesis
   c. Simple Hypothesis
   d. Composite Hypothesis

9. **A hypothesis which defines the population distribution is called?**
   a. Null Hypothesis
   b. Statistical Hypothesis
   c. Simple Hypothesis
   d. Composite Hypothesis

NOTES 

10. If the null hypothesis is false then which of the following is accepted?

a. Null Hypothesis
b. Positive Hypothesis
c. Negative Hypothesis
d. Alternative Hypothesis.

UNIT V

REPORT WRITING

STRUCTURE

NOTES 

5.1 LEARNING OBJECTIVE

- Students should know the steps in the process of quantitative data collection.
- Students should be able to distinguish between a population and a sample.
- Students should know the various types of quantitative sampling and which ones present the most rigorous approach to use.
- Students should understand the link between quantitative research questions and data collection and how research questions are operational zed in educational practice.
- Students should be familiar with the steps involved in identifying and selecting a good instrument to use in a study.

5.2 INTRODUCTION

The next step after the completion of data collection is to organize the data in a meaningful form so that the trend, if any, emerging from the data can be easily observed. A common method of organizing data is to construct a frequency distribution. The frequency distribution is an organized tabular/graphical representation of the number of individuals in each category on a scale of measurement. This allows the researcher to easily keep track of the entire data. It shows whether observations are high or low and also whether they are concentrated in one area or spread across the scale. Thus, the frequency distribution presents a picture of how individual observations are distributed in the measurement scale.

Frequency distribution is used to organize the collected data in tabular form. The data can be marks scored by students, temperature of different cities, points scored in volleyball match, etc. After data collection, we have to show the data in a meaningful way for better understanding. Organize the data in such a way that all its characteristics are summarized in one table. This is known as the frequency distribution.

5.3 MEANING OF THESIS

A *thesis statement* is "a short summary of the main idea, purpose, or argument of an essay that usually appears in the first paragraph." It's generally only one or two sentences in length. A strong thesis statement is the backbone of a well-organized paper, and helps you decide what information is most important to include and how it should be presented.

What is a good thesis statement?

For example, this thesis statement might open a paper on the importance of Dr. Martin Luther King Jr. as a civil rights leader: "Dr. Martin Luther King Jr. was one of the most influential figures in the American civil rights movement. The eloquent speeches and non-violent protests helped to unite a nation divided by race."

This example explains the author's original argument (King was an important leader of the American Civil Rights Movement), offers two areas of evidence (his speeches and nonviolent protests), and explains why the argument matters (a divided unites the nation).

A good thesis statement gives a clear message about the scope of the topic and the author's attitude towards the topic. In contrast, poor thesis statements fail to take a position, are

based solely on personal opinion, or state an obvious truth. For example, "Democracy is a form of government," is a weak thesis statement because it is too general, does not take a stance, and states a well-known fact that needs no further explanation.

5.4 TYPES OF THESIS STATEMENT

Thesis statements can be *explanatory*, *argumentative*, or *analytical*. The type of paper determines the form of the thesis statement.

1. **Explanatory thesis statement**
   The *explanatory thesis statement* is based entirely on factual information. It does not include personal opinions or claims that are not supported by evidence. Instead, it tells the reader exactly what the topic will be and touches on the key points to be explored in the essay. An explanatory thesis statement is also sometimes called an expository thesis statement.

   For example: The main components of a healthy lifestyle include a nutritious diet, regular exercise and adequate sleep.

2. **Argumentative thesis statement**
   In an argumentative essay, the author takes a stance on a debatable topic. This stance, and the claim to support it, is logic. In contrast to an explanatory thesis statement, *an argumentative thesis statement* allows the author to take a position about a topic (for example, the deeper meaning of a literary text, the best policy towards a social problem) and guide readers about their stance. to explain about. The body of an argumentative essay uses examples and other evidence to support the author's opinion.

   For example: Shakespeare's The Taming of the Shrews was in Elizabethan England to criticize the lack of humor, disguise, and the power of women in social roles.

3. **Analytical thesis statement**
   An *analytical thesis statement* analyzes, or breaks down an issue or idea into its various parts. Then, it evaluates the topic and clearly presents the sequence of analysis to the reader.

   For example: the school's policy of starting the school day an hour later revealed three related benefits: students were more alert and attentive in class, more positive about school, and performed better in their research work.

How to write a thesis statement

Writing a thesis statement requires time and careful thought. The thesis statement should flow naturally from the research and set out the author's discoveries. When composing a thesis statement, make sure it focuses on a main idea that can be reasonably covered within your desired page length. For example, try not to write about the entire history of America in a three-page paper.

5.5 STRUCTURE OF THESIS REPORT

When you have a good structure for your thesis, you are already halfway to writing your thesis. Since writing a report involves structuring your results and ideas, it is advisable

NOTES 

to start writing your thesis before the end of the term. You can start with writing your background, introduction, materials and methods without any consequences. This will help you structure your plans. Don't underestimate the time required to write your thesis. When you finally have to do everything, most people run out of time, or lose their concentration. A thesis should be good for the reader to read, so turn it into a story to guide the reader through. Avoid mere summation of facts.

The thesis should contain the following chapters:

- Title page
- Summary/abstract
- Table of content
- Introduction
- Background information
- Materials and methods
- Results and discussion (or separate chapters)
- Conclusion (recommendations)
- References

Summary: The summary should contain a brief overview of the research and the most important results (usually half a page)

Introduction: Your introduction contains information about why you work. It should contain a brief description of the problem. If possible, what has happened (literature). What is still lacking in research and how are you going to contribute to that area. So it should end with a goal or goal. It can also include a hypothesis, if you are expecting something specific to come up. The introduction section is usually about 1 page.

Background information: The background information contains all information needed to understand your results. This contains information about the ingredients that you use. The background of the methods that you use. Start with the more general concepts and go into more detail from there. This chapter involves the use of literature. Try to turn it into a logical story. Do not just put different literature statements after each other (5-10 pages).

Materials and Methods: That chapter begins with the material. Name all the materials and where they were purchased, purchased, received as a gift, etc. Methods contain all the information about how you performed the experiments. It also includes all the equipment's settings: temperature, how long you shake, the equipment's settings. All the information should be there, so that someone else can redo your experiment. The Materials and Methods section is always written in the past.

Results and Discussion: Since the results are so difficult to separate from the discussion, they are often combined into a single chapter. It often improves the flow of the story as well. Results are often represented in figures and tables. Don't just show raw data. Figures should be self-explanatory. In the text, do not repeat the data of these tables and figures, but explain the results. be critical. What have I measured? did i duplicate? What are error

margins? What do the results tell me? How do I explain to them? And what do I learn from this?

In the results section, you should also compare your results with the results in the literature. What have others done, what do they find? And is it the same as my results? In the end, your results should be used to answer your goal/question/hypothesis that you had at the beginning of your thesis.

Conclusion: This section should contain your most important conclusions. Begin by mentioning your goal, so people know why you worked. Again, don't mention all the results in detail, but describe the results as an overview. You can end up with what kind of implications your results have (in terms of new product development or something. Or use in another area of science). The conclusion is usually maximal. 1 page.

References: There are a lot of different ways to make a reference list. Check some articles that you read to see the different versions. It is up to you to choose one. However, when you choose one, stick to it. Do not use different version in your list. Since it is easier to know the relevance of a paper, also include the title of the article!

Use of Figures:

- Figures should contain names on both axis with their unity in brackets: Force (N)
- They should not contain any lines on the inside, only if they have a function.
- Remove the lines around the complete Figure (standard in excel)
- Make sure that the size of the symbols and letters are large enough so you can read them.
- Use scientific numbering: 1.105
- Avoid very large numbers for clarity: 10000000 should be 1.107
- Figure numbering should be underneath the Figures

Use of Tables:

- Make sure all tables have the same lay-out
- Table columns should contain the parameter with unity in brackets
- Table numbering should be above the Table.

Length of the thesis:

There is not a standard length of the thesis. In general, a BSc thesis is 25-35 pages, and a MSc thesis between 30-50 pages. Only relevant information should be presented in the thesis itself. Less relevant information and additional info (pre-testing for example) could be presented in the appendix

5.6 INTRODUCTION OF DATA ANALYSIS

Data analysis software is defined as a tool that is used to process and manipulate information, quality using transcription analysis, discourse analysis, foundational theory methodology and content analysis, and decision-making methods. Analyzes the relationship and correlation between datasets by providing analysis. Statistical and analytical capabilities,

NOTES

based on these capabilities data analysis software is classified as exploratory data analysis and confirmatory data analysis.

What is data analysis?

Data analysis helps in the form of explanation, understanding or interpretation of persons and things to aid within the meaningful and symbolic content of qualitative and quantitative information. There are two fundamental methods of collecting and interpreting data in qualitative and quantitative analysis. These strategies can be used independently or at the same time as they all have similar objectives.

Quantitative analysis is often related to numerical analysis where data is collected, classified, and then calculated for definite conclusions using a set of statistical methods. Qualitative analysis, on the other hand, deals with the analysis of information that cannot be quantified and is concerned with the understanding and insight of objects.

Quantitative and qualitative research data analysis strategies provide tools that help in transcription analysis, cryptography and text interpretation, algorithmic abstraction, content analysis and discourse analysis that help users avoid wasting time and manage large amounts of information, flexibility Helps to increase and improve validity. Applicability of information analysis.

Data analysis software tool

Data analysis software tools make it easy for users to process and manipulate information, analyze relationships and correlations between datasets:

- Data analysis software provides tools to aid in qualitative analysis such as transcription analysis, content analysis, discourse analysis, and foundational theory methodology.
- Data analysis software has statistical and analytical capability for decision making methods.
- Data analysis software processes can be classified into descriptive statistics, exploratory data analysis (EDA), and confirmatory data analysis (CDA).

5.7 TYPES OF DATA ANALYSIS

There are several types of Data Analysis Software that exist based on business and technology. The major Data Analysis Software are:

1. **NVivo**
   - NVivo is employed for data analysis. It is a program that supports qualitative and mixed strategies analysis. It also helps users to arrange, analyze, and find insights in qualitative data such as interviews, open-ended survey responses, articles, social media, and web sites.
   - Analyze and organize unstructured text, audio, video or image information.
   - Easily manage your information and enhance your internal workflow and coverage processes.
   - Deliver quality outputs backed by a clear discovery and analysis method.

- Increase productivity and scale back project timeframes.
- With NVivo, you can import articles and make transcripts from the reference management code.

2. Transana

- Transana is an open-source software designed for each – the transcription and analysis of transmission information. With Transana, multiple approaches to the qualitative data analysis of still pictures, audio, and video area unit are possible.
- Transana's graphical and text-based reports are extremely versatile and customizable.
- It permits users to explore analytic relationships in their data and preserve their insights during a sort of different way.
- Transana Multi-User version allows synchronous access to multiple researchers to figure on the constant data at the same time, even from completely different locations.
- Explore coded information through text/graphical reports.
- With transana, you can code still images using cryptography shapes, including screenshots from video information.

3. MAXQDA

- MAXQDA is a skilled software for qualitative, quantitative, and mixed strategies of the data analysis process. It provides researchers with a powerful, innovative and simple to use analytical tools that help to make a research project successful.
- MAQDA can assist you with systematic analysis and interpretation of your data.
- Professionals use it to analyze interviews, reports, tables, on-line surveys, focus teams, videos, audio files, literature, pictures and a lot more.
- MAXQDA is offered as three product options: MAXQDA Standard, MAXQDA Plus and MAXQDA Analytics Pro.
- MAXQDA Standard is a Qualitative and Mixed Methods Data Analysis Strategies, MAXQDA Plus is a Quantitative Text Analysis, and MAXQDA Analytics Pro is a module for Statistical Analysis.
- With MAXQDA, you can easily acknowledge different speakers in focus groups, compare their contributions, analyze each and every speaker, and visualize them in a variety of ways.
- Qiqqa is an innovative data analysis resolution on the market employed by academics, researchers, and businesses. It is a vital free research and reference manager that may be used to search for, read, and annotate PDFs.
- Qiqqa keeps all of a user's PDFs secure and makes them instantly accessible and searchable across all their devices.

NOTES

- It helps users to capture all their tags, comments, highlights, and annotations whereas they scan their PDFs within Qiqqa.
- Users can review their work, write up, and make bibliographies instantly.
- Qiqqa lets consumers find what next to scan by following quotations, authors and keywords.

4. **ATLAS.ti**
   - ATLAS.ti is leading software for Qualitative Data Analysis for people who wish to visualize the large picture and appreciate details. It reveals meanings and relationships permitting users to ground their findings within the information.
   - .ti allows users to achieve rich insights with the foremost intuitive and powerful QDA code.
   - .ti is used by researchers and practitioners during a big variety of fields including social science, arts, design, communication, scientific discipline, economics, psychology, and sociology.
   - It provides analytical and visualization tools designed to open new instructive views on the fabric.
   - .ti Eight Windows is poised to line new standards for computer-assisted qualitative information analysis.

5.8 INTRODUCTION OF DATA FREQUENCY DISTRIBUTION

A frequency distribution shows the frequency of repeated items in a graphical form or tabular form. It gives a visual display of the frequency of items or shows the number of times they occurred. Let's learn about frequency distribution in this article in detail.

What is frequency distribution?

Frequency distribution is used to organize the collected data in tabular form. The data can be marks scored by students, temperature of different cities, points scored in volleyball match, etc. After data collection, we have to show the data in a meaningful way for better understanding. Organize the data in such a way that all its characteristics are summarized in one table. This is known as the frequency distribution

Let us consider an example to understand it better. GK Following are the marks of 10 students in Quiz released by Mr. Chris 15, 17, 20, 15, 20, 17, 17, 14, 14, 20. Let us present this data in a frequency distribution and find the number of students who got the same marks.

Quiz Marks	No. of Students
15	2
17	3
20	3
14	2

We can see that all the collected data is arranged under the column Quiz Marks and Number of Students. This makes the given information easy to understand and we can see that the number of students who got the same marks. Thus, the frequency distribution in the data helps us to organize the data in an easy way to understand its characteristics at a glance.

Frequency distribution graph

There is another way of showing data which is in the form of graphs and this can be done by using frequency distribution graphs. Graphs help us to understand the collected data in an easy way. A graphical representation of a frequency distribution can be shown using the following:

- **Bar Graphs:** Bar graphs represent data using rectangular bars of uniform width along with equal spacing between the rectangular bars.
- **Histograms:** A histogram is a graphical presentation of data using rectangular bars of different heights. In a histogram, there is no space between the rectangular bars.
- **Pie Chart:** A pie chart is a type of graph that visually displays data in a circular chart. It records data in a circular manner and then it is further divided into sectors that show a particular part of data out of the whole part.
- **Frequency Polygon:** A frequency polygon is drawn by joining the mid-points of the bars in a histogram.

5.9 TYPES OF DATA FREQUENCY DISTRIBUTION

There are four types of frequency distribution under statistics which are explained below:

- **Ungrouped frequency distribution:** It shows the frequency of an item in each separate data value rather than groups of data values.
- **Grouped frequency distribution:** In this type, the data is arranged and separated into groups called class intervals. The frequency of data belonging to each class interval is noted in a frequency distribution table. The grouped frequency table shows the distribution of frequencies in class intervals.
- **Relative frequency distribution:** It tells the proportion of the total number of observations associated with each category.
- **Cumulative frequency distribution:** It is the sum of the first frequency and all frequencies below it in a frequency distribution. You have to add a value with the next value then add the sum with the next value again and so on till the last. The last cumulative frequency will be the total sum of all frequencies.

5.10 FREQUENCY DISTRIBUTION TABLE

A frequency distribution table is a chart that shows the frequency of each item in a data set. Let us consider an example of how to construct a frequency distribution table using tally marks. Jar containing beads of different colors- red, green, blue, black, red, green, blue, yellow, red, red, green, green, green, yellow, red, green, yellow. To know the exact number of beads of each particular colour, we need to classify the beads into categories. An easy way to

NOTES

find the number of beads of each color is to use numerals. Select the beads one by one and enter the matching mark in the respective row and column. Then, indicate the frequency for each item in the table. Thus, the table obtained is called frequency distribution table.

5.11 TYPES OF FREQUENCY DISTRIBUTION TABLE

There are two types of frequency distribution tables: Grouped and ungrouped frequency distribution tables.

1. **Grouped Frequency Distribution Table:** We use grouped frequency distribution tables to organize a large number of observations or data. In this, we create class intervals to match the frequencies of the data belonging to that particular class interval.

   For example, the marks obtained by 20 students in the examination are as follows. 5, 10, 20, 15, 5, 20, 20, 15, 15, 15, 10, 10, 10, 20, 15, 5, 18, 18, 18, 18. Make a class interval. Thus, we will make a class interval of numbers like 0 - 5, 6 - 10, etc. The table below shows two columns, one is of class interval (marks obtained in the examination) and the other is of frequency (number of students). In this we have not used tally marks because we have directly counted marks.

Marks obtained in Test (class intervals)	No. of Students (Frequency)
0 – 5	3
6 – 10	4
11 – 15	5
16 – 20	8
Total	20

Ungrouped Frequency Distribution Table: In the ungrouped frequency distribution table, we don't make class intervals, we write the accurate frequency of individual data. Considering the above example, the ungrouped table will be like this. Given below table shows two columns: one is of marks obtained in the test and the second is of frequency (no. of students).

Marks obtained in Test	No. of Students
5	3
10	4
15	5

Marks obtained in Test	No. of Students
18	4
20	4
Total	20

What is data analysis

Data analysis is defined as the process of cleaning, transforming and modeling data to find useful information for business decision making. The purpose of data analysis is to extract useful information from the data and make decisions based on the data analysis.

A simple example of data analysis is whenever we make any decision in our daily life it is by thinking about what happened last time or what will happen by choosing that particular decision. It is nothing more than analyzing our past or future and taking decisions based on that. For that we collect our past memories or our future dreams. So this is nothing but data analysis. Now the same work that an analyst does for business purposes is called data analysis.

5.12 TECHNIQUES OF DATA ANALYSIS

There are several **types of Data Analysis** techniques that exist based on business and technology. However, the major Data Analysis methods are:

- Text Analysis
- Statistical Analysis
- Diagnostic Analysis
- Predictive Analysis
- Prescriptive Analysis
- **Text analysis**
  Text analysis is also called data mining. It is one of the methods of data analysis to discover a pattern in large data sets using database or data mining tools. It used to convert raw data into business information. Business intelligence tools are present in the market which are used to make strategic business decisions. Overall, it provides a way to extract and examine the data and obtain patterns and finally interpret the data.
- **Statistical analysis**
  Statistical analysis reveals "what happens?" By using past data as dashboard. Statistical analysis involves the collection, analysis, interpretation, presentation and modeling of data. It analyzes a set of data or a sample of data. There are two categories of this type of analysis – descriptive analysis and inferential analysis.

NOTES 

- **Descriptive analysis**
  Analysis complete data or a sample of summarized numerical data. It shows mean and deviation for continuous data whereas percentage and frequency for categorical data.
- **Inferential analysis**
  Analysis sample from complete data. In this type of Analysis, you can find different conclusions from the same data by selecting different samples.
- **Diagnostic analysis**
  Clinical Analysis Reveals "Why Did This Happen?" By ascertaining the cause from the insights gained in statistical analysis. This analysis is useful for identifying the behavioral patterns of the data. If a new problem occurs in your business process, you can look at this analysis to find patterns similar to that problem. And therein may be the possibility of using similar prescriptions for new problems.
- **Predictive analysis**
  Prediction analysis shows "what is likely to happen" using past data. The simplest data analysis example is that last year I bought two clothes based on my savings and if my salary is doubled this year I can buy four clothes. But of course, it is not easy like this because you have to think about other circumstances like there is a possibility of increase in the prices of clothes this year or maybe instead of clothes you want to buy a new bike, or you need to buy a house. Is!

  So here, this analysis makes predictions about future results based on current or past data. The forecast is just a guess. Its accuracy is based on how detailed information you have and how much you dig into it.
- **Prescriptive analysis**
  Prescriptive Analysis combines insights from all previous analysis to determine what action to take in the current problem or decision. Most of the data-driven companies are using prescriptive analysis because predictive and descriptive analysis are not enough to improve data performance. Based on current situations and problems, they analyze the data and make decisions.

5.13 CHI SQUARE STATISTICS

A chi-square (χ^2) statistic is a test that measures how a model compares to actual observed data. The data used in calculating a chi-square statistic must be random, raw, mutually exclusive, drawn from independent variables, and drawn from a large enough sample. For example, the results of tossing a fair coin meet these criteria.

Chi-square tests are often used in hypothesis testing. The chi-square statistic compares the size of any discrepancies between the expected results and the actual results, given the size of the sample and the number of variables in the relationship.

For these tests, degrees of freedom are utilized to determine if a certain null hypothesis can be rejected based on the total number of variables and samples within the experiment. As with any statistic, the larger the sample size, the more reliable the results.

When to use chi saquare test

A chi-square test is used to help determine if observed results are in line with expected results, and to rule out that observations are due to chance. A chi-square test is appropriate for this when the data being analyzed is from a random sample, and when the variable in question is a categorical variable. A categorical variable is one that consists of selections such as type of car, race, educational attainment, male vs. female, how much somebody likes a political candidate (from very much to very little), etc.

These types of data are often collected via survey responses or questionnaires. Therefore, chi-square analysis is often most useful in analyzing this type of data.

Chi square test used for

Chi-square is a statistical test used to examine the differences between categorical variables from a random sample in order to judge goodness of fit between expected and observed results.

Who use chi square analysis

Since chi-square applies to categorical variables, it is most used by researchers who are studying survey response data. This type of research can range from demography to consumer and marketing research to political science and economics.

Who Uses Chi-Square Analysis?

Chi-square is most commonly used by researchers who are studying survey response data because it applies to categorical variables. Demography, consumer and marketing research, political science, and economics are all examples of this type of research.

5.14 MEANING OF T-TEST

A t-test is a type of inferential statistic used to determine whether there is a significant difference between the means of two groups, which may be related in certain characteristics. It is mostly used when a data set, such as the data set entered as the result of flipping a coin 100 times, will follow a normal distribution and may have unknown variances. A t-test is used as a hypothesis testing tool, allowing the test of an inference applicable to a population.

A t-test looks at t-statistics, t-distribution values, and degrees of freedom to determine statistical significance. To perform a test with three or more means, analysis of variance must be used.

Explaining the T-Test

Essentially, a t-test allows us to compare the mean values of two data sets and determine whether they came from the same population. In the above examples, if we take another sample of class A students and another sample of class B students, we would not expect them to have exactly the same mean and standard deviation. Similarly, the mean and standard deviation of samples taken from the placebo-fed control group and those from the drug-prescribed group should be slightly different.

If the null hypothesis is eligible to be rejected, it indicates that the data readings are robust and are probably not due to coincidence. The t-test is one of several tests used for this

NOTES

purpose. Statisticians should use tests other than the t-test to examine tests with more variables and larger sample sizes. For large sample sizes, statisticians use the az-test. Other test options include the chi-square test and the F-test.

There are three types of t-tests, and they are classified as dependent and independent t-tests.

Ambiguous Test Results

Consider that a drug manufacturer wants to test a newly invented drug. It follows the standard procedure of trying the drug on one group of patients and giving a placebo to another group, called the control group. The placebo given to the control group is a substance of no therapeutic value and serves as a benchmark to measure how the other group, given the actual drug, responds.

After the drug test, members of the placebo-fed control group reported an increase in average life expectancy of three years, while members of the group who were prescribed the new drug experienced a four-year increase in average life expectancy. Immediate observation may indicate that the drug is indeed working because outcomes are better for the group using the drug.

However, it is also possible that the observation was due to a coincidental event, specifically a surprising piece of luck. The t-test is useful to conclude whether the results are indeed true and apply to the entire population.

In a school, 100 students of class A scored an average of 85% marks with a standard deviation of 3%. Another 100 students of class B scored an average of 87% marks with a standard deviation of 4%. While the average of class B is better than that of class A, it may not be correct to conclude that the overall performance of students in class B is better than that of students of class A. This is because there is natural variability in test scores in both the sections, so the difference may be due to chance alone. A t-test can help determine whether one class performed better than another.

T-Test Assumptions

1. The first assumption made regarding t-tests concerns the scale of measurement. The assumption for a t-test is that the scale of measurement applied to the data collected follows a continuous or ordinal scale, such as the scores for an IQ test.
2. The second assumption made is that of a simple random sample, that the data is collected from a representative, randomly selected portion of the total population.
3. The third assumption is the data, when plotted, results in a normal distribution, bell-shaped distribution curve.
4. The final assumption is the homogeneity of variance. Homogeneous, or equal, variance exists when the standard deviations of samples are approximately equal.

T-Distribution Tables

The T-Distribution Table is available in one-tail and two-tails formats. The former is used for assessing cases which have a fixed value or range with a clear direction (positive or negative). For instance, what is the probability of output value remaining below -3, or

getting more than seven when rolling a pair of dice? The latter is used for range bound analysis, such as asking if the coordinates fall between -2 and +2.

The calculations can be performed with standard software programs that support the necessary statistical functions, like those found in MS Excel.

T-Values and Degrees of Freedom

The t-test produces two values as its output: the t-value and the degrees of freedom. The t-value is the ratio of the difference between the mean of two sample sets and the variance within the sample set. While the numerator value (the difference between two sample sets) is straightforward to calculate, the denominator (the variation within the sample set) can be a bit complicated depending on the types of data values involved. The denominator of a ratio is a measure of spread or variability. Higher values of the t-value, also known as the t-score, indicate that a large difference exists between the two sample sets. The smaller the t-value, the greater the similarity between the two sample sets.

- A large t-score indicates that the groups are different.
- A small t-score indicates that the groups are similar.

Degrees of freedom refers to the values in a study that has the freedom to vary and are essential for assessing the importance and the validity of the null hypothesis. Computation of these values usually depends upon the number of data records available in the sample set.

5.15 PAIRED T-TEST

The Paired Samples *t* Test compares the means of two measurements taken from the same individual, object, or related units. These «paired» measurements can represent things like:

A measurement taken at two different times (e.g., pre-test and post-test score with an intervention administered between the two time points)

A measurement taken under two different conditions (e.g., completing a test under a "control" condition and an "experimental" condition)

Measurements taken from two halves or sides of a subject or experimental unit (e.g., measuring hearing loss in a subject's left and right ears).

The purpose of the test is to determine whether there is statistical evidence that the mean difference between paired observations is significantly different from zero. The Paired Samples *t* Test is a parametric test.

This test is also known as:

Dependent *t* Test

Paired *t* Test

Repeated Measures *t* Test

NOTES 

The variable used in this test is known as:
Dependent variable, or test variable (continuous), measured at two different times or for two related conditions or units

The Paired Samples t Test is commonly used to test the following:

- Statistical difference between two time points
- Statistical difference between two conditions
- Statistical difference between two measurements
- Statistical difference between a matched pair

Note: The Paired Samples t Test can only compare the means for two (and only two) related (paired) units on a continuous outcome that is normally distributed. The Paired Samples t Test is not appropriate for analyses involving the following: 1) unpaired data; 2) comparisons between more than two units/groups; 3) a continuous outcome that is not normally distributed; and 4) an ordinal/ranked outcome.

a. To compare unpaired means between two independent groups on a continuous outcome that is normally distributed, choose the Independent Samples *t* Test.
b. To compare unpaired means between more than two groups on a continuous outcome that is normally distributed, choose ANOVA.
c. To compare paired means for continuous data that are not normally distributed, choose the nonparametric Wilcox on Signed-Ranks Test.
d. To compare paired means for ranked data, choose the nonparametric Wilcox on Signed-Ranks Test.

Your data must meet the following requirements:

1. Dependent variable that is continuous (i.e., interval or ratio level)

   Note: The paired measurements must be recorded in two separate variables.

2. Related samples/groups (i.e., dependent observations)

   The subjects in each sample, or group, are the same. This means that the subjects in the first group are also in the second group.

3. Random sample of data from the population
4. Normal distribution (approximately) of the difference between the paired values
5. No outliers in the difference between the two related groups

   Note: When testing assumptions related to normality and outliers, you must use a variable that represents the difference between the paired values - not the original variables themselves.

   Note: When one or more of the assumptions for the Paired Samples t Test are not met, you may want to run the nonparametric Wilcox on Signed-Ranks Test instead.

NOTES

5.16 NON-PARAMETRIC TEST

Non parametric tests on two independent sample are used to compare the distribution of two independent samples.

Non-parametric tests have been put forward in order to get round the assumption that a sample is normally distributed, required for using the parametric tests (z test, Student's t test, Fisher's F test, Levene's test and Bartlett's test).

Non-parametric Tests on two independent samples

If we designate D to be the assumed difference in position between the samples (in general we test for equality, and D is therefore 0), and P1-P2 to be the difference of position between the samples, three tests are possible depending on the alternative hypothesis chosen:

- The two-tailed test: **H0: P1 - P2 = D and Ha: P1 - P2 ≠ D**
- The left-tailed test: **H0: P1 - P2 = D and Ha: P1 - P2 < D**
- The right-tailed test: **H0: P1 - P2 = D and Ha: P1 - P2 > D**

5.17 MANN WHITNEY TEST

Use the **Mann-Whitney test** to determine if the samples come from a single population or from two different populations meaning that the two samples may be considered identical or not. This test is based on on the ranks. XLSTAT can perform a two-tailed or a one-tailed test. This test is often called the Mann-Whitney test, sometimes the Wilcox on-Mann-Whitney test or the Wilcox on Rank-Sum test.

Let S1 be a sample made up of n1 observations (x1, x2, …, xn1) and S2 a second sample made up of n2 observations (y1, y2, …, yn2) independent of S1. Let N be the sum of n1 and n2.

XLSTAT calculates the Wilcox on Ws statistic which measures the difference in position between the first sample S1 and sample S2 from which D has been subtracted, we combine the values obtained for both samples, then put them in order. For XLSTAT, the Ws statistic is the sum of the ranks of the first samples.

For the expectation and variance of Ws we therefore have:

E(Ws) = 1/2 n1(N + 1) and V(Ws) = 1/12 n1n2(N + 1)

The Mann-Whitney U statistic is the sum of the number of pairs (xi, yi) where xi>yi, from among all the possible pairs. We show that:

E(U) = n1n2/2 and V(U) = 1/12 n1n2(N + 1)

We may observe that the variances of Ws and U are identical. In fact, the relationship between U and Ws is:

Ws = U + n1(n1 + 1) / 2

The results offered by XLSTAT are those relating to Mann-Whitney's U statistic.

Kolmogorov smirnov test

Use the Kolmogorov-Smirnov's test to determine if the populations from which the

NOTES

samples were taken have different cumulative distribution functions. XLSTAT performs a two-tailed test.

5.18 SPEARMEN

Spearman correlation coefficient: Definition

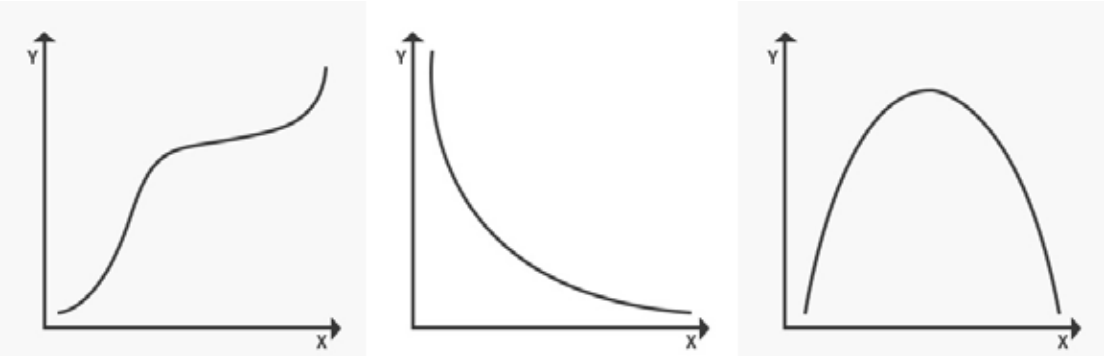
The Spearman's rank coefficient of correlation is a nonparametric measure of rank correlation (statistical dependence of ranking between two variables).

Named after Charles Spearman, it is often denoted by the Greek letter '□' (rho) and is primarily used for analysis. It measures the strength and direction of the association between two ranked variables. But before we talk about the Spearman correlation coefficient, it is important to understand Pearson's correlation first. A Pearson correlation is a statistical measure of the strength of a linear relationship between paired data.

For the calculation and significance testing of the ranking variable, it requires the following data assumption to hold true:

- Interval or ratio level
- Linearly related
- Bivariant distributed

If your data doesn't meet the above assumptions, then you would need Spearman's Coefficient. It is necessary to know what monotonic function is to understand Spearman correlation coefficient. A monotonic function is one that either never decreases or never increases as it is an independent variable increase. A monotonic function can be explained using the image below:



The image explains three concepts in monotonic function:

1. Monotonically increasing: When the 'x' variable increases and the 'y' variable never decreases.
2. Monotonically decreasing: When the 'x' variable increases but the 'y' variable never increases
3. Not monotonic: When the 'x' variable increases and the 'y' variable sometimes increases and sometimes decreases.

Monotonic relation is less restrictive when compared to a linear relationship that is used in Pearson's coefficient. Although monotonicity is not the ultimate requirement for Spearman

correlation coefficient, it will not be meaningful to pursue Spearman's correlation without actually determining the strength and direction of a monotonic relationship if it was already known that the relationship between the variable is non-monotonic.

Spearman correlation coefficient: Formula and Calculation with Example

$$r_R = 1 - \frac{6\Sigma_i {d_i}^2}{n(n^2-1)}$$

Here,

n= number of data points of the two variables

di= difference in ranks of the "ith" element

The Spearman Coefficient, ρ, can take a value between +1 to -1 where,

- A ρ value of +1 means a perfect association of rank
- A ρ value of 0 means no association of ranks
- A ρ value of -1 means a perfect negative association between ranks.

Closer the ρ value to 0, weaker is the association between the two ranks.

We must be able to rank the data before proceeding with the Spearman's Rank Coefficient of Correlation. It is important to observe if increasing one variable, the other variable follows a monotonic relation.

5.19 CHAPTER SUMMARY

Frequency tells you **how often something happened**. The frequency of an observation tells you the number of times the observation occurs in the data. For example, in the following list of numbers, the frequency of the number 9 is 5 (because it occurs 5 times):

1, 2, 3, 4, 6, 9, 9, 8, 5, 1, 1, 9, 9, 0, 6, 9.

For every essay you write, you must focus on a central idea. This idea stems from a topic you have chosen or been assigned or from a question your teacher has asked. It is not enough merely to discuss a general topic or simply answer a question with a yes or no. You have to form a specific opinion, and then articulate that into a controlling idea—the main idea upon which you build your thesis.

Remember that a thesis is not the topic itself, but rather your interpretation of the question or subject. For whatever topic your professor gives you, you must ask yourself, "What do I want to say about it?" Asking and then answering this question is vital to forming a thesis that is precise, forceful and confident.

A thesis is one sentence long and appears toward the end of your introduction. It is specific and focuses on one to three points of a single idea—points that are able to be demonstrated in the body. It forecasts the content of the essay and suggests how you will organize your information. Remember that a thesis statement does not summarize an issue but rather dissects it.

NOTES 

5.20 REVIEW QUESTIONS

SHORT ANSWER TYPE QUESTIONS

1. **Discuss the types of data analysis?**
2. **What is frequency distribution?**
3. **Explain the method of frequency distribution?**
4. **what is chi square test?**
5. **Discuss the type of frequency distribution?**

LONG ANSWER TYPE QUESTIONS

1. **Explain the type of thesis statement?**
2. **Elaborate spearmen test?**
3. **Discuss ANOVA?**
4. **Explain Mann Whitney test?**
5. **What is the structure of thesis report?**

5.21 MULTIPLE CHOICE QUESTIONS

1. **A researcher asked 933 people what their favorite type of TV program was: news, documentary, soap or sports. They could only choose one answer. As such, the researcher had the number of people who chose each category of program. How should she analyze these data?**
   a. t-test
   b. One-way analysis of variance
   c. Chi-square test
   d. Regression
2. **Chi-square is used to analyze:**
   a. Scores
   b. Ranks
   c. Frequencies
   d. Any of these
3. **On which of the following does the critical value for a chi-square statistic rely?**
   a. The degrees of freedom
   b. The sum of the frequencies
   c. The row totals
   d. The number of variables
4. **What is the primary purpose of ANOVA?**
   a. Comparing means across three or more groups
   b. Comparing medians across three or more groups
   c. Examining the relationship between two categorical variables
   d. Identifying normally distributed data

5. **Which of the following assumptions does not apply to ANOVA?**
   a. Independent observations
   b. Normal distribution of continuous variable
   c. Homogeneity of variances
   d. Inclusion of one bivariate variable

6. **How many pair wise comparisons would there be for an ANOVA with four groups?**
   a. 16
   b. 4
   c. 12
   d. 6

7. **Apply a Bonferroni adjustment to a p-value of .01 if the analyses included six pair wise comparisons. If the threshold for statistical significance were .05, would the adjusted p-value be significant?**
   a. Yes
   b. No

8. **If the assumed hypothesis is tested for rejection considering it to be true is called?**
   a. Null Hypothesis
   b. Statistical Hypothesis
   c. Simple Hypothesis
   d. Composite Hypothesis

9. **If the null hypothesis is false then which of the following is accepted?**
   a. Null Hypothesis
   b. Positive Hypothesis
   c. Negative Hypothesis
   d. Alternative Hypothesis.

10. **Which of these distributions is used for a testing hypothesis?**
    a. Normal Distribution
    b. Chi-Squared Distribution
    c. Gamma Distribution
    d. Poisson Distribution

♦♦♦♦♦

ANSWER KEY

UNIT I

QUESTION	ANSWER	QUESTION	ANSWER
1	b.	6	a.
2	d.	7	b.
3	d.	8	d.
4	a.	9	d.
5	a.	10	d.

UNIT II

QUESTION	ANSWER	QUESTION	ANSWER
1	d.	6	b.
2	b.	7	d.
3	b.	8	a.
4	d.	9	a.
5	c.	10	d.

UNIT III

QUESTION	ANSWER	QUESTION	ANSWER
1	b.	6	d.
2	a.	7	b.
3	a.	8	d.
4	c.	9	d.
5	c.	10	c.

UNIT IV

QUESTION	ANSWER	QUESTION	ANSWER
1	c.	6	b.
2	b.	7	a.
3	b.	8	b.
4	b.	9	c.
5	c.	10	d.

UNIT V

QUESTION	ANSWER	QUESTION	ANSWER
1	c.	6	d.
2	c.	7	b.
3	a.	8	a.
4	a.	9	d.
5	d.	10	b.

References and Suggested Reading

Books :

1. Ackoff, Russell L., The Design of Social Research, Chicago: University of Chicago Press, 1961.

2. Ackoff, Russell L., Scientific Method, New York: John Wiley & Sons, 1962.

3. Allen, T. Harrell, New Methods in Social Science Research, New York: Praeger Publishers, 1978.

4. Anderson, H.H., and Anderson, G.L., An Introduction to Projective Techniques and Other Devices for Understanding the Dynamics of Human Behaviour, New York: Prentice Hall, 1951.

5. Anderson, T.W., An Introduction to Multivariate Analysis, New York: John Wiley & Sons, 1958.

6. Bailey, Kenneth D., "Methods of Social Research," New York, 1978.

7. Baker, R.P., and Howell, A.C., The Preparation of Reports, New York: Ronald Press, 1938.

8. Bartee, T.C., "Digital Computer Fundamentals," 5th Ed., McGraw-Hill, International Book Co., 1981.

9. Barzun, Jacques, and Graff, Henery, F., The Modern Researcher, rev. ed., New York: Harcourt, Brace & World, Inc., 1970.

10. Bell, J.E., Projective Techniques: A. Dynamic Approach to the Study of Personality, New York: Longmans Green, 1948.

11. Bellenger, Danny N., and Greenberg, Barnett A., Marketing Research—A Management Information Approach, Homewood, Illinois: Richard D. Irwin, Inc., 1978.

12. Berdie, Douglas R., and Anderson, John F., Questionnaires: Design and Use, Metuchen N.J.: The

Scarecrow Press, Inc., 1974.

13. Berelson, Bernard, Content Analysis in Communication Research, New York: Free Press, 1952.

14. Berenson, Conard, and Colton, Raymond, Research and Report Writing for Business and Economics, New York: Random House, 1971.

15. Best, John W., and Kahn, James V., "Research in Education," 5th Ed., New Delhi: Prentice-Hall of India Pvt. Ltd., 1986.

16.D. K. Bhattacharya: Research Methodology (Excel)

17.P. C. Tripathy: A text book of Research Methodology in Social Science(Sultan

Chand)

18. Saunder: Research Methods for business students (Pearson)

19. Marketing Research –Hair, Bush, Ortinau (2nd edition Tata McGraw Hill)

20. Business Research Methods – Alan Bryman& Emma Bell – Oxford Publications

21. Business Research Methods – Naval Bajpai – Pearson Publications

Internet links :

1.https://www.youtube.com/watch?v=jbDRLkGEeIU&list=PLRb7ot-9tbChzZkkVpoICCzGNJ1aMo91M

2. https://www.youtube.com/watch?v=ur-pIS0CxOg&list=PLsh2FvSr3n7eJR5_YtdRvwoYv4JZ00hqe

3. https://www.youtube.com/watch?v=ur-pIS0CxOg&list=PLsh2FvSr3n7eJR5_YtdRvwoYv4JZ00hqe

4. https://www.youtube.com/watch?v=VUCicpiNdMI

5. https://www.youtube.com/watch?v=ABLHV5Ce6TI&list=PLPjSqITyvDeWBBaFUbkLDJ0egyEYuNeR1

Related Research Articles :

• Amaratunga, D., Baldry, D., Sarshar, M., & Newton, R. (2002). Quantitative and qualitative research in the built environment: application of “mixed” research approach. Work Study, 51(1), 17-31. https://doi.org/10.1108/00438020210415488

• Anderson, V. (2009). Research methods in human resource management: Chartered Institute of Personnel and Development.

• Azorín, J. M., & Cameron, R. (2010). The application of mixed methods in organisational research: A literature review. Electronic journal of business research methods, 8(2), 95-105.

• Bailey, K. (2008). Methods of social research: Simon and Schuster.

• Becker, J., & Niehaves, B. (2007). Epistemological perspectives on IS research: a framework for analysing and systematizing epistemological assumptions. Information Systems Journal, 17(2), 197-214. https://doi.org/10.1111/j.1365-2575.2007.00234.x

• Bell, J. (2005). Doing your Research Project. Buckingham: Open University Press.

• Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative research in psychology, 3(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

• Brown, J., & Sice, P. (2003). Towards a Second Order Research Methodology. Electronic journal of business research methods, 3(1), 25-36.

• Bryman, A. (1992). Quantitative and qualitative research: further reflections on their integration. Mixing methods: Qualitative and quantitative research, 57-78.

• Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? Qualitative research, 6(1), 97-113. https://doi.org/10.1177/1468794106058877

• Bryman, A. (2012). Social research methods (4th Edition ed.): Oxford university press.

• Burrell, G., & Morgan, G. (1979). Sociological Paradigms and Organisational Analysis: Heinemann, London.

• Cameron, R. (2011). Mixed Methods Research: The Five Ps Framework. Electronic journal of business research methods, 9(2).

• Creswell, J. W. (2002). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (4th Ed ed.): Prentice Hall.

• Creswell, J. W. (2012). Qualitative inquiry and research design: Choosing among five approaches (3rd Ed ed.). Lincoln, NB: Sage Publications.

• Crotty, M. (1998). The foundations of social research: Meaning and perspective in the research process: Sage.

• Darke, P., Shanks, G., & Broadbent, M. (1998). Successfully completing case study research: combining rigour, relevance and pragmatism. Information Systems Journal, 8(4), 273-289.