

MBA02C204
Semester 2



RESEARCH METHODOLOGY

Message for the Students

Dr. Babasaheb Ambedkar Open (University is the only state Open University, established by the Government of Gujarat by the Act No. 14 of 1994 passed by the Gujarat State Legislature; in the memory of the creator of Indian Constitution and Bharat Ratna Dr. Babasaheb Ambedkar. We Stand at the seventh position in terms of establishment of the Open Universities in the country. The University provides as many as 54 courses including various Certificate, Diploma, UG, PG as well as Doctoral to strengthen Higher Education across the state.



On the occasion of the birth anniversary of Babasaheb Ambedkar, the Gujarat government secured a quiet place with the latest convenience for University, and created a building with all the modern amenities named 'Jyotirmay' Parisar. The Board of Management of the University has greatly contributed to the making of the University and will continue to this by all the means.

Education is the perceived capital investment. Education can contribute more to improving the quality of the people. Here I remember the educational philosophy laid down by Shri Swami Vivekananda:

“We want the education by which the character is formed, strength of mind is Increased, the intellect is expand and by which one can stand on one’s own feet”.

In order to provide students with qualitative, skill and life oriented education at their threshold. Dr. Babaasaheb Ambedkar Open University is dedicated to this very manifestation of education. The university is incessantly working to provide higher education to the wider mass across the state of Gujarat and prepare them to face day to day challenges and lead their lives with all the capacity for the upliftment of the society in general and the nation in particular.

The university following the core motto ‘स्वाध्यायः परमम् तपः’ does believe in offering enriched curriculum to the student. The university has come up with lucid material for the better understanding of the students in their concerned subject. With this, the university has widened scope for those students who

are not able to continue with their education in regular/conventional mode. In every subject a dedicated term for Self Learning Material comprising of Programme advisory committee members, content writers and content and language reviewers has been formed to cater the needs of the students.

Matching with the pace of the digital world, the university has its own digital platform Omkar-e to provide education through ICT. Very soon, the University going to offer new online Certificate and Diploma programme on various subjects like Yoga, Naturopathy, and Indian Classical Dance etc. would be available as elective also.

With all these efforts, Dr. Babasaheb Ambedkar Open University is in the process of being core centre of Knowledge and Education and we invite you to join hands to this pious *Yajna* and bring the dreams of Dr. Babasaheb Ambedkar of Harmonious Society come true.



Prof. Ami Upadhyay

Vice Chancellor,

Dr. Babasaheb Ambedkar Open University,
Ahmedabad.

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SEMESTER-2
RESEARCH METHODOLOGY
BLOCK: 1

Authors' Name: Dr. Ravi Vaidya
Dr. Hiren Patel

Review (Subject): Prof. (Dr.) Manoj Shah
Dr. Gurumit Singh
Dr. Ravi Vaidya
Dr. Maulik Desai

Review (Language): Dr. Dushyantbhai Nimavat

Editor's Name: Prof. (Dr.) Manoj Shah,
Professor and Director,
School of Commerce and Management,
Dr. Babasaheb Ambedkar Open University, Ahmedabad.

Co-Editor's Name: Dr. Dhaval Pandya
Assistant Professor,
School of Commerce and Management,
Dr. Babasaheb Ambedkar Open University, Ahmedabad.

Publisher's Name: Dr. Ajaysinh Jadeja,
Registrar,
Dr. Babasaheb Ambedkar Open University,
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Gujarat, India.

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Dr. Babasaheb Ambedkar Open University
(Established by Government of Gujarat)

RESEARCH METHODOLOGY
SEMESTER-2

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1.1 INTRODUCTION

Research is as old as mankind itself. The earliest creatures that predated human beings were probably well aware of the fire. When lightning would strike a forest and create a fire, it probably intrigued and amazed them. Many scientists believe that the controlled use of fire was likely first achieved by an ancient human ancestor known as *Homo erectus* during the Early Stone Age. Evidence at some of the archaeological sites indicates that the use of fire could date back almost two million years. In northern Jordan, archaeologists found the remnants of ancient flatbread¹ in what was once a fireplace. The entire journey of human evolution is a witness to how human curiosity has been the propelling force behind all research. All the inventions and discoveries are outcomes of persistent and systematic research and nothing else.

Exercise 1: Can you find out the ten or fifteen most significant inventions and discoveries which have influenced human evolution?

Meaning

Research is a process to discover new knowledge. Normally, the prefix-*re* is understood as again, leading to the misconception that research means to search again. That understanding is incorrect. The word research has its origin in the Middle and Old French word *recherché/rechercher*, wherein *re* means expressing intensive force and *cerchier* means to search. Thus, research means an intensive, concentrated search for a specific target set. Consider an example. A mosquito bites you. You clutch your arm and angrily look around for the mosquito. You are performing a search. You are just looking for the bug to kill it. Now, if you start to develop a cure for malaria, you

research. You perform deep searches, analyse patterns and conduct tests. In other words, you are doing multiple searches.

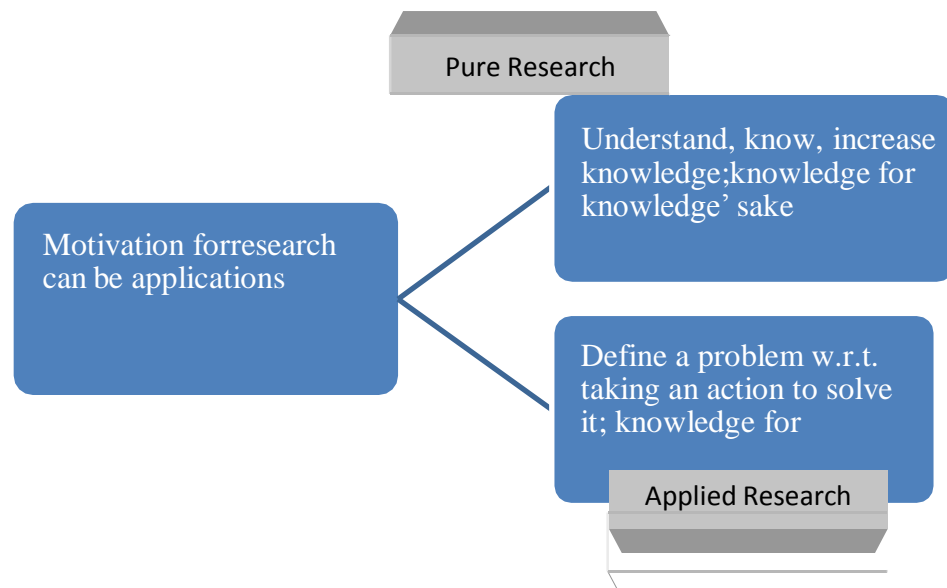
1.2 DEFINITION OF RESEARCH

Research is defined as: A systematic investigation (i.e., the gathering and analysis of information) designed to develop or contribute to generalizable knowledge.

Research is a process of systematic inquiry that entails the 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.

From a process and purpose perspective, research is

- Manipulations of things, and concepts;
- For generalizing purposes
 - The result should be a proposition which tells us to expect something when certain conditions influence them
- To extend, correct or verify knowledge
- And the knowledge is to be put to two uses:
 - Theoretical
 - Practical



Research can also be defined as *the creation of new knowledge and/or the*

use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes.

A broad notion of research is that it is a creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications.

This definition of research encompasses pure and strategic basic research, applied research and experimental development. Applied research is an original investigation undertaken to acquire new knowledge but directed towards a specific, practical aim or objective (including a client-driven purpose).

Business and management research is usually aimed at finding solutions to problems or exploiting opportunities. Thus, most business research is applied research.

The table below mentions some key differences between pure and applied research:

Pure research	Applied research
Only finds out what and how	More concerned with the why
Solves abstract problems	Solves specific problems
Life is for Science	Science is for life
Laws aren't discovered to solve problems, they are only stated asexisting facts	Speeds up the process of building theories

Not all research is done to find answers to questions being asked for the very first time. The same search might have been done countless times before. A huge chunk of it also includes analysing the same search results differently or drawing different conclusions

1.3 IMPORTANCE OF SCIENTIFIC RESEARCH

Research is not meaningful and significant if it is not done scientifically. It is very important to understand why research needs to be scientific.

What is Science? - The word –science is derived from the Latin word *scientia* meaning knowledge. Science refers to a systematic and organized body of knowledge in any area of inquiry that is acquired using —the scientific method. Science can be grouped into two broad categories:

natural science and social science. Natural science is the science of naturally occurring objects or phenomena, such as light, objects, matter, earth, celestial bodies, or the human body. On the other hand, social science is the science of people or collections of people, such as groups, firms, societies, or economies, and their individual or collective behaviours.

As mentioned above, science is science only if it has been acquired using a scientific method. So, if research has to be scientific, it too should be carried out using a scientific method. The scientific method refers to a standardized set of techniques for building scientific knowledge, such as how to make valid observations, how to interpret results, and how to generalize those results. The scientific method must satisfy four characteristics:

- **Replicability** : If the research result can be obtained only by you and not others, this research is of no help to the world. Research is purposeful only when others can independently replicate a study and obtain similar or identical results. And that is why an art is an art and not a science because no two artists can create the same drawing or the same painting.
- **Precision** : Any concept must be defined so precisely that others can use those definitions to measure those concepts and test those theories.
- **Falsifiability**: A theory must be stated in a way that it can be disproven. Theories that cannot be tested or falsified are not scientific theories and any such knowledge is not scientific knowledge. A theory that is specified in imprecise terms or whose concepts are not accurately measurable cannot be tested and is therefore not scientific.
- **Parsimony** : When there are multiple explanations of a phenomenon, researchers must always accept the simplest or logically most economical explanation. This concept is called parsimony and it prevents researchers from pursuing complex theories with limited implications.

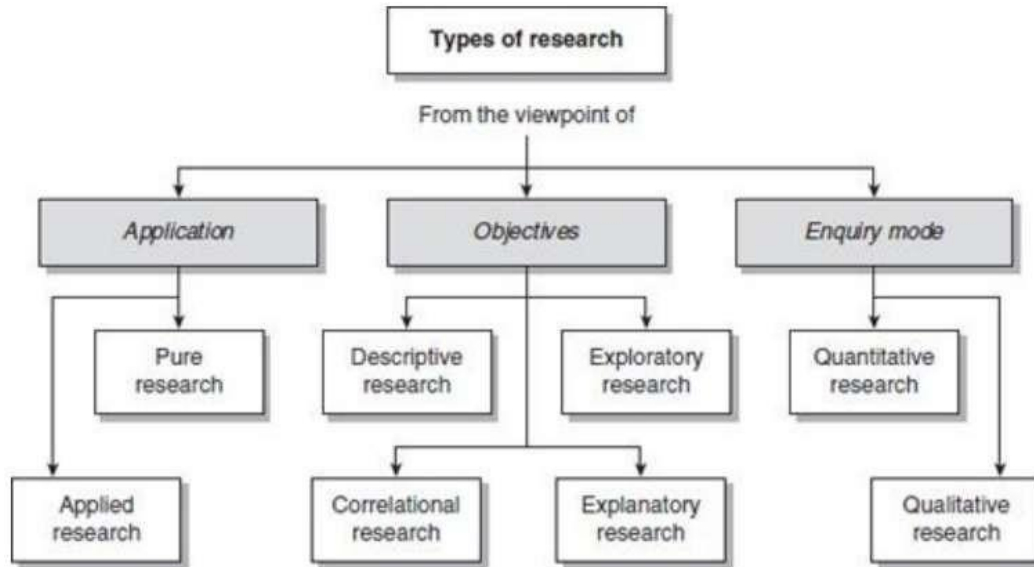
A good research process should have the following characteristics:

- **Rigorous** – follow relevant, appropriate and justified procedures to find answers.
- **Systematic** — a systematic and logical sequence of procedures is undertaken for the study. It cannot be done haphazard manner.
- Valid and verifiable – the conclusions must be correct and verifiable by others
- **Empirical** – conclusions are based upon hard evidence gathered from information collected from real experiences and observations
- **Critical** — process and procedures should be able to pass critical scrutiny, must be foolproof and free of any errors or drawbacks.

1.4 TYPES OF RESEARCH

The types of research can be classified on different bases:

- Applications of the findings of the research study
- Objectives of the study
- Mode of enquiry used in conducting the study



Source: Research Methodology: a step-by-step guide for beginners, 3rd ed., Ranjit Kumar

Applications perspective: There are two broad categories of research based on the applications of the findings of the research study: pure and applied research. Pure research is also concerned with the development, examination, verification and refinement of research methods, procedures, techniques and tools that form the body of research methodology. E.g. developing an instrument to measure the stress level in people, and finding the best way of measuring people's attitudes. The knowledge produced through pure research is sought in order to add to the existing body of knowledge.

Applied research involves the research techniques, procedures and methods for the collection of information about various aspects of a situation, issue, problem or phenomenon so that the information gathered can be used in other ways — such as for policy formulation, administration and the enhancement of understanding of a phenomenon.

Objectives perspective: Based on the objectives of undertaking the research study, it can be classified as exploratory and conclusive, where conclusive includes descriptive, explanatory and correlational research.

A descriptive study attempts to describe a situation, problem, or phenomenon or describes an existing situation or characteristic. E.g. attitude of employees towards management, living conditions of a community or existing rates of unemployment in a region.

A correlation study establishes a relationship or association between two or more aspects of a situation. E.g. what is the influence of advertising on sales? What is the relationship between employee stress and employee performance?

Explanatory research clarifies the why and how of the relationship between two aspects. E.g. Why does stress result in heart attack?

Exploratory research is undertaken with the objective of either exploring an unknown or lesser-known domain or assessing the possibilities of undertaking a research in a domain. They are also used to develop hypotheses, develop and test instruments and refine procedures and tools.

1.5 FUNDAMENTALS IN RESEARCH

We shall now be looking at the fundamentals in research. These are the building blocks of theory formulation and testing.

Concept: A bundle of meanings or characteristics associated with certain events, objects, conditions, situations, etc. It is an abstraction formed from observed generalizations. e.g. weight, energy, etc.

Concepts have progressive levels of abstraction— that is, the degree to which the concept does or does not have something objective to refer to. The table is an objective concept. We can point to a table, and we have images of the characteristics of all tables in our minds. An abstraction-like personality is much more difficult to visualize. Such abstract concepts are often called constructs.

Constructs: A construct is an image or abstract idea specifically invented for a given research and/or theory-building purpose. Constructs are broad concepts or topics for a study. Constructs can be conceptually defined in that they have meaning in theoretical terms. They can be abstract and do not necessarily need to be directly observable. Examples of constructs include intelligence, aggression, and love or life satisfaction.

A construct is an abstract idea inferred from specific instances that are thought to be related. Typical marketing constructs are brand loyalty, satisfaction, preference, awareness, and knowledge. Research objectives typically call for the measurement of constructs.

Variables: The purpose of all research is to describe and explain variance in the world. Variance is simply the difference; that is, a variation that occurs naturally in the world or change that we create as a result of manipulation. Variables are names that are given to the variance we wish to explain. Variables are created by developing the construct into a measurable form. Variables, by definition, correspond to any characteristic that varies (meaning they have at least two possible values). Examples of variables include height in inches, scores on a depression inventory, and the ages of employees.

A concept/construct is a variable only if it can assume two or more values. Some variables can be measured by manipulating or controlling them e.g. changing the frequency of advertising on a medium. However, there are certain variables which cannot be manipulated or controlled, they can only be observed and measured – e.g. age and gender.

An *active* variable is one which can be manipulated and measured, whereas an *attribute* variable is one which can only be measured and not manipulated.

There are multiple ways of classifying variables; based on the causal relationships, study design and unit of measurement.

Causal Relationship: Variables are classified depending on how they interact with other variables in the model. On this basis, the different variables are:

- Independent variable (IV) — this is the change variable, the one supposed to bring about a change in another variable (s). Researchers manipulate or control the variable through its multiple levels and measure the corresponding change in the phenomenon being observed. This variable is also called the manipulated / predictor/input/ stimulus variable. The number of hours of study can be an example of an IV.
- Dependent variable (DV) — this is the outcome variable, the one which is observed and measured as it *varies* as per the different treatments of the IV. This variable is also called the measured / observed / criterion/ output / response variable. The marks obtained in exams can be an example of DV.
- Moderating variable — this variable alters the strength of an effect between the IV and DV. Female students might be scoring more marks than male students for the same number of hours of study. Thus, gender moderates the effect of hours of study on marks obtained.
- Intervening variable — this variable *intervenes* between the IV and DV. The independent variable cannot affect the dependent variable without the presence of an intervening variable. The intervening

variable is caused in part or total due to the IV and in turn affects the DV in part or total. Confidence in the subject due to high recall levels and in-depth comprehensive coverage of the syllabus is an intervening variable caused by long hours of study (IV) and in turn, influences the performance in the exam (DV).

- Extraneous variable – this variable is external to the study and in most cases is unpredictable, and difficult to test. It however has an influence on the IV – DV relationship. A traffic jam en route to the exam centre increases the stress on the student, resulting in poor performance and lower grades.

Design of Study: The classification of the variable is on the basis of whether the design of the study involved manipulating variables or simply observing them. A concept/construct is a variable only if it can assume two or more two values. Some variables can be measured by manipulating or controlling them — e.g. changing the frequency of advertising on a medium. However, there are certain variables which cannot be manipulated or controlled, they can only be observed and measured — e.g. age and gender.

An *active* variable is one which can be manipulated and measured, whereas an *attribute* variable is one which can only be measured and not manipulated.

Unit of measurement: Here, the variable is classified on the way it is measured, and its unit of measurement. The two major classes of variables are:

- Categorical variables – it is a variable that can take on one of a limited, and usually fixed, number of possible values, thus assigning each case to a particular group or category. E.g. Toothpaste brands, political parties, gender, occupation. Certain categorical variables may be dichotomous only two possible categories (e.g. day or night). Others can be polychotomous can have more than two possible categories (e.g. religion, occupation).
- Continuous variables — it is a variable which can assume an infinite number of values between two endpoints. E.g. time, weight, age.

Exercise 2: identify which variables are independent and dependent in the following examples:

Example	Independent	Dependent
Physical activity and weight loss		
Positive feedback and self-confidence		
Headache and aspirin		
Calcium consumption and bone density		
Blood pressure and salt intake		
Advertising and sales		
Salary and employee morale		
Total debt and profits		

For the above, also try and find out the moderating, intervening and extraneous variables.

Hypotheses: A hypothesis (singular) is a proposition, a tentative statement about the relationship between two or more variables formulated for empirical testing. It is a specific, testable prediction about what the researcher expects to happen in a study. It is the goal of research to determine whether the researcher's prediction was correct or wrong. An example of a hypothesis is: *"Motorists who talk on the phone while driving will be more likely to make errors on a driving course than those who do not talk on the phone."*

The case of the study is the motorist, talking on the phone is the independent variable and errors in driving are the dependent variable.

Types of hypotheses:

Depending upon the research objective and the outcome the researcher expects to attain, hypotheses are of two types:

- Descriptive
- Propositions which state the existence, size, form or distribution of some variable.
- E.g.:
- The current literacy rate in Gujarat is 67.4%
- Do kids prefer Cartoon Network over Jetix?
- Relational
- Statements that describe a relationship between two variables with respect to some case
- E.G.:
- Foreign banks are considered to be more efficient than Indian banks (Co

relational)

- Increase in disposable income leads to increase in spending on entertainment & leisure (Causal)

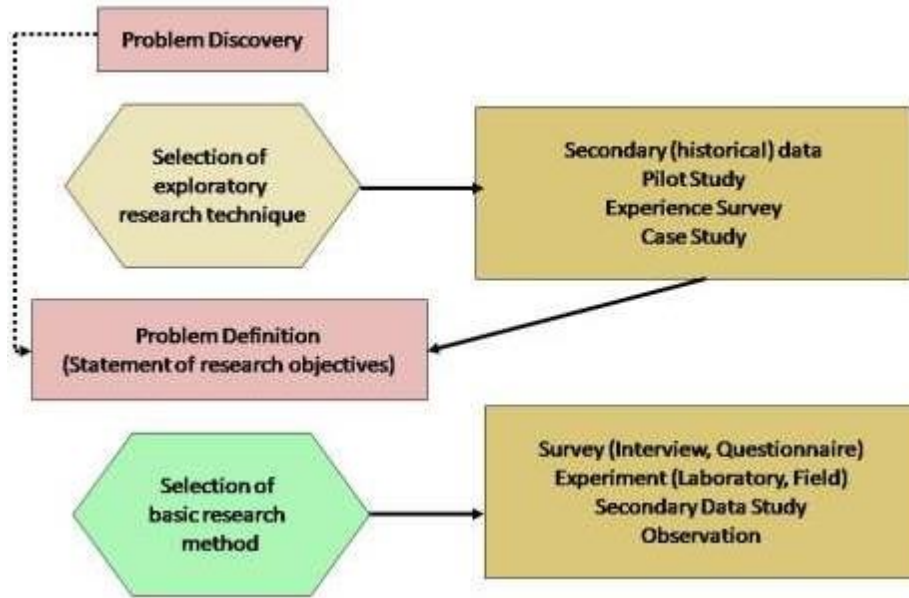
Theory: A theory is a set of interrelated concepts, definitions, and propositions that explains or predicts events or situations by specifying relations among variables. Theories vary in the extent to which they have been conceptually developed and empirically tested; however, all theories have to be empirically tested to be accepted. The theory explains phenomena by showing how the variables are related, thus helping in predicting and generalizing.

The theory is constantly revised as new knowledge is discovered through research. Three stages of theory development exist in any new science:

- 1) Speculative - attempts to explain what is happening.
- 2) Descriptive - gathers descriptive data to describe what is really happening.
- 3) Constructive - revises old theories and develops new ones based on continuing research.

1.6 RESEARCH PROBLEM

Defining the research problem with total clarity is the first step in the research process. The research problem is a general statement of an issue meriting research. A research problem is a statement about an area of concern, a condition to be improved, a difficulty to be eliminated, or a troubling question that exists in scholarly literature, in theory, or in practice that points to the need for meaningful understanding and deliberate investigation. In some social science disciplines, the research problem is typically posed in the form of a question. A research problem does **not** state how to do something, offer a vague or broad proposition, or present a value question. In a real sense formulation of a problem is often a lot more crucial than its solution. It is only on careful detailing of the research problem that we can work out research design and can smoothly carry on all the consequential steps involved while doing research.



The Five Elements of a Research Problem are:

- Aim of the problem to be investigated — Why is there a need for research?
- Theme to be investigated – What is to be researched?
- Time dimension – When is the research to be performed?
- Location of investigation – Where is the study to be conducted?
- Population for data – Who do we collect data from?

Some examples of research problem statements are mentioned below:

- How can the construction industry overcome impediments to deploying wireless communication technology on secure construction sites; and what are the applications with the highest payoffs?
- What are the opportunities for implementing augmented reality/serious gaming (ARSG) approaches in the construction industry?
- What are the best practices for effective succession planning?
- How can a project identify and quantify the unintended waste involved in a project?

Types of research problems:

There are three basic types of research problems and understanding them is very important as the type of the problem also determines the use of research and statistical methods:

1. Descriptive: The research problem aims at describing a situation, condition or occurrence of a phenomenon.
 - e.g. What is the proportion of households who have shifted to online ordering of groceries during the COVID Pandemic?
2. Relative: The aim is to explore if there is the relationship between two or

more phenomena, and how close is this relationship. Here, you should take care that a relationship does not necessarily mean cause and effect. The exact cause of the phenomenon cannot be ascertained through relative research problems.

- e.g. What is the relationship between the education of the consumers and their shift towards online ordering of groceries?
3. Causal: It aims to establish the cause of the occurrence of the phenomenon. It explores and establishes causality-based relationships between phenomena.
- e.g. What is the influence of safety measures undertaken by online grocers on consumers' shift towards online grocery shopping?

1.7 FORMULATION OF RESEARCH HYPOTHESIS

As we saw above, a hypothesis is a prediction of what will be found at the outcome of a research project and is typically focused on the relationship between two different variables studied in the research. *f* A problem cannot be scientifically solved unless it is reduced to hypothesis form.

A hypothesis can take two forms. It can predict that there is no relationship between two variables, in which case it is a *null* hypothesis. Or, it can predict the existence of a relationship between variables, which is known as an *alternative* hypothesis.

In either case, the variable that is thought to either affect or not affect the outcome is known as the independent variable, and the variable that is thought to either be affected or not is the dependent variable.

Null Hypothesis: A null hypothesis is formulated by a researcher when she believes (based on theory and existing scientific evidence) that there is NO relationship between the two variables being studied. The null hypothesis ALWAYS states that the dependent variable *varies* due to chance and not due to the influence of the independent variable. It is denoted by H_0 or H_N (H Null).

Alternate Hypothesis: The alternative hypothesis is a statement of what a hypothesis test is set up to establish. It is the exact opposite of null hypothesis and is only reached once the null hypothesis is rejected.

EXAMPLE

In a clinical trial of a new drug, the null hypothesis might be that the new drug is no better, on average, than the current drug.

We would write H_0 : there is no difference between the two drugs on average. The alternative hypothesis might be that:

The new drug has a different effect, on average, compared to that of the current drug.

We would write H_1 : the two drugs have different effects, on average. The new drug is better, on average, than the current drug.

We would write H_1 : the new drug is better than the current drug, on average.

All hypothesis testing is with reference to the null hypothesis. This is since the null hypothesis relates to the statement being tested, whereas the alternative hypothesis relates to the statement to be accepted if / when the null is rejected. Once the statistical test has been carried out, the conclusion is always expressed in terms of the null hypothesis. We either 'reject H_0 in favour of H_1 ' or 'do not reject H_0 '; we never conclude 'reject H_1 ', or even 'accept H_1 '. If we conclude 'do not reject H_0 ', this does not necessarily mean that the null hypothesis is true, it only suggests that there is not sufficient evidence against H_0 in favour of H_1 ; rejecting the null hypothesis then, suggests that the alternative hypothesis may be true.

Functions of a hypothesis

A hypothesis serves the following functions:

- The formulation of a hypothesis provides a study with focus. It tells you what specific aspects of a research problem to investigate.
- A hypothesis tells you what data to collect and what not to collect, thereby providing focus to the study.
- As it provides a focus, the construction of a hypothesis enhances objectivity in a study.
- A hypothesis may enable you to add to the formulation of the theory. It enables you to conclude specifically what is true or what is false.

Formulation of Hypothesis:

Hypothesis formulation should be done with utmost care and objectivity. The following attributes are to be considered while framing a hypothesis:

A hypothesis should be simple, specific and conceptually clear

Ambiguity makes hypothesis testing almost impossible. All hypotheses should be uni-dimensional — testing only one relationship or assumption at a time. This is only possible if there has been in-depth study of the concerned area through literature review or pilot studies. An example of a good hypothesis is:

The average weight of the male students in this class is more than the average weight of the female students.

The following hypothesis would be difficult to test.

Suicide rates vary inversely with social cohesion.

Social cohesion as a phenomenon would be difficult to measure as there would be no clear direction as to how to measure social cohesion.

A hypothesis should be capable of verification

A hypothesis can only be tested if there are methods and tools available to test it. There is no point in framing a hypothesis for which tools and techniques are not available for testing.

A hypothesis should be related to the existing body of knowledge

The hypothesis should emerge from an existing body of knowledge and must aim to add to it.

A hypothesis should be operationalisable

It should be expressed in measurable terms. If it can't be measured, it can't be tested, and if it can't be tested, it cannot be used for drawing conclusions. Thus, a hypothesis always uses operational definitions of the constructs and variables.

A badly expressed hypothesis is:

The average salary of the managers is moderately high.

The salary has to be expressed in operational terms. For e.g.

The average salary of the managers is in the income bracket of Rs. 50,000 to Rs. 75,000 per month.

Exercise 3: Formulate two or three hypotheses that relate to your own areas of interest and consider the factors that might affect their validity.

Quiz:

1. Why is it important for research staff to maintain the integrity of the research protocol? (Ans.: 3)
2. To provide a better work environment for the research team
3. To make the study look more professional
4. To ensure the study is conducted correctly
5. To guarantee publication of the study results.

Scenario: You are a Health Educator in a nutrition study that examined the effects of exercise and a low-salt diet on high blood pressure risk reduction. You are responsible for translating the study results and sharing them with local community organizations that may benefit from learning about the study results. The study had significant findings for exercise, but not the low-salt diet. The low-salt diet did not have the expected effect on high blood pressure. However, you really believe in the low-salt diet program and participants in the study really liked the low-salt recipes.

What should you do?

Select the best answer. (Ans. 2)

1. Report only the positive effect of exercise because that is all that was found.
2. Report the positive effect of exercise, but also explain that no effect was found for a low-salt diet.

3. Report the positive effect of exercise, but also explain the importance of a low-salt diet even though no effect was found for a low-salt diet.
4. Contact the program manager or PI to explain your worry and ask how it is best for you to proceed.
2. Which of the following statement (s) is/are not correct? (Ans. 2 and 4)
 1. Do not reject H_0
 2. Reject H_1
 3. Reject H_0 in favour of H_1
 4. Accept H_1

Detailed Answers:

Q.1: How is pure research different from applied research? Why does business research fall under applied research?

Q.2: Many children who live in the Bronx, a borough of New York City, are developing asthma. In a descriptive study investigating this problem, parents whose children have asthma are asked about whether they smoke around their child, whether they live near a freeway, whether their child regularly sees a healthcare provider, their family income level and also if there is a history in their family of asthma. Prior research has shown that these factors may have an influence on the development of asthma in children.

- 1) What are the variables that are under investigation in this study?
- 2) If you were the researcher, what other variables would you study to see if it may contribute to developing asthma? Why?

CHECK YOUR PROGRESS

1. Types of variables
2. Exploratory research
3. Elements of a research problem

Answer in Brief:

1. How will you ensure that a hypothesis is operationally valid? Give examples.
2. What is a scientific method? Why is it necessary for research to be scientific?
3. Define research. Identify the main goals of the research.

State the differences between the following:

- 1) Search and research
- 2) Pure and applied research
- 3) Active and attribute variable
- 4) Intervening and moderating variable
- 5) Independent and dependent variable
- 6) Concept and construct.

2.1 Introduction**2.2 Research Design****2.3 Types of Research Design****2.4 Methodologies and Types of Exploratory Research**

- **Check Your Progress**

2.1 INTRODUCTION

In the preceding chapter, we learned about the research problem statement. A research problem statement determines and establishes the “what” in research: What is to be done? It provides clarity, objectivity and ambiguity on what would be studied, the key concepts and variables; and communicates the study’s importance, benefits and expected results. However, it does not tell anything about “how” all this is to be done. How will the study fulfil research objects and find answers to research questions? This crucial question is unanswered at this stage of the researcher’s journey and he is looking for directions, for a roadmap to proceed further. This is where research design comes to his rescue.

2.2 RESEARCH DESIGN

Each research problem is different from another one. Differences emerge due to the scope and boundaries of the study, the contextual framework, the variables and constructs adopted, or the end results expected. Researchers undertake a thorough consideration of the research problem and research objectives, and then decide upon a master plan which specifies the methods and procedures for collecting and analysing the required information. This master plan is termed Research Design. It is a conceptual structure within which research is conducted. It is a general plan about what the researcher will do to answer the research question. Zikmund defined research design as “a master plan specifying the methods and procedures for collecting and analyzing the needed information”.

According to Green and Tull, “It is the specification of techniques and processes for obtaining the information required. It is the over-all operational pattern or framework of the project which states what data is

to be gathered from which source by what processes.’’

The research design should be able to provide answers of the following research queries:

1. What is the study about and, what type of data is required?
2. What is the purpose of the study?
3. What are the sources of needed data?
4. What should be the place or area of the study?
5. What time, approximately, is required for the study?
6. What should be the number of materials or the number of cases for the study?
7. What type of sampling should be used?
8. What method of data collection would be appropriate?
9. How will data be analysed?
10. What should be the approximate expenditure?
11. What should be the specific nature of the study?

2.3 TYPES OF RESEARCH DESIGN

Research design can be divided into two groups: exploratory and conclusive. To understand the differences between both kinds of research designs, the following table distinguishes them on various components.

<i>Research Component</i>	<i>Exploratory research</i>	<i>Conclusive research</i>
Purpose of research	General: to generate insights about a situation	Specific: to verify insights and aid in selecting a course of action
Data requirements	Vague	Clear and specific
Data sources	Ill-defined	Well defined
Data collection Instrument	Open-ended	Usually structured
Sample	Relatively small; subjectively selected to maximize generalization of insights	Relatively large; objectively selected to permit generalization of findings
Data collection	Flexible	Rigid
Data analysis	Informal, typically qualitative	Formal, typically quantitative
Inferences and Recommendations	More tentative than final	More final than tentative
Generalizable?	No	yes

Source: Pride and Ferrell (2007)

It has been stated that “an exploratory study may not have as rigorous a methodology as is used in conclusive studies, and sample sizes may be smaller. But it helps to do the exploratory study as methodically as possible; if it is going to be used for major decisions about the way we are going to conduct our next study¹”.

Exploratory research design simply explores the research questions, leaving room for further research, whereas conclusive research design is aimed to provide final findings for the research.

Conclusive Research is again divided into two groups: descriptive and causal. Descriptive research describes specific elements, causes or phenomena in the research area. Descriptive research stretches up to the point of revealing correlations between variables or constructs. It does not venture into the „why“ of the relationship. Causal research extends itself into the realm of establishing cause-and-effect relationships between variables. We shall now investigate all these research designs in detail.

Exploratory Research

An exploratory design is conducted about a research problem when there are few or no earlier studies to refer to or rely upon to predict an outcome. The focus is on gaining insights and familiarity for later investigation or undertaken when research problems are in the preliminary stage of the investigation. Exploratory designs are often used to establish an understanding of how best to proceed in studying an issue or what methodology would effectively apply to gathering information about the issue. It is not, however, necessarily meant to be used to validate or provide final conclusions.

Exploratory research is conducted on problems that have not been investigated clearly and there is not much information available on it. The purpose of conducting exploratory research is to develop more understanding of the problem and there is no surety that the research will provide any conclusive outcomes.

Exploratory research, as the name implies, intends merely to explore the research questions and does not intend to offer final and conclusive solutions to existing problems. This type of research is usually conducted to study a problem that has not been clearly defined yet.

E.g. the owner of an ice cream parlour feels that if he introduced more flavours of ice-creams in his ice cream parlour it would enable him to get a greater number of customers. To find out, he carries out exploratory research to determine whether expanding the range of flavours of ice-creams, it will get more customers.

Some more examples of exploratory research are:

- Assess the competitive landscape by better understanding how your brand or product fits within the competitive landscape and identify whitespace opportunities.
- Uncover your consumers' habits, practices, and tendencies using a product or category to identify unmet needs and optimize positioning and messaging.
- Create user profiles by gaining a deeper understanding of your consumer audience; identify the key differences between them and the rest of the population; dive into your audience's demographics, attitudes, and behaviours.
- Role of Human resource management in the process of change
- Study of Human Resource Management Practices and Business Strategy in Multi-Unit Restaurant Firms
- Study of Financial Management Practices Among Indian Households
- Study on Working Capital Management Practices of MSMEs in Gujarat
- Study on the growth and existing status of Fintech companies in India

The goals of exploratory research are:

- Familiarity with basic details, settings, and concerns.
- Generation of new ideas and assumptions.
- Development of tentative theories or hypotheses.
- Determination about whether a study is feasible in the future.
- More systematic investigation and formulation of new research questions.
- Direction for future research and development of techniques

Characteristics of Exploratory Research:

- Inexpensive, interactive, unrestricted, and open-ended in nature.
- An unstructured type of research.
- No pre-research is conducted to support exploratory research
- No prior information available on the problem from past research.
- Time-consuming, might sometimes lead to disappointments.
- No standard format to carry out exploratory research.
- It is flexible, scattered, and broad in nature.
- Qualitative data as an outcome of the research.

2.4 METHODOLOGIES AND TYPES OF EXPLORATORY RESEARCH

There are two methods such as primary and secondary to conduct exploratory research. There are various methods under these categories to conduct exploratory research. The data collected by conducting this

research can be qualitative or quantitative. The next chapter explains in detail the primary and secondary data collection techniques and sources. A brief description of the techniques used in exploratory research is explained herewith.

Primary Research Method

Primary research is where the researcher directly gathers data from the subject first-hand. The information can be collected from a group or an individual. A researcher can either use a third party to conduct research for him or he can himself conduct the research. The purpose of conducting this research is to collect information about the problem which requires in-depth analysis. The techniques of undertaking primary research are as under Interviews.

You can collect in-depth information on the subject using the in-person interview technique. This technique generates qualitative data. Interviews with experts in the subject area of the study can help you to gather a lot of useful data.

Usually, open-ended questions are asked in interviews and interviews can be conducted in-person as well as on the telephone. For example, you interview a loyal customer of your company to know about their experience with your company.

Surveys/Polls

This method is used to collect data from a predefined group of participants. Data collected from this method is quantitative in nature. A variety of polls and surveys can be conducted to explore trends, and opinions of people. Surveys can be conducted both online as well as offline. With the advancement of technology, it has become easy to conduct a survey.

You can use an audience worldwide to respond to your survey. In this way, you can get opinions of a diverse audience. In addition to this, you can collect data in real time. Response rate can be increased by providing rewards to respondents. For example, a survey can be conducted about the price range of mobile phones that most people usually buy within.

Observational method

In this type of exploratory research, the researcher does not make direct contact with the subject. There are two types of observational study.

- The subject is aware that he is being observed.
- The Subject has no idea about the research.

The chances of getting better data are higher in the second method. However, it can be difficult to conduct. The observation method can

provide both types of data qualitative or quantitative. For example, an ice cream company wants to know which size of ice cream people usually prefer when they buy ice-cream.

Focus Group

This method is very frequently used by a researcher to find out the answers to their questions. For this technique, a group of people is chosen, and they are asked to express their views on the subject of the study.

However, you should make sure the people that you are choosing for the discussions have the same background and are representative of the target sample respondents. For example, a focus group can help you to get insights on what people usually think about before buying mobile phones.

Secondary Research method

Secondary research uses existing resources on the subject under study. To conduct this research, you collect information from resources like newspapers, books, articles, magazines, and case studies etc.

Literature Research

This research technique is the most inexpensive way to conduct exploratory research. You can make use of the abundance of information available in libraries, online sources (such as discussion forums, websites, and blogs), and Government and commercial databases.

You can get information from resources like newspapers, articles, documents from the government, published statistics, annual reports, specific topic-related articles etc. However, you can't rely on information gathered from all types of resources blindly.

Documents from government agencies can be valid but they can cost you some amount of money. You can also get useful data from educational institutes.

Online Research

This type of research is the fastest and easiest way to collect data. You can conduct this research in the comfort of your home or office on your laptop or mobile phone. There is an abundance of data available online. A user can download it and use it whenever he wants to.

However, one should check the authenticity and genuineness of the online sources before using their information in your study. For example, you can easily find out the leading features preferred by people while buying a camera. You can simply enter a query in a search engine and can get thousands of links to websites which provide similar information.

Case Study Research

By using this research, a researcher can find out information on the

problem by studying the existing cases that have gone through a similar problem as yours.

This is a very useful method in business research. It is important for a researcher to analyze all variables of the existing case to check whether they can be used in his study. This method is also preferred by health organizations and social science sectors to conduct research. For example.

doctors refer to the cases performed by successful doctors to improve their own practice.

How does exploratory research differ from quantitative research?

In research, the terms exploratory research and qualitative research are typically used interchangeably. In contrast, business researchers use the term quantitative research to refer to descriptive research as well as conclusive research. Descriptive research typically consists of a survey, cross-sectional or longitudinal, aimed at describing specific aspects of consumer perceptions, attitudes, and behaviours. Conclusive research usually consists of causal studies designed as an experiment to establish cause-and-effect relationships.

Exploratory Research Example on Product Research

Organizations conduct two major types of research when working on a new product or service. The first one is conducted before developing the product while the second one is conducted after product development.

Our focus will be on the exploratory research conducted after product development. For tech products, it is called the beta testing stage of product development.

If a new feature is added to an existing app, for example, product researchers will want to investigate whether the feature will be well received among the users. If the feature added to the app is something that is already in existence, then the research is not exploratory.

For example, if telegram adds a status feature to its app, the beta research stage of the app is not exploratory. This is because this feature is something that is already in existence, and they can easily get enough information from WhatsApp.

However, if it is a new feature like the Snapchat filters when they just came out, the research is explanatory. In this case, exploratory research is carried out using a focus group of beta testers.

- A business school in the Midwest wants to conduct a survey to ascertain the demand for healthcare management programs. To design the various program profiles, a series of focus groups and in-depth interviews were undertaken with physicians, hospital administrators, residents, and nurses

Conclusive Research

Conclusive research is undertaken to generate findings that are practically useful in reaching conclusions or making decisions. The research objectives and data requirements are clearly defined. It usually involves the use of quantitative methods of data collection and analysis. The findings of such studies usually have specific uses. The conclusive studies tend to be deductive in nature and the research objectives are achieved via the testing of hypotheses.

“Conclusive research is more likely to use statistical tests, advanced analytical techniques, and larger sample sizes, compared with exploratory studies. Conclusive research is more likely to use quantitative, rather than qualitative techniques.³”

The purpose of conclusive research is to provide a reliable or representative picture of the population through the use of a valid research instrument. In the case of formal research, it will also test the hypothesis. Conclusive research can be sub-divided into two major categories :

- Descriptive or statistical research, and
- Causal research

Descriptive Research

Descriptive research is a type of research that describes a population, situation, or phenomenon that is being studied. It provides data about the population or universe being studied. It focuses on answering the how, what, when, and where questions of a research problem, but does not focus on the why.

This is mainly because it is important to have a proper understanding of what a research problem is about before investigating why it exists in the first place.

For example, an investor considering an investment in the ever-changing Ahmedabad housing market needs to understand what the current state of the market is, how it changes (increasing or decreasing), and when it changes (time of the year) before asking for the why. This is where descriptive research comes in.

Descriptive research explains the state of affairs as they are at present, with the researcher having no control over the variables. Descriptive research is a suitable choice if you want to learn about the trends of a particular field or the frequency of an event. This research is also an appropriate option when you do not have any information about the research problem, and primary information gathering is required to

establish a hypothesis.

Descriptive research can be either quantitative or qualitative. It can involve collections of quantitative information that can be tabulated along a continuum in numerical forms, such as scores on a test or the number of times a person chooses to use certain features of a multimedia program, or it can describe categories of information such as gender or patterns of interaction when using technology in a group situation.

A descriptive research design can use a wide variety of research methods to investigate one or more variables. Unlike in experimental research, the researcher does not control or manipulate any of the variables, but only observes and measures them.

The goals of descriptive research are:

- Describe various aspects of a phenomenon
- Describe characteristics/behaviour of a sample population
- Describe, explain and validate research findings
- Identify the variables of interest for further quantitative analysis
- Deduce from the observations for generalization

Characteristics of descriptive research:

- The “what” is answered in statistical form and can be used for decisionmaking.
- Being statistical in nature, the results can also be used as secondary data for similar research problems.
- It is not in the hands of researchers to control the variables of descriptive research.
- It is usually conducted in natural settings.
- Different aspects of a single group are studied and compared to gain a different insight into the group.

Descriptive research methods

Descriptive research is usually defined as a type of quantitative research, though qualitative research can also be used for descriptive purposes. The research design should be carefully developed to ensure that the results are valid and reliable. There are three methods to conduct descriptive research: observation, surveys and case studies.

Observations

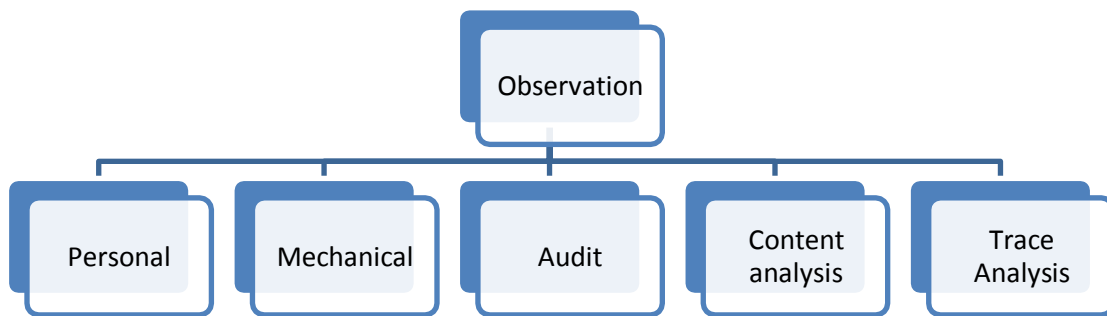
Observations allow you to gather data on behaviours and phenomena without having to rely on the honesty and accuracy of respondents. This method is often used by psychological, social and market researchers to understand how people act in real-life situations. Researchers use both qualitative and quantitative observations in their study.

A quantitative observation is the objective collection of data, which comprises of numbers and values. The results of such observations are derived through statistical and numerical analysis methods. The observation of any entity associated with a numeric value such as age, shape, weight, volume, scale, etc. can be carried out.

Qualitative observation doesn't involve measurements or numbers but instead just monitoring characteristics. In this case, the researcher observes the respondents from a distance. Since the respondents are in a comfortable environment, the characteristics observed are natural and effective.

Observation of physical entities and phenomena is also an important part of research in the natural sciences. Before you can develop testable hypotheses, models or theories, it is necessary to observe and systematically describe the subject under investigation.

Observations include five different methods:



❖ Observation Methods

- Personal Observation
- Observe actual behavior
- No attempt to control or manipulate the phenomenon
- Merely record occurrences
- Helpful for store designs, layouts, shelf space allocations, etc.

❖ Observation Methods

- Mechanical Observation
- Audimeters, people meters
- On-site cameras
- ❖ With respondent participation
- Eye-tracking monitors
- Pupilometers
- Psycho galvanometers



- Voice pitch analyzers
- ❖ Audit
 - Consumer audit.....taking inventory of (for e.g.) kitchen
 - Need to obtain permission
 - Cannot be considered conclusive
- ❖ Content Analysis
 - Used to observe communication, rather than objects or actions
 - Objective, systematic and quantitative description of the content of a communication
 - Unit of analysis
 - Words (good, excellent, poor,...developing, dirty.)
 - Characters (Donald Trump, Narendra Modi, Sushant Singh Rajput, Virat Kohli)
 - Topics (India shining, women in workforce, youth in politics. COVID Pandemic)
 - Trace Analysis
 - Physical traces or evidence of past behavior
 - Radio station in cars
 - Magazines at the “kabadiwala”
 - Cookies on the net

Surveys

This research method includes gathering answers from respondents through surveys or questionnaires or polls. Survey research allows you to gather large volumes of data that can be analyzed for frequencies, averages and patterns. Common uses of surveys include:

- Describing the demographics of a country or region
- Gauging public opinion on political and social topics
- Evaluating satisfaction with a company’s products or an organization’s services

Case studies

A case study can be used to describe the characteristics of a specific subject (such as a person, group, event or organization). Instead of gathering a large volume of data to identify patterns across time or location, case studies gather detailed data to identify the characteristics of a narrowly defined subject.

Case studies are not used for the purpose of generalization. Case studies are unique as they often focus on unusual or interesting cases that challenge assumptions, add complexity, or reveal something new about a research problem.

Examples of Descriptive Research:

What are the most effective intangible employee motivation tools in the hospitality industry in the 21st century?

What is the impact of the global financial crisis of 2007 — 2009 on the fitness industry in the UK?

What kind of people patronizes our stores compared to our primary competitor?

What product features are the most important to our customers? To describe.

- Characteristics of consumers, markets, etc.
 - A profiling of the urban social networker
- The estimation of % of units exhibiting a certain behavior
 - 30% of youngsters log onto social networks through their cellular phones.
- To determine the perceptions of product characteristics
 - Are high-end cell phones poor on battery life?
- To determine the degree to which variables are associated
 - Is shopping online related to age?
- To make predictions
- What will be the retail sales of Aircel „Pocket Internet“?

Causal Research

When the objective of the research study is to determine which variable might be causing certain behaviour — in other words, whether there is a cause-and-effect relationship between variables, causal research must be undertaken. Causality can be determined by manipulating the independent variable and observing its impact on the dependent variable. Thus, this study should be undertaken only when you have control over variables, unlike descriptive research wherein plain observation of phenomenon would suffice.

The goals of causal research are:

- Test hypotheses about cause-and effect relationships

Characteristics of causal research:

- The research objectives are clearly defined
- It employs a highly structured approach
- Generally, the last stage in hypothesis testing
- Establishes cause and effect relationship between variables

Examples of causal research:

- To assess the impacts of foreign direct investment on the levels of economic growth in India
- To analyse the effects of re-branding initiatives on the levels of

customer loyalty

- To identify the nature of impact of work process re-engineering on the levels of employee motivation
- "Will consumers buy more products in a blue package?"
- Which of two advertising campaigns will be more effective? "

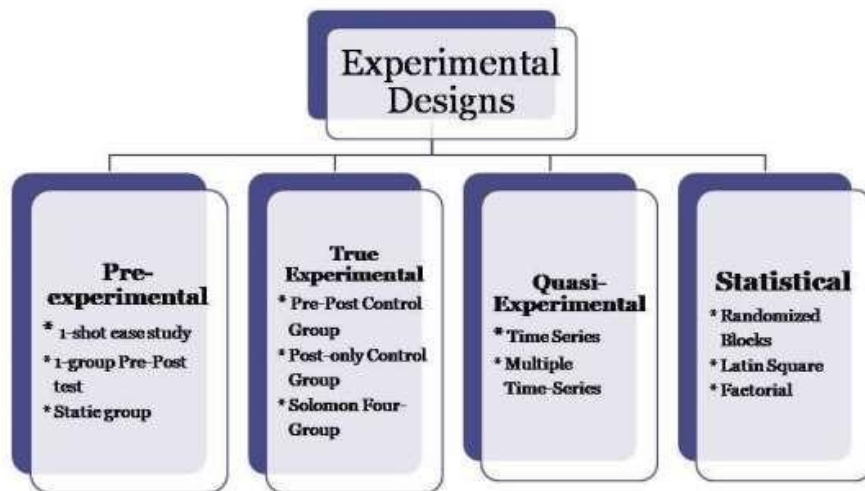
Lead lag relationship between future and spot markets.

Causal research is used to explain the patterns of relationships between variables by focusing on a specific problem. Experiments are the most popular primary data collection methods in causal research design. Experiments or experimental research involves manipulation of an independent variable to assess its impact on dependent variables. The experiments can be laboratory experiments or field experiments.

Experimentation

One way of establishing causality between variables is through the use of experimentation. Here, the researcher exerts tight control on the method and he manipulates a specific variable in order to assess its effect on the other variable(s). The experimental designs are classified as under.

Classification of Experimental Designs



As seen above, there are many kinds of experimental designs. In general, those designs considered to be true experiments contain three key features: independent and dependent variables, pretesting and post-testing, and experimental and control groups. The effect of an intervention (introduction of the independent variable) is tested by comparing two groups: one that is exposed to the intervention (the experimental group, also known as the treatment group) and another that does not receive the intervention (the control group).

A very important characteristic of a true experiment is randomization. Participants in a true experiment need to be randomly assigned to either the control or experimental groups. Random assignment is done using a random number generator or some other random process to assign people into experimental and control groups. Random assignment is important in experimental research because it helps to ensure that the experimental group and control group are comparable and that any differences between the experimental and control groups are due to random chance. A pretest is when the characteristics of the dependent variable are measured BEFORE the intervention, and a posttest is when the dependent variable is measured after the intervention.

Thus, a classic experimental design would be proceeding as follows :



Source: www.pressbooks.com

Pre-experimental designs:

These are the simplest forms of experimental research designs. In here, either a single group or multiple groups are observed after they have been treated with the intervention which is presumed to cause change. Randomization is absent, so there is no control of extraneous variables through randomization.

❖ Types of Pre-Experimental Design

One-shot case study design

One-group pre-test-posttest design Static-group comparison

One-shot case study design (after – only without control group)

$X \quad O_1$ (X is the treatment, O_1 is one group)

A single group of test units is exposed to a treatment X and a single measurement taken. There is no random assignment of test units. It is more appropriate for exploratory than conclusive research.

One-group pre-test-post test design (Before After without control group)

$O_1 \quad X \quad O_2$

A single group is measured twice, and there is no control group. The effect of the treatment = $O_2 - O_1$. There is somewhat more structure, there is a single selected group under observation, with a careful measurement being done before applying the experimental treatment and then measuring after.

Static group

EG: X O₁
 CG: O₂

There are two groups in the study, one experimental and one control. The measurements are taken only after treatment. A group that has experienced some treatment is compared with one that has not. Observed differences between the two groups are assumed to be a result of the treatment.

True experimental designs:

These experimental designs are called true experimental designs, because :

- Clear randomization — random allocation of units to groups, and random selection of groups for treatments.
- ❖ Types of True Experimental Designs
- Pre-test-Post test Control group (Before after with control)
- Post-test-only Control group (After only with control)
- Solomon 4 group
- ❖ *Pre-test-Post test Control group (Before and after with control)*

EG: R O₁ X O₂
 CG: R O₃ O₄

$$\text{Effect of treatment} = (O_2 - O_1) - (O_4 - O_3)$$

This is also called the classic controlled experiment because it:

- Controls the assignment of units to experimental and control groups
- Controls the timing of the treatment and which group receives the treatment
- Controls all other conditions in which the experiment is occurring.

The steps in this experimental design are:

- randomly assign subjects to treatment or control groups.
- administer the pre-test to all subjects in both groups.
- ensure that both groups experience the same conditions except that in addition the experimental group experiences the treatment.
- administer the post-test to all subjects in both groups
- Assess the amount of change on the value of the dependent variable from the pre-test to the post-test for each group separately.

Post test-only Control group (After only with control)

EG: R X O₁
 CG: R O₂

$$\text{Effect of treatment} = (O_1 - O_2)$$

This design is almost the same as classic experimental design, except it does not use a pre-test. There are many situations where a pre-test is impossible because the participants have already been exposed to the treatment, or it would be too expensive or too time-consuming.

Solomon Four Group

EG1: O1 X O2 CG1:
 O3 O4
 EG2: X O5
 CG2: O6

The Solomon four group test is a combination of pre-test-post test two-group design and the posttest only control design. The various combinations of tested and untested groups with treatment and control groups allow the researcher to ensure that extraneous factors have not influenced the results.

In a Solomon four-group design, the participants in the study are randomly assigned to four different conditions: a) intervention with pre-test and post-test, b) pre-test and post-test with no intervention, c) intervention with post-test, d) post-test with no intervention.

The Solomon four-group designs are challenging to implement in the real world because they are time- and resource-intensive. Researchers must recruit enough participants to create four groups and implement interventions in two of them.

Quasi-experimental designs:

A quasi-experimental design is one that looks a bit like an experimental design but lacks the key ingredient — random assignment. The researcher is unable to achieve full manipulation of scheduling or random allocation of treatments to test units but can still do a part of true experimentation. Quasi-experiments aim to demonstrate causality between an intervention and an outcome. It is quicker and less expensive, though it lacks full control. The two prominent types of quasi-experimental designs are

- Time series
- Multiple time series

Time series

It is a series of periodic measurements of the DV. The treatment is then administered/ occurs naturally after which there are periodic treatments to determine the treatment effect

O1 O2 O3 O4 O5 X O6 O7 O8 O9 O10

Multiple Time Series

In addition to the time series design, one control group is added which is not subjected to the treatment.

EG: $O_1 O_2 O_3 O_4 X O_5 O_6 O_7 O_8$

CG: $O_9 O_{10} O_{11} O_{12} O_{13} O_{14} O_{15} O_{16}$

Statistical designs:

These are experiments that allow for statistical control and analysis of external variables. Here, the effects of more than one IV can be measured. The major statistical experimental designs are:

- Randomized Block Design
- Completely Randomized Design
- Latin Square Design
- Factorial Design

A detailed explanation of these designs would be beyond the scope of this syllabus.

CHECK YOUR PROGRESS

1. Explain the steps of conducting exploratory research
2. A nursing home wanted to find out why its front-line staff had a high turnover rate. Explain the method through which this exploratory research can be conducted.
3. “Research design in exploratory studies must be flexible but in descriptive studies, it must minimize bias and maximize reliability.” Discuss.
4. What is research design? Why is it necessary for conducting a study?
5. How do exploratory, descriptive and casual studies differ from each other? Explain with examples.
6. Give your understanding of a good research design. Is a single research design suitable for all research studies? If not, why?
7. Define „experimental research, and discuss its features.
8. Select a research problem and prepare a research design for its study

Distinguish Between:

1. Pure research and Applied research
2. Exploratory and Descriptive studies
3. Pre-experimental and True experimental designs
4. With control and without control experimental groups
5. Consumer audit and Trace analysis

MCQ :

1. Which of the following is a method of causal research? (ans. 1)
 - a) experiment
 - b) cross-sectional studies
 - c) secondary data analysis
 - d) focus groups

2. "If I spend more on advertising, then sales will rise." This statement is an illustration of which of the following concepts? (Ans. 4)
- a) consequential effect
 - b) exploratory research
 - c) descriptive research
 - d) causality
3. Which of the following is not a method typically used to conduct exploratory research? (ans. 3)
- a) secondary data analysis
 - b) experience surveys
 - c) test marketing
 - d) focus groups
 - e) case analysis
4. Amrita plans to conduct a study that involves cosmetics. She wanted to know the preference of cosmetic use among adolescents, young adult, middle adult and the late adult women. The research design of her study would be: (ans. 2)
- a) Exploratory
 - b) Descriptive
 - c) Causal
 - d) Case study
5. What is a research design? (ans. 4)
- a) A way of conducting research that is not grounded in theory
 - b) The choice between using qualitative or quantitative methods
 - c) The style in which you present your research findings, e.g. a graph
 - d) A framework for every stage of the collection and analysis of data

3.1 Introduction**3.2 Data collection Techniques and Data Types****❖ Check Your Progress**

3.1 INTRODUCTION

In the previous chapter, we studied the different research designs, each with its own characteristics, uses and methodologies. Though the designs vary in their approaches towards undertaking a research study, there is one thing common across all of them: Data.

Data is at the heart of the research. Data is a collection of facts, such as numbers, words, measurements, observations or even just descriptions of things. It comprises of facts or figures to be processed; evidence, records, statistics, etc. from which conclusions can be inferred. In the field of statistics, data are individual pieces of factual information recorded and used for the purpose of analysis. It is the raw information from which statistics are created. Statistics are the results of data analysis - its interpretation and presentation. Thus, data is the basic unit in statistical studies.

Data can be defined as the quantitative or qualitative values of a variable. Data is thought to be the lowest unit of information from which other measurements and analysis can be done. Data can be numbers, images, words, figures, facts or ideas. Data in itself cannot be understood and to get information from the data one must interpret it into meaningful information.

Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes. The data collection component of research is common to all fields of study including physical and social sciences, humanities, business, etc. While methods vary by discipline, the emphasis on ensuring accurate and honest collection remains the same.

3.2 DATA COLLECTION TECHNIQUES AND DATA TYPES

The types of data are primarily determined by the nature of data and the techniques through which the data have been collected, and this also collates with the types of data sources.

Based on the nature of data and its form of existence, data can be classified as qualitative and quantitative data.

Qualitative data: It is data which describes qualities or characteristics. They are measures of 'types' and may be represented by a name, symbol, or number code. They explain what type of data, and are usually categorical variables. Data collected about a categorical variable will always be qualitative.

Quantitative data: It is data which can be counted. Quantitative data are data about numeric variables (e.g. how many; how much; or how often). A numerical scale is used to collect quantities of data. Data collected about a numeric variable will always be quantitative.

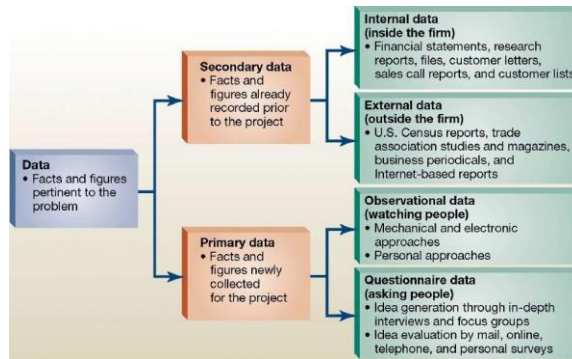
Exercise 1: Make a list of variables (ten each) for which you will collect qualitative data and quantitative data. For e.g., for frequency of shaving — it will be quantitative data.

There are two significant data collection techniques — primary and secondary data collection techniques. The sources through which data is collected through primary data collection techniques are called primary data sources and the data is termed primary data. Similarly, secondary data sources and secondary data are related to secondary data collection techniques.

Primary data:

It is the original data collected specially for a defined purpose. The data has been collected from the data source firsthand, either by a human or a machine. It has yet not been published and is more reliable, timely and authentic. It has not been altered; hence its validity is greater than secondary data.

The sources of primary data are selected specifically to meet the demands or requirements of a particular research study. Prior to choosing a data collection source, things like the aim of the research and target population need to be identified.



Source:

<https://sites.google.com/site/geographyfais/fieldwork/data-collection/types-of-data>

Primary data collection methods:

The two major ways of collecting primary data: either by observing people / situations or by interacting with them and asking. The techniques which can be used to interact with people and gather primary data are interviews, focus groups, surveys, and expert interviews. Observation includes the use of either machines or people to observe and collect data.

Interviews: A method of data collection involving two people or groups of people — one asks the questions (interviewer) and the other replies (interviewee). These interviews are normally held in person, but can also be done on telephones, and increasingly on an internet-enabled platform.



It is highly critical that the responses of the interviewee be captured verbatim (as it is). Thus, interviews should be recorded, although with the permission of the interviewee. At the same time, the interviewer should also take down notes. An audio-visual recording is also useful in observing body language, facial expressions and non-verbal cues. Telephonic interviews should be resorted to when it is not physically possible to conduct a personal interview, when the numbers of questions are not too many, and when the responses to the questions tend to be more or less standardized. If the responses are complex, and

unpredictable, if the responses can only be acquired after detailed probing and leading, and if the quantum of data to be collected is pretty large, personal interviewing is advisable. The data which emerges out of interviews would be words, sentences, expressions, phrases, etc. which fall under the category of qualitative data. These data are largely unstructured.

Advantages

- In-depth information can be obtained
- Higher response rate
- Ambiguities can be clarified, cross-checking can be used to verify authenticity
- Complex aspects such as technical skills, emotions and feelings, and personal experiences can be wonderfully captured
- Non-response and response bias can be detected
- Samples can be controlled

Disadvantages

- Time-consuming and labour-intensive
- Expensive
- Requires an expert interviewer
- Chances of interviewer bias are high
- Difficult to ensure confidentiality
- Geographical limitations
- Respondents may be unwilling to interact with strangers

A variant of personal interviewing is expert interviews. Here, the respondent is an expert in the subject of study. The expertise may be due to experience, expertise or position. For e.g., in order to understand the future of e-vehicles, rather than ask common people, it makes sense to interview the senior / top managers of major automobile manufacturing companies.

Surveys and Questionnaire:

They involve forming a group of questions to which the respondent submits the answer. The questionnaire as a tool is perhaps the most widely used tool for collecting primary data. A pilot study is carried out before finalizing the questionnaire to identify any errors or weaknesses. The survey can be carried out online or offline. Offline surveys can be through personal interaction, through telephone or mail. Online surveys use online survey platforms or a questionnaire sent through the mail to the respondent.

Advantages

- Respondents have adequate time to respond
- Free from interviewer bias
- Economical compared to personal interviewing
- Very effective for large sample size

Disadvantages

- Time consuming
- Inflexible, questionnaire cannot be changed once the survey begins
- High rate of non-response
- Probing is difficult

Focus Group Discussions (FGDs):FGDs vary from interviews in that they involve more participants, and the focus is on discussions and interactions rather than questions and answers. A typical FGD will involve a Focus Group (FG) comprising of 8 — 12 participants who are representatives of the target population of the study. The duration of the discussion is for 90 — 120 minutes. The researcher moderates the session or appoints a trained moderator for the same. The role of the moderator is to channelize the discussion in the right direction by posing the right questions and intervening only when needed. Taking notes during the discussion is a must, but to ensure that nothing is lost in collecting and translation, it is now a practice to record the entire discussion. The recording can then be played multiple times to capture the correct words through a systematic transcription of the entire discussion. FGDs result in the generation of qualitative data and are normally used for exploratory research purposes. FGDs are best suited to gain insights into the domain of study.

There are many variations of the FGD format, some of which are mentioned below:

Two-Way

The first group answers the questions posed by the moderator. The second group which is watching and listening to what the first group thinks and says joins later and is able to facilitate more discussion and potentially draw different conclusions.

Dual-Moderator

Instead of one moderator, the FGD is facilitated by two moderators — the first one ensures the group session progresses smoothly and the second one (mostly the senior of the two) ensures that all the intended questions and topics are discussed adequately. This enhances the productivity of the session.

Dueling-Moderator

A variant of the dual moderator, this involves two moderators with one

playing the devil's advocate, in the sense that both moderators take up an alternative viewpoint from each other. They start taking sides with participants with opposite or differing viewpoints. The purpose of the dueling-moderator focus group is to facilitate new ideas by introducing new ways of thinking and varying viewpoints.

Respondent-Moderator

To avoid unintentional bias, one or more of the participants in the group assumes the role of a moderator for some time. This is done to change the dynamics of the group and generate more varied responses.

Mini Focus Group

It is a focus group which consists of fewer participants – usually four or five. It creates a more intimate environment for discussion, which is essential in discussing sensitive issues.

Online Focus Group

Participants respond and share information through online means like teleconferencing or video-conferencing. Online focus groups are created to reach participants at far and remote locations.

Advantages

- Cost-effective way of obtaining information, as compared to individual interviews
- Participants can listen to the responses of other participants and “feed off each other.”
- More data are gathered, as participants are given the opportunity to rebut each other.
- Compared to a quantitative survey, these groups are able to gather more information about perceptions, attitudes, and experiences.

Disadvantages

- Group dynamics, such as groupthink, may inhibit discussion
- Difficulty in managing groups
- Shy participants or introverts may feel overpowered and intimidated by assertive participants. This can introduce bias and affect the end result.
- Analysis of data may be time-consuming and challenging.
- Group culture may intimidate or fail to energize participants, resulting in poor participation and weak data collection

Exercise 2: Identify a few topics which can be subjected to FGDs.

Conduct at least one FGD with people you know or are associated with.

Identify the complexities of planning and executing an FGD.

Observation:

It is a way of collecting data through observation. In almost all cases, the researcher has to immerse himself in the physical setting where the respondents are; hence it is a participatory form of research. Observation

can be structured or unstructured. In structured observation, data is collected only on specific variables and during specific time schedules. For e.g. one may count the number of cars crossing a particular intersection at a given time of the day for estimating traffic control requirements. Unstructured observation does not have any pre-determined variables. E.g. standing in a supermarket to understand the buying patterns of customers.

The major techniques of observation are:

Naturalistic observation

People's behaviour is observed in their natural settings. It is a type of field research and is carried out in the real surroundings of the people who are being observed. If the researcher ensures that his presence is not felt by the people who are being observed, it is termed as disguised naturalistic observation. This method has ethical concerns as people are being observed without their knowledge or permission; hence it is mandated that their identities kept anonymous. In undisguised naturalistic observation, participants are made aware of the researcher's presence and monitoring of their behaviour. But this has its ill effects as the behaviour of the participants now may no longer be natural.

Participant observation

This is an extension of the naturalistic observation. The researcher goes one step ahead and becomes a participant in the group of situation being studied. To observe how shoppers shop and interact with the staff of the store, the researcher may pose as a shopper and appear to be shopping with other shoppers while constantly observing. Disguised participant observation is when the participants don't know the identity of the researcher, whereas undisguised participant observation is when the researcher reveals his identity and purpose of joining the group to the participants.

Controlled observation

Here, the researcher creates a setting wherein the participants are invited and their behaviours observed. Thus, it is a structured form of observation as the settings are more structured than natural situations. This is resorted to when the researchers are interested in a limited set of the phenomenon to be observed and analyzed.

Advantages

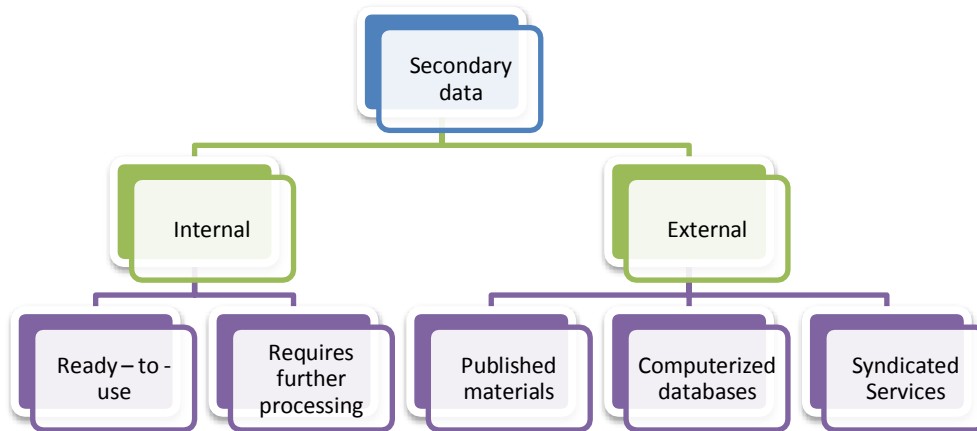
- Direct access to research phenomenon
- High levels of flexibility, the study can be altered in real-time

Disadvantages

- Need thoroughly skilled observers

- Objectivity may be compromised as each observer shall interpret an occurrence differently
- Requires more time
- Presence of the observer may also influence behaviour

Secondary data:



Compiled from various sources

It is data which was collected by someone other than the researcher, for some other purpose, but is being utilized by the researcher for a different purpose.

E.g. Census data collected by the government is used by a marketer to assess market potential in a city. A search for secondary data is also termed desk research. As this data is easily available, it saves precious time and effort in data collection. However, secondary data may not exist for all your research requirements. And even if they do exist, they may be outdated or not relevant to your current research needs. For certain studies, secondary data is best suited, such as historic stock prices or past sales data or employee turnover ratio. In such situations, secondary data is also often more reliable than primary data. The authenticity and reliability of the source play a crucial role in the judgment of using secondary data. E.g. online Q&A sites Quora or Wikipedia cannot be cited as a reliable secondary source as the content is crowd-sourced.

Secondary data collection methods:

Secondary data collection methods can be classified on the basis of where the data exists currently – within the organization or outside of it: Internal and External secondary data collection.

Internal Secondary data collection:

It is logical to use data which is readily available to you or your organization rather than to go and seek it from outside. Every department

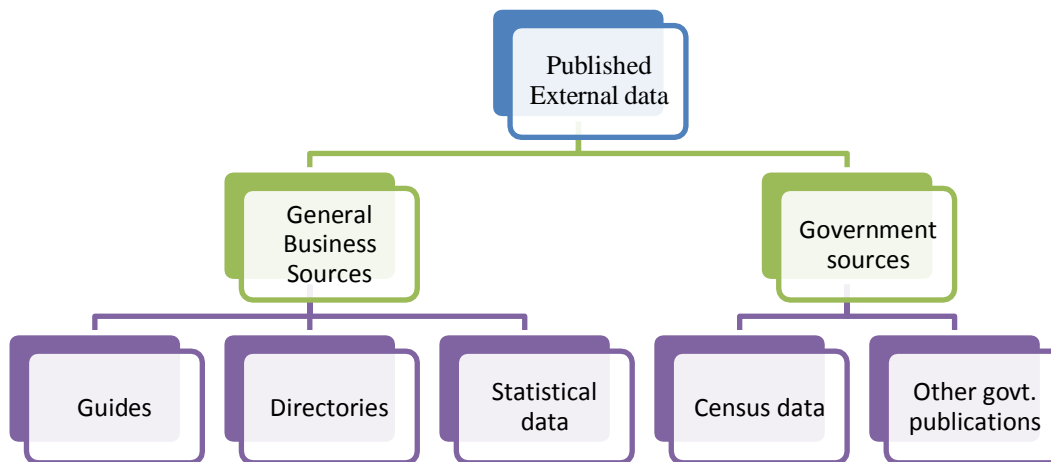
within an organization will have its own records that represent a potential source of valuable data. Internal secondary data is data which exists within the organization, as it has been collected during the normal functioning of the organization. E.g. A study on employee enrichment might want to begin with the educational background of the employees. Rather than collect the information first-hand, it is better to access recruitment and selection records lying in the company, as this data would have been availed of during each employee's selection. Such data would not require any further processing and would be used readily. However, certain internal secondary data might require additional processing. Some sources of internal secondary data are: Financial statements, sales figures, inventory records, previous marketing research studies, and payroll and absenteeism details.

External Secondary data collection

External data collection involves collecting secondary data that are generated by an entity other than the researcher's organization. The techniques include published materials, computerized databases and syndicated services.

Published Materials:

Secondary data is usually gathered from published (printed) sources.



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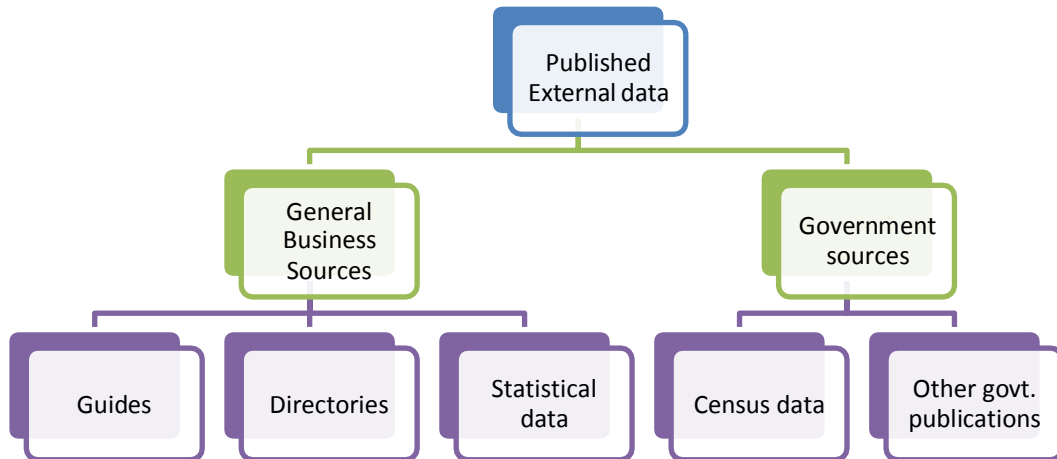
It is logical to use data which is readily available to you or your organization rather than to go and seek it from outside. Every department within an organization will have its own records that represent a potential source of valuable data. Internal secondary data is data which exists within the organization, as it has been collected during the normal functioning of the organization. E.g. A study on employee enrichment might want to begin with the educational background of the employees. Rather than collect the information first-hand, it is better to access recruitment and selection records lying in the company, as this data would have been available during each employee's selection. Such data would not require any further processing and would be used readily. However, certain internal secondary data might require additional processing. Some sources of internal secondary data are: Financial statements, sales figures, inventory records, previous marketing research studies, and payroll and absenteeism details.

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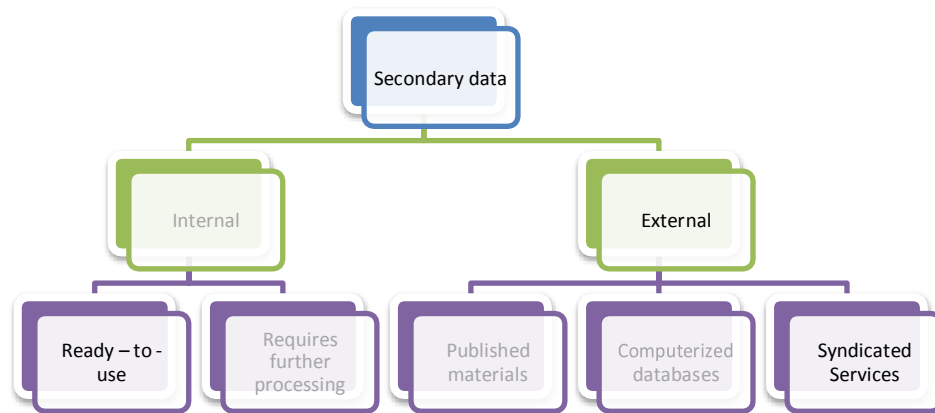
Compiled from various sources

Published data is further classified on the basis of the publisher. At one end, we have the governmental sources which gather, collate and present huge varied data in the public domain. Data from governmental sources can rarely be provided by commercial sources, and the best examples of that are the Census and other trade publications. Commercial sources fall under the category of General Business Sources.

Government statistics is one of the largest sources of secondary data as the government conducts research to develop policies and take decisions. The most comprehensive data collection exercise is the Census Study. Also, there are multiple government and semi-government organizations, institutions and research centers which keep on sharing relevant data in their fields. Government publications related to trade, agriculture, economics, commerce, industrial production and foreign trade are considered the most relevant and authentic source of data across many countries.

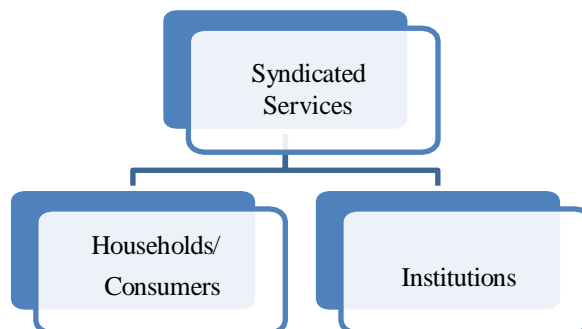
Syndicated Services:

These comprise companies that collect a pool of data. They do not collect data for any specific research problem. Rather, data collection is a continuous business activity for them through which they create a large and varied data reservoir. This data is then sold to a client in the form of personalized reports.



Compiled from various sources

Syndicated research reports should be used during the exploratory research process to gain more information about a market, industry or company at a lesser cost and in the shorter time span. Many companies providing syndicated research reports often provide customization services too.

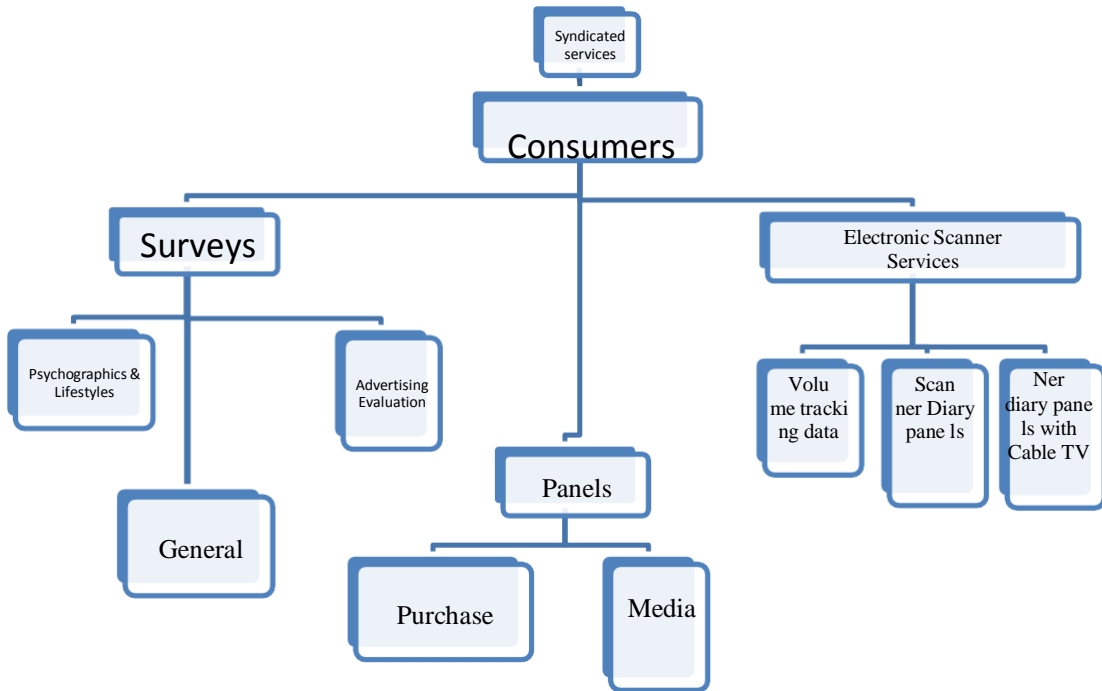


Compiled from various sources

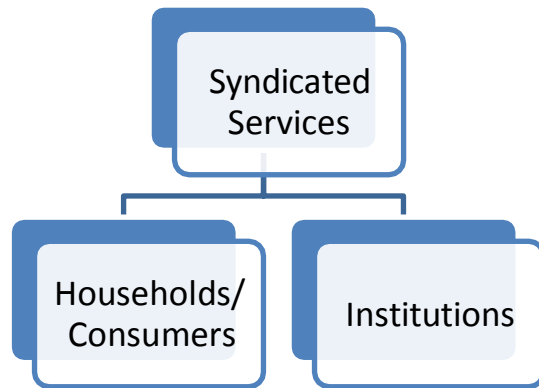
Syndicated services specialize in providing consumers / household data or data of industries, institutes and companies.

Consumer and household data are collected either through surveys or through electronic scanner services.

Some prominent companies offering syndicated services in India are Nielsen Holdings, Kantar Group, Ipsos, Gartner, etc.



Compiled from various sources



The surveys are similar to the ones carried out in primary data collection; however, the purpose is not for any specific study. Electronic scanner services collect data electronically through devices or automatic readers. The surveys collect data from a very large part of the representative population through a pre-designed questionnaire. The primary purpose of the survey is to collect information about consumer psychographics and lifestyle. The Yankelovich monitor is a survey conducted at the same time every year and contacts 2500 respondents, 16 years and above and including 300 college students living on campus. Surveys are also carried out to assess the effectiveness of advertising. Starch readership survey is

a popular syndicated service for assessing aspects related to print media. General surveys on investment behaviour, consumption and purchase behaviour, employment scenarios, etc. Panel data collects data from a panel. A panel is a sample of respondents who provide specified information at regular intervals over an extended period of time (longitudinal research). The panels can be organizations, households or individuals, though household panels are the most popular form of panels. The panel members are compensated for their willingness and participation for a long period of time. Kantar IMRB manages the largest syndicated consumer panel in India with 81,200 sample homes delivering regular and deep insights into consumer behaviour. The paper diaries of yesteryears are now replaced with electronic diaries.

Consumer Panels chiefly focus on two aspects:

- ❖ purchase, shopping and consumption
 - Respondents record their purchases on a variety of different products.
 - E.g. NPD online purchase panel
- ❖ Media
 - These panels collect data through electronic devices which automatically record viewing behaviour.
 - E.g. The Nielsen's People meter technology is perhaps the most widely used and popular media panel.



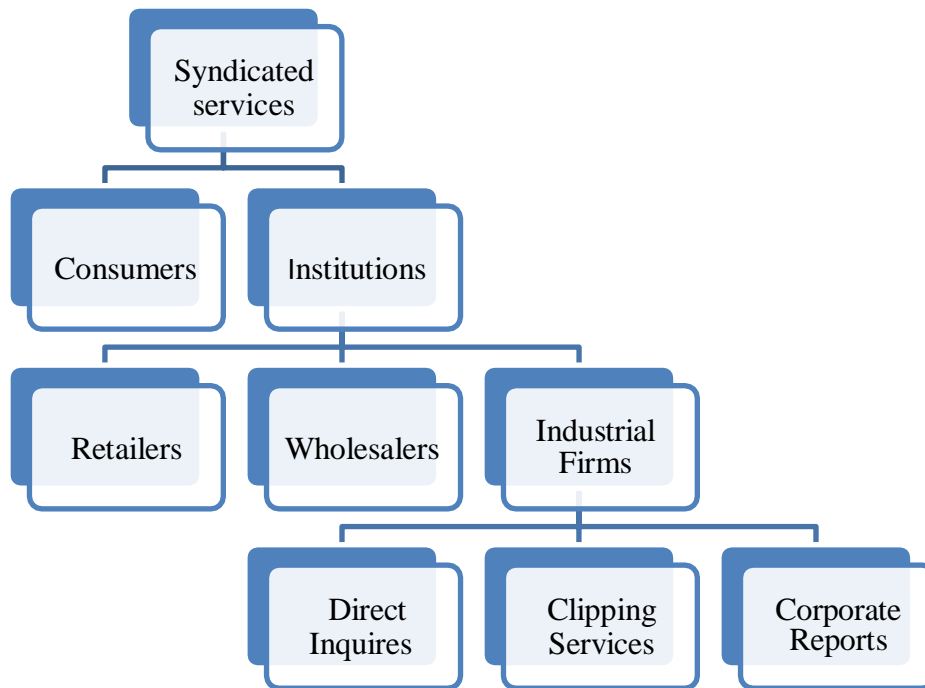
Electronic scanner services are becoming increasingly popular as these deploy technology to collect data without having the need to disturb the consumer.

Electronic Scanner Services are of three types

- ❖ Volume tracking data
 - Information on purchases (brand, size, price, flavor, etc.)
- ❖ Scanner panels

- Each household member is given an ID card to be read by the electronic scanner at the cash register. Scanner panel members are identified by this ID card allowing each member's purchases to be stored against their identity.
- Consumer identity is linked to purchase
- ❖ Scanner panels with Cable TV
- It is a combination of a scanner panel with manipulation of the advertising that is being broadcast by cable TV companies. Different households connected to cable TV are shown different ads, and this is then correlated with their purchase and consumption data.

Syndicated services collecting institutional data are also a vital source of information.



The syndicated services can collect data about retailers and wholesalers. Starting from product-level data and expanding to the market level, syndicated retail data for brick-and-mortar stores measure consumer behaviour based on environment and competition. Syndicated data helps non-retailers such as manufacturers or brokers, to understand the consumer market. Competitors or new-to-market companies also benefit from syndicated store data because the information helps them manage pricing and inventory. Market aggregate data can be collected through wholesalers and retailers. This gives an idea of the overall trend of a product.

Exercise 3: You are the product manager for P&G in charge of laundry detergents. How would you make use of information available from a store audit?

Syndicated secondary data providers also cater to the collection and dissemination of data related to industrial firms. The source of gathering data can be direct inquiries with the firm, extracting and compiling vital information from the corporate reports and clipping services. Clipping services are usually used to obtain content such as print, editorials, and sometimes advertising. Originally, they limited their sources to specifically print media, but as the industries changed, they began to add broadcasting and online content into the mix. A clipping service can tell you who is talking about your business and what they are saying. They also help you can monitor the latest happenings and trends in your industry.

Computerized databases:

This is a type of secondary data that can only be read using a computer and can be obtained either online or offline, i.e. data on storage media such as CDs or floppy disks. Computerized databases can only be shared through electronic data transfer media. There are five common computerized databases: bibliographic databases, numeric databases, full-text databases, directory databases, and special purposed databases.

A bibliographic database is an organized collection of references to published literature in journals, magazines, newspapers, conference proceedings, reports, legal publications, government official documents, books, patents, etc. It can be generic or specific to a particular scope or discipline.

Bibliographic databases only provide a description of an item and not the item itself. For instance, it may mention the author's name, the title of the article, subject, publisher, etc.; but the article won't be available.

Full-text databases provide the full text of the publication. This saves a lot of time and effort of the researcher.

Numeric databases provide numeric information, such as statistics of other numerical figures. Prowess and CapitaMarket in India are examples of numeric databases which focus primarily on empirical data from the financial and corporate business sectors.

Directory databases are like the telephone directory or yellow pages. They provide online/computerized information on individuals and organizations.

Special purpose databases contain information of a highly specific nature, such as an online database of NGOs or cancer hospitals or a list of all brokers.

Summary

Data is the heart and soul of research as the aims of the study can only be fulfilled through analysis and interpretation of relevant data and information. Data can be qualitative or quantitative. Data can be availed through two major techniques: Primary data and Secondary data.

Primary data is data collected first-hand by the researcher. The techniques include observation, focus group discussions, surveys and interviews.

Secondary data is the first recourse of the researcher. Secondary data can either be available from internal sources or has to be sourced from outside the organization. External sources provide data about consumers, markets, industries and other macroeconomic parameters. Commercial sources include syndicated services whose business is data. Government sources are also a major contributor to secondary data.

CHECK YOUR PROGRESS :

1. Which are the classical methods of primary data collection?
2. How will you decide whether to use primary data or secondary data for your study?
3. What are the advantages and disadvantages of secondary data collection?

MCQ :

1. _____ sources means data available in printed form.
(ans. a)
 - a. Published
 - b. Unpublished
 - c. Both (a) and (b)
 - d. None of the above
2. Secondary data has two important advantages over primary data. It is:
(Ans. D)
 - a. capable of compensating for rapid environmental changes and technical improvements.
 - b. always available and complete.
 - c. seldom obsolete and usually fits the dimensions of your problem.
 - d. generally cheaper to gather than primary data and takes less time to find.
3. Most governments in the world have statistical departments but they are unlikely to provide: (Ans. A)
 - a. television programme viewing figures.
 - b. industrial output figures.
 - c. general population census records.
 - d. housing statistics.
 - e. agricultural census results.

Short Notes:

1. Observation
2. Types of FGDs
3. Advantages and disadvantages of surveys

Answer in Brief:

1. Why is quantitative research considered more scientific than qualitative research?
2. Identify prominent published sources for facilitating economic, business and trade data.

State the differences between the following:

1. Primary and secondary data
2. Internal and external sources of data
3. Personal interview and FGD
4. Qualitative and quantitative research

4.1 Introduction**4.2 Definition****4.3 Objectives of a Questionnaire:****4.4 Characteristics of Questionnaires:****4.5 Questionnaire Design Process****❖ Check Your Progress**

4.1 INTRODUCTION

The chapter on primary and secondary data explained the various techniques, methods and tools for collecting data vital for the analysis of the research problem. A very important and widely used tool for data collection is the questionnaire. In this chapter, you shall learn about questionnaire design and its various aspects.

4.2 DEFINITION

A questionnaire is a research data collection instrument which consists of a series of questions to which respondents submit their responses. The response is the information sought by the researcher for the research study and is further processed through qualitative or quantitative techniques to provide vital findings and solutions to the research problem.

Questionnaires can be thought of as written interviews. However, personal interviews are not standardized and can be modified even while interviewing, whereas questionnaires once floated cannot be altered or modified.

Webster's dictionary defines a questionnaire as a set of questions for obtaining statistically useful or personal information from individuals. A questionnaire may or may not be delivered in the form of a survey, but a survey always consists of a questionnaire. It should be clearly understood that a survey is a research method whereas a questionnaire is a research instrument.

Questionnaires are a part of both qualitative and quantitative methods, depending upon the nature of the questions. Questionnaires can also be a

part of exploratory or conclusive research, depending upon the purpose for which the data is collected using the questionnaires. Questionnaires facilitate the collection of both subjective and objective data. Thus, the questionnaire is a very useful and flexible tool in research, especially in social sciences.

4.3 OBJECTIVES OF A QUESTIONNAIRE

- Create questions (for the information needed) that the respondent can and will answer
- Make the respondent involved in the interview
- Minimize the response error (response error will be explained later on)

4.4 CHARACTERISTICS OF QUESTIONNAIRES

The most common characteristics of a questionnaire are:

- Should address a particular topic with a clear objective
- It should be free from bias
- Can collect standardized data from a large set of the population
- Relatively inexpensive, quick and efficient way of collecting large amounts of data
- The researcher's presence at all data collection points is not needed
- Uniformity and standardization of data being collected
- It should strike a balance between brevity and comprehensiveness
- Questionnaires should not compromise the ethicality involved with collecting and analyzing data

Advantages of Questionnaires:

- Inexpensive way of collecting data
- Can generate large amounts of data
- Respondents' anonymity can be maintained
- Usually has an easy-to-understand and easy-to-respond design which makes it easy to understand and respond to
- Easy to quantify and analyze the results
- It is not necessary to establish personal rapport or touch with the respondents to elicit their responses
- Respondents can take their time before responding

Disadvantages of Questionnaires:

- Time-consuming
- Difficult when the respondents are less educated
- Respondents may not give true answers, and may lie
- Difficult to understand and interpret open-ended questions
- Difficult to measure abstracts
- Respondents lack motivation to reply

- Heavy dependency on external help, which increases bias in the study
- Success depends upon the sense of responsibility of the respondent


Types of questions in a questionnaire:

- *Open-ended (unstructured)*

- The respondent is free to respond in his or her own manner
- The responses are noted down verbatim
- These questions can record more data as they don't have a fixed pre-determined set of responses
- It is hard for the researcher to categorize the responses and summarize them
- Results in the generation of qualitative data
- These questions are generally placed towards the end of the questionnaire

- *Close ended (structured)*

- These questions have finite, multiple options as answers
- Respondents are asked to choose either one or more from amongst those options
- Best suited for quantitative research
- Used when the data to be collected can be structured in finite options.

Format	How it looks on a questionnaire	Uses and advantages
Statements with tick box categories	Please tick the box that best matches your answer Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/>	General attitude measurement. Easily understood and quick to complete. Generates data suitable for non-parametric statistical analysis
Rating scales (see Sapsford³ or Oppenheim² for details of different formats)	Please indicate how you feel about our new surgery opening hours by circling the number that best matches your opinion Find them convenient Find them inconvenient 1 2 3 4 5	Quantifies attitudes on 5 or 7 point scale and differentiates between positive and negative. Good for participants who can conceptualise linear scales and numerical values. Generates data suitable for non-parametric statistical analysis
Visual analogue scales	On the line below please draw a cross to indicate how you've reacted to your new medication Reacted badly Reacted well _____X_____	Precise quantification of attitudes. Good for participants who can conceptualise linear scales and have good visual skills. Data must be transformed for statistical analysis
Symbols	The nurse has just given you a lesson in healthy eating. Look at the faces below and circle the one that best shows how you feel about the advice you have been given 	Similar to numerical rating scale and can be analysed using similar tests but easier to complete for children or those with visual or literacy problems
Open ended items	Do you think exercise and health are linked, and if so, how? Please write your response in the box below <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	Allows creative expression but may not suit less forthcoming participants. Must be formally analysed with qualitative methods

Source: www.ncbi.nlm.nih.gov

What are the indicators of a good questionnaire?

Valid

- Ask what it is supposed to ask
 - Review by a content expert during the pilot study
- Reliable
- The same respondent should yield the same answer when asked again
 - There should be the consistency of responses
 - Do a “test-retest” to check consistency
 - Delivers better response rate, as more respondents are likely to fill an

interesting questionnaire than a boring one

- Relevance and logical sequencing of questions is important here Succinct
- Exclude unwanted questions, questions that are beyond the scope of research or questions which do not answer research objectives.
- Do not ask unnecessary questions in the desire to collect as much data as you can, or else response rates will go down.

Errors in the use of the questionnaire:

There are some major causes of errors in using questionnaires and they are non-response errors, specification errors and response errors.

Non-response errors:

It arises from the inability to obtain a useful response to all survey items from the entire sample.

Specification error:

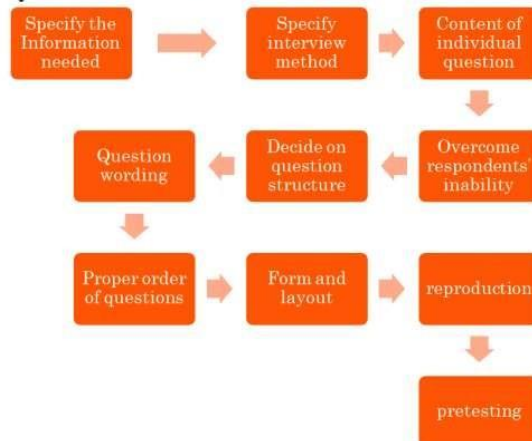
Each questionnaire is prepared to achieve an intended purpose and measure specific aspects to satisfy research objectives. When the questionnaire is measuring something different than what it was intended to measure, specification error arises. Specification errors can occur due to two reasons: a concept which had to be measured gets measured poorly, and a concept which was not supposed to be measured gets measured.

Response error:

These errors represent a lack of accuracy in response to questions. The reasons can be a questionnaire that requires improvements, misinterpretation of questions by interviewers or respondents, and errors in respondents' statements.

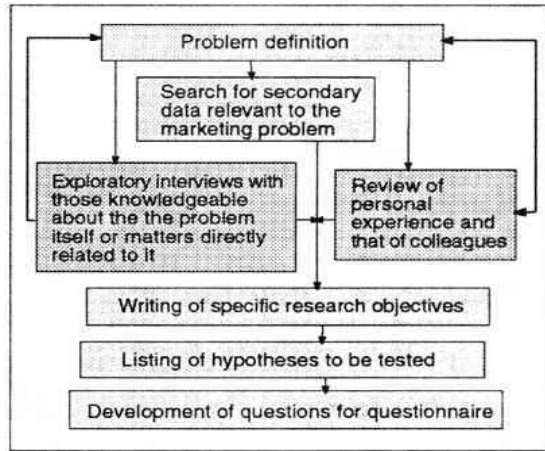
4.5 QUESTIONNAIRE DESIGN PROCESS

QUESTIONNAIRE DESIGN PROCESS



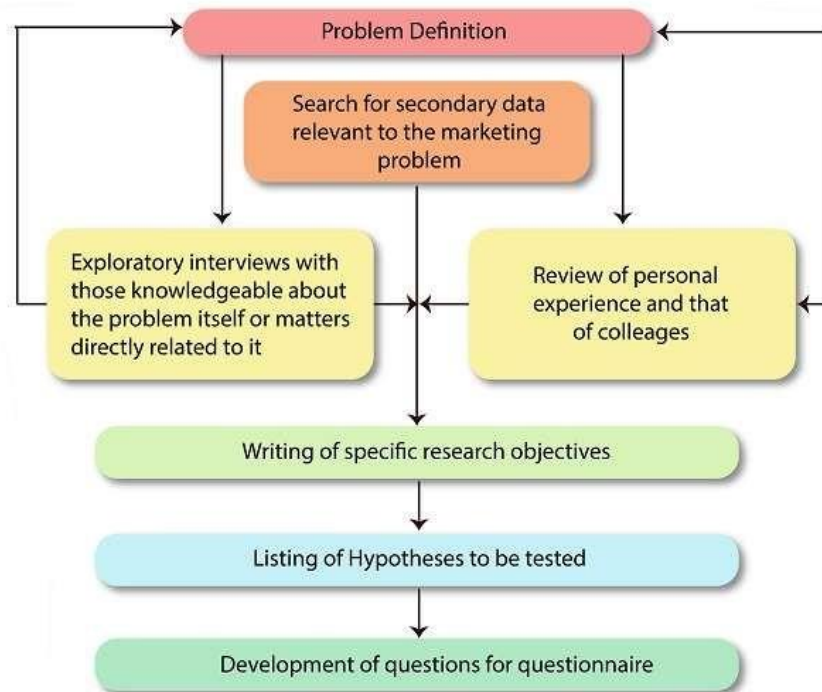
Step 1: Specify the information needed

Do not directly jump to writing down questions while designing the questionnaire. The first step is to make a list of information that you would want to extract from the respondent. The specific information needed from the questionnaire can be generated through the following process:



Source: www.fao.org

Source: www.planningtank.com



It is very crucial to ascertain whether you have planned for all information needed for answering your research questions and testing

your research hypotheses. It is advisable to consult a few target respondents to be clear about all the information you would need, and which is to be extracted through your questionnaire.

Another way to decide on the information which you would need from your questionnaire is to make a conceptual framework. It is similar to a mind map, and it gives you a precise idea of the dimensions on which you need to frame questions.

You should also decide and define in unambiguous terms, which your target respondent is. This is possible through drawing up the sampling frame.

Step 2: Specify the interview method

A reasonable part of the decisions pertaining to questionnaire design are affected by the type of interviewing method. The method of contacting the respondents shall not only influence questions that the researcher will be able to ask, but also the phrasing and wording of the questions. The main methods of reaching out to respondents are:

- Personal interviews
- Group or focus interviews
- Mail questionnaires
- Telephonic questionnaires

The personal interviewing method allows for the most comprehensive but standardized format of design. Such questionnaires would largely be objective and quantitative in nature, and be highly structured. Group and focus interviewing-based questionnaires aim at generating and collecting a lot of subjective and qualitative data in addition to quantitative data. Such questionnaires would be largely unstructured, with there being only a sequence of open-ended questions thus allowing respondents to respond without the constraints of fixed options of responses. Mail questionnaires snail mail or e-mail, are highly structured and aim at capturing only objective data, as the filling up would be done in the absence of the researcher. The obligation to mail back the questionnaire is also missing, thus there is a high rejection rate. Thus, the questionnaire should be simple, succinct and easy to fill. Telephonic interviews entail the smallest questionnaires, as the respondents would rarely be willing to engage in a long question-answer session on the phone.

Step 3: Decide on the content of individual questions

At this stage, the researcher needs to actually start deciding on the set of questions which shall make up his questionnaire. Each researcher at this stage will be faced with the question “What should I include in each individual question?”

Whenever the researcher formulates a question, the first thing he needs to ask is “Is the question necessary?” Remember, each question involves time and cost. Check if the question will yield any information.

However, there are two situations in which a seemingly unwanted question can be asked:

- Opening questions which are neutral and are also easy to answer. This puts the respondent at ease.

- Dummy questions, wherein the purpose of the survey is to be hidden.

You should also take care not to ask double-barreled questions, where two questions are combined into one. For e.g.

Do you think Coca-Cola is a tasty and refreshing soft drink? () Yes () No

Either response yes or „no“ can be for tasty also and refreshing also.

Thus, each individual question should only address one variable or object at a time.

- Do you think Coca-Cola is a tasty soft drink?
- Do you think Coca-Cola is a refreshing soft drink?

Step 4: Overcome respondent’s inability to answer

Sometimes, researchers come across incomplete questionnaires, and upon inquiry come to know that the respondent did not provide responses to one or more questions. This is in most cases an error from the researcher’s end, as perhaps there was a failure to anticipate respondents’ lack of willingness or ability to reply. The researcher needs to address both issues separately: inability to answer and unwillingness to answer. Thus, as a researcher, you should ask yourself the question:

Why is the respondent unable to answer?

The reasons can be:

- He is not informed
- The respondent does not possess information of the topic on hand
- A bigger problem arises when the respondent responds EVEN when he does not know about the topic.
- He cannot remember
- It is unfair to expect respondents to remember trivial aspects of life, especially when they did not know that they would be interviewed about those aspects. For e.g. would you be able to answer the following question:
 - How many minutes did you talk on your cell phone in the last 7 days?
 - How many fruit drinks did you consume in the last one month?
- Thus, it is better to avoid questions where respondents cannot recall the facts. Equally dangerous would be that even if they don’t recall, they would still submit an answer.

- A better way to ask behavioural questions is by asking about the frequency of undertaking the behaviour. For e.g.
- How often do you consume fruit drinks?
- Less than once a week
- 1-3 times a week
- 3-5 times a week
- He cannot describe/ articulate
- Most people find it difficult to articulate and express abstracts like emotions, feelings, etc. For e.g.
- How did you feel when the Lockdown was declared?
- Though they would be able to recall their initial reactions to the lockdown, they would be unable to express it in clear terms. In such a situation, it is advisable to provide options / alternatives / categories of responses. For e.g.
- How did you feel when the Lockdown was declared?
- Angry
- Happy
- Confused
- Nervous
- Indifferent

Why is the respondent unwilling to answer?

Here, the respondent is able to answer, meaning he does possess the information asked of him. However, he is unwilling to respond.

The reasons can be:

- Effort is required
- Asking questions which require an elaborate effort from the respondent would generally discourage them from giving the correct answer or giving an answer at all. For e.g.
- List all the restaurants that you recently visited.
- The above question requires the respondent to recall and mention all the restaurants. He would in most cases not submit beyond only a few names. However, if the same questions is broken down into manageable tasks, for e.g.
- For the following, which restaurants did you visit?
- South Indian –
- Pizzas/Pastas -
- Chinese -
- Mughlai -
- Thai -
- This makes it easier for the respondent to reply for each category of

restaurants.

- Context
- The respondent would be unwilling to answer if he or she feels that the question is not related to the survey.
- Legitimate purpose
- If the respondent feels that there is no legitimate reason to ask for information about certain aspects, then he would be unwilling to respond. If you were to ask a respondent her exact age in a survey related to toilet cleaners, respondents would be wary of answering.
- Sensitive matter
- Respondents normally shy away from replying on sensitive information, such as family matters, relationships, intimacies, religious beliefs, social stigma and taboos.
- One should avoid asking such questions as they shall make the respondent uncomfortable and unwilling to participate in the survey. Thus, the inability and / or unwillingness of respondents leads to both — response and non-response errors. Hence, this is a loophole you should avoid clearly.

Step 5: Decide on question structure

Once the researcher is clear about the effectiveness of the questions in collecting data, he needs to decide on how he should structure each question. As seen above, questions can be structured (close-ended) or unstructured (open-ended).

- Unstructured
- Open-ended questions, respondents free to respond
- Useful in exploratory research
- Interviewer bias is high
- Coding is time-consuming
- Structured
- Response alternatives specified
- Structured questions take the form of scales on which responses are measured.
- Dichotomous questions
- Only two options/ alternative responses
- Yes / No questions
- Should include a DKCS response apart from Y/N
 - Yes / No / Don't Know
 - Yes / No / Can't say
- Multiple Choice
- How likely is it that you may visit Gir Sanctuary this Diwali?

- Most Unlikely
- Somewhat unlikely
- Undecided
- Somewhat likely
- Most Likely
- Use of standardized scales
- Likert, Semantic differential, Staple
These can be item scales or non-itemized scales, rating / ranking scales, cumulative scales, etc

Step 6: Decide on question wording

Once you have decided about the choice of structured / unstructured questions for each piece of information needed, you will need to start forming your questions. Language and its elements play a very vital role here. You should remember that communication is not what you say; it is what the opposite person understands. Certain aspects to be taken care of while selecting words, phrases and sentences for your questions are as under:

- Use ordinary wording
- Do not use jargon
- Do not use words which are beyond the understanding of the respondents
- Do you think the Coca-cola ad will generate supporting arguments? (The meaning of support arguments is only understood by the researcher and not the respondent.)
- Use unambiguous words
- Different people have different meanings for certain words. For e.g.
- How often do you consume ice-creams?
- Very frequently (daily or thrice a week?)
- Rarely (once a month or once a year?)
- Sometimes (only in summer?)
- The words often, frequently, rarely, and sometimes, etc. have different meaning for different people. Such questions should be asked as a frequency, as follows:
- How often do you consume ice-creams?
- Once a week
- Once in a fortnight
- Once in a month
- Once in three months
- Less than once in three months
- Do not ask leading / biased questions
- A leading question puts a response in the minds of the respondent and

leads him towards a specific alternative among the responses of the question.

- Do you support the statement that a true Indian should consider Pakistan an enemy?
- Such a question forces the respondent to respond in a particular manner only. This should not be allowed.
- Do you think BJP will win in the Municipal elections because it has done good development work?
- Such a question leads by giving a reason to choose a specific alternative. Such leads should not be mentioned in the question.
- Avoid implicit alternatives
- An implicit alternative means the answer is already hidden in the question.
- Do you like to have snacks when you are hungry?
- Do you like to have snacks when you are hungry, or would you prefer a whole meal?
- The first question has an implicit alternative. The second question gives respondents a choice.
- Avoid generalizations and estimates
- Avoid asking questions which result in responses which are very rough or generalized estimates. For e.g.
- What is your annual consumption of petrol?
- Anyone would hardly remember how many litres of petrol they have used in a year. They would at best give rough estimates.
- What is your monthly/weekly consumption of petrol?
- The answer can be expected to be much more specific to the above question.
- Be as specific as possible
- If you want meaningful results, ask as specific questions as possible. There are two ways to ask the same thing, and you would agree that the second question is a much better way to determine the correct consumption behaviour.
- Which brand of shampoo do you use?
- Which brand of shampoos have you personally used at home during the last one month? In case of more than one brand, please list all.

Step 7: Decide on proper order of questions

Once you have made the complete set of questions, some open-ended and some close-ended, you need to determine the exact sequence of asking questions. The order of the questions should be as follows:

- Easy difficult

- General particular
- Factual abstract
- The starting question(s) can be
- Simple
- With closed format
- Relevant to the main subject
- Non-offending
- Neither demographic nor personal questions

Do not reserve the most important questions till the end. The most important and relevant questions would form the main portion of your questionnaire. The questionnaire can end with some open-ended questions, followed by questions on demographic information.

Step 8: Decide on the form and layout of the questionnaire

While deciding on the layout of the questionnaire, one vital aspect to be considered is the coding sheet or coding schedule. Questionnaires can and should be pre-coded. This makes it quicker and easier to enter data from the physical form onto statistical software. An example of question coding is mentioned below:

Male	<input type="checkbox"/> 1	Ill	<input type="checkbox"/> 1
Female	<input type="checkbox"/> 2	Not ill	<input type="checkbox"/> 0
Don't know	<input type="checkbox"/> 3	Don't know	<input type="checkbox"/> 9
Single	<input type="checkbox"/> 1	Separated	<input type="checkbox"/> 3
Married	<input type="checkbox"/> 2	Divorced	<input type="checkbox"/> 4
Widowed	<input type="checkbox"/> 5	Don't know	<input type="checkbox"/> 9

Step 9: Reproduction of the final set

You have the entire questionnaire ready. What is needed now is precise formatting and reproduction of the questionnaire to generate multiple copies for the next phase of pre-testing.

The physical appearance of a questionnaire can have a significant effect on both the quantity and quality of data obtained. Higher response rates shall lead to a larger quantity of data which would lend credibility to the study. Poorly designed questionnaires can give an impression of complexity, medium and too big a time commitment. Data quality can also be affected by the physical appearance of the questionnaire with unnecessarily confusing layouts making it more difficult for interviewers or respondents in the case of self-completion questionnaires, to complete this task accurately. Attention to just a few basic details can have a

disproportionately advantageous impact on the data obtained through a questionnaire.

The title of the questionnaire should be highlighted and it should reflect the main objective of the research. If possible, divide the questionnaire into sections according to the content (e.g. boxes with bold headings) and it should flow smoothly from one section to another with appropriate filtering. If your respondents involve older persons, a bigger font size should be used. Finally, a cover letter stating the objective of your study, your affiliations, and, if appropriate, ensuring confidentiality and how you are going to use the information you have collected.

Step 10: Pretesting

The draft questionnaire, though prepared systematically, involves the thinking of a few people, and it needs to be tested independently to identify any errors. This is where pre-testing comes in. A pre-test involves undertaking the survey among a select few people, who are representative of the sample population to be interviewed in the main survey.

The purpose of pre-testing the questionnaire is to determine:

- whether the questions as they are worded will achieve the desired results
- whether the questions have been placed in the best order
- whether the questions are understood by all classes of respondent
- whether additional or specifying questions are needed or whether some questions should be eliminated
- whether the instructions to interviewers are adequate If the pre-testing has been conducted systematically, a very well-defined and appropriate final questionnaire would emerge. It would be ready for final printing and circulation with all the proper sequence of questions and instructions for interviewers.

Summary

A well-designed questionnaire is essential to a successful survey. However, the researcher must develop his/her own intuition with respect to what constitutes 'good design' since there is no theory of questionnaires to guide him/her.

A good questionnaire is one which helps directly achieve the research objectives, provides complete and accurate information; is easy for both interviewers and respondents to complete, is so designed as to make sound analysis and interpretation possible and is brief.

There are at least ten distinct steps in the questionnaire designing process:

decide on the information required and define the target respondents, select the method(s) of reaching the respondents; determine question content; plan for overcoming respondents' inability or unwillingness to respond; decide the question structure; word the questions; sequence the questions; check questionnaire length, form and layout; reproduce the final copy and pre-test the questionnaire and develop the final questionnaire.

CHECK YOUR PROGRESS:

1. Summarize the qualities of a good questionnaire.
2. What are the two occasions when apparently "redundant" questions should be found in a questionnaire?
3. Name the three advantages and disadvantages of questionnaires.
4. What are the reasons why a respondent is unable to answer a question?
5. What are the key characteristics of opening questions in a questionnaire?
6. Explain the questionnaire designing process in detail.
7. Prepare a questionnaire for a given research objective.
8. Create questions using different scales, for measuring different

MCQ :

1. Participants in a pretest should be: (Ans. 1)
 - a. **representative of the target population under study**
 - b. members of the client firm
 - c. individuals from outside of the population under study
 - d. friends and relatives
 - e. other market researchers
2. What do you call the systematic process in which the researcher contemplates various question formats, words the various questions very carefully, and organizes the questionnaire's layout? (ans. 5)
 - a. pretesting
 - b. scale development
 - c. a survey
 - d. measurement
 - e. **questionnaire design**

Short Notes:

1. Open-ended and close-ended questions
2. Types of errors in use of questionnaire
3. Advantages and disadvantages of questionnaires
4. Characteristics and objectives of questionnaires

5.1 Introduction**5.2 Meaning and Example of Sampling****5.3 Objectives of Sampling****5.4 Types of Sampling Methods****5.5 Meaning of Measurement Scaling****5.6 Importance of Measurement Scaling****5.7 Types of Measurement Scaling****5.8 Characteristics of Good Scale (Validity, Reliability and Sensitivity)****❖ Check Your Progress**

5.1 INTRODUCTION

A sample is a very popular concept in the real world. We take a sample of wheat and assess whether the entire wheat is quality or not. We take a sample of tea when to check the taste of it or a sample of respondents from a mall to assess their satisfaction. In the world of research, the sample has a unique importance and the same is reflected in various studies. Before we proceed further with this chapter, we will understand the meaning and examples of several sample-taking exercises.

5.2 MEANING AND EXAMPLE OF SAMPLING

The sample is representative of the population and the method to select a sample is called sampling. A sample is defined as a smaller set of data (Called Population) that a researcher chooses or selects from a larger population by using a pre-defined selection method (Method known as Sampling). These elements are known as sample points, sampling units, or observations.

Selecting a sample is an efficient method of conducting research. The rationale behind the sample would include cost, energy and other reasons. Hence, examining the sample provides insights that the researcher can apply to the entire population.

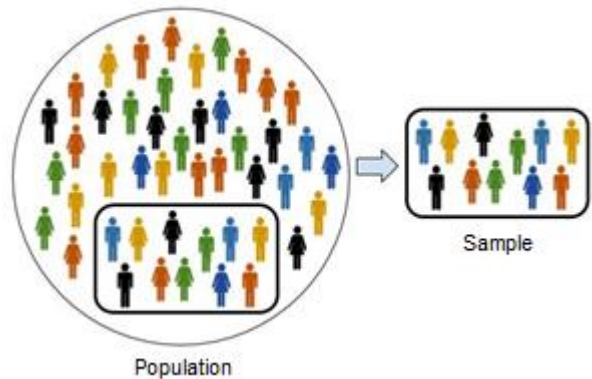


Figure 1 : Schematical Diagram for Population and Sample

The followings are a few examples of samples representing the population.

1. An internet service provider wants to understand the level of satisfaction among their user for the internet connection speed, they would consider 5% of their total users to conduct this study. This 5% of respondents are called the sample.
2. A restaurant owner wants to understand the repeat visit of customers to her restaurant and consider 250 visitors to fill up a form about a repeat visit. These 250 visitors are called samples.
3. A Product facility of mobile manufacturer wants to check at what temperature the battery of the mobile phone blasts. They consider 3 batches randomly out of 150 batches that manufactured mobile phone. These 3 batches are called samples.

5.3 OBJECTIVE OF SAMPLING

It is apparent that the sample always saves the resources for the organisation. Time, energy, cost and money that the company needs to spend while the study population is reasonably higher than the study of a sample.

Typically, a sample is a saver of resources. However, besides a resource saver, the sample serves two more purposes; Destroying the nature of the experiment and the unknown population

1. In several experiments, the sample is subject to destruction and under such a situation, the sample saves the remaining population and the business can use the same for selling. For example, in the example of testing the temperature at which mobile battery blasts, the company needs to check the battery to the temperature level when it blasts and this would not allow the same battery to be used again ever. In such a case, just

imagine if the company have considered the entire population. Surely, it is not possible practically.

2. In several cases, the entire population is not known even. For example, a biologist wants to measure the average length of Crocodiles in this world. Just think of how to assess all the crocodiles in this world.

Therefore, it is clear that the sample is useful to save time, save energy, save money, in case of experiments that destroy samples under study and for the unknown population.

5.4 TYPES OF SAMPLING METHOD

Sampling is a technique of selecting a sample means an individual object or a subset of the population to make a conclusion to estimate the characteristics of the whole population. Various sampling methods are widely used by researchers so that they do not need to research the entire population to collect actionable insights. It is also a time-convenient and cost-effective method.

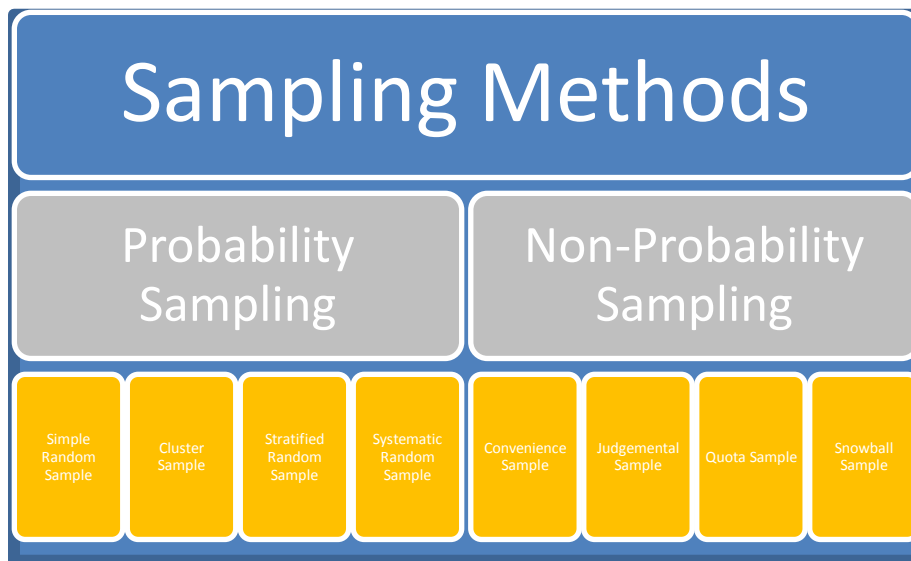


Figure 2 : Sampling Methods

There are mainly two types of sampling techniques

1) Probability Sampling

It is a sampling method that provides equal probability to each element of the population for selection as a sample. Under this method, a researcher sets a selection of a few criteria and chooses members of a population randomly based on those criteria. All the members have an equal opportunity to be a part of the sample with this selection parameter.

This method is considered to be a stronger method of selection of sample compared to non-probability sampling, as it provides equal opportunity to each member of the population for selection. Also, the researcher is able

to get rid of biasness using this method. However, with a view to using this method of sampling, the researcher needs to have a sampling frame. The sampling frame is a complete list of the population (having each and every element included in that list).

There are four types of probability sampling methods; Simple Random Sampling, Cluster Sampling, Systematic Sampling and Stratified Random Sampling. Let us understand each of these in detail.

A) Simple Random Sampling

It is one of the best probability sampling techniques that helps in saving time and resources. Simple random sampling is a reliable method of obtaining information where every single member of a population is chosen randomly, merely by chance. For example, if a researcher wants to select 6 students from a class of 60 MBA students, she can ask the roll numbers randomly and pick up 6 students. Each individual has the same probability of being chosen to be a part of a sample.

B) Cluster Sampling

It is a sampling method for selecting a cluster. A cluster is a group of different/varied characteristic respondents/objects. For example, to select a sample of 6 students from the class of 60 MBA students, the researcher can divide the class into small uniform (homogenous) groups, each group is called a cluster. It means one stratum has one student from BBA, B.Com., B.E. and BCA graduation study. Then the researcher selects a sample from each cluster.

C) Systematic Sampling

It is a technique to select the sample systematically using certain predefined norms or criteria. For Example, to select a sample of 6 students from class of 60 MBA students, the researcher can decide on any one digit out of 0 to 9 (For example 6 is selected) and select roll no. 6 as the first sample. Repeating this exercise for five more times with non-replacement of selected roll no. would bring a sample of 6 students.

D) Stratified Random Sampling

It is a sampling method in which the researcher divides the population into smaller groups that don't overlap but represent the entire population. While sampling, these groups can be organized and then drawn a sample from each group separately. Each group is called stratum. For example, in a study of selecting 6 students from a class of 60 MBA students, the entire class can be divided into 4 strata based on their graduation study (BBA, B.Com., B.E. and BCA). Then any one stratum will be selected as a sample.

1) Non-probability Sampling

It is a sampling method that does not provide equal probability to each element of the population for selection as a sample. Under this method, the researcher chooses members for research at random. This sampling method is not a fixed or predefined selection process. This makes it difficult for all elements of a population to have equal opportunities to be included in a sample.

This method is a relatively weaker method of sample selection as it does not provide equal opportunity to each element of the population. This method does not allow the researcher to be completely free from biases. However, this method does not require the researcher to have a sampling frame/complete list of the population.

There are four types of Non-probability sampling methods; Convenience sampling, Judgemental or purposive sampling, Snowball sampling and Quota sampling. Let us understand each of these in detail.

A) Convenience Sampling

It is the method that is dependent on the ease of access to subjects such as surveying customers at a mall or passers-by on a busy street. Under this method of sampling, the researcher is at the ease in carrying it out and getting in touch with the subjects. Researchers have nearly no authority to select the sample elements, and it's purely done based on proximity and not representativeness. For example, the researcher wants to select 100 respondents who have ever carried shopping from Big Bazar can be selected by standing outside any Big Bazar store and ask questions related to their shopping experience only to those respondents to whom the researcher finds herself comfortable asking.

B) Judgemental or purposive sampling

It is the sampling method to be used by the researcher to select the sample based on their Judgement or purpose of research. Such samples are formed at the discretion of the researcher. Researchers purely consider the purpose of the study, along with the understanding of the target audience. For example, the researcher wants to select 100 respondents who have ever carried shopping from Big Bazar can be selected with a purpose that they must be from age between 20 to 30 years only. This method is best suitable to carry out a study with a selective purpose.

A) Snowball sampling

It is the sampling method to be used by the researcher to select the sample with reference to another sample. Snowball sampling is a sampling method that researchers apply when the subjects/respondents are difficult to trace. For example, a researcher wants to carry out a study

on the socio-economic status of prostitutes in Gujarat. For such a sensitive study, having a sample is a big challenge and therefore the researcher can start with finding one prostitute. Then after, the researcher asks for references from other prostitutes and continues the sampling in this way.

B) Quota sampling

It is the sampling method to be used by the researcher to select the sample based on pre-set standards. In this case, as a sample is formed based on specific attributes, the created sample will have the same qualities found in the total population. It is a rapid method of collecting samples. For example, a researcher wants to take a sample of shoppers of Big Bazar but the quota is pre-set as 80 percent female shoppers and 20 percentage male shoppers. It means in a sample of 100 respondents, 80 would be female shoppers and 20 would be male shoppers.

5.5 MEANING OF MEASUREMENT AND SCALING

Measurement is a technique to assign numbers to object or events according to predefined rules. Measurement is a systematic assignment of numbers to a set of observations or responses to reflect the status of each response in terms of variable properties. In a simple sense, measurement is an exercise to assign a number to qualitative measures (in social science) such as feelings, satisfaction, behaviour, patriotism, service quality, perception etc.

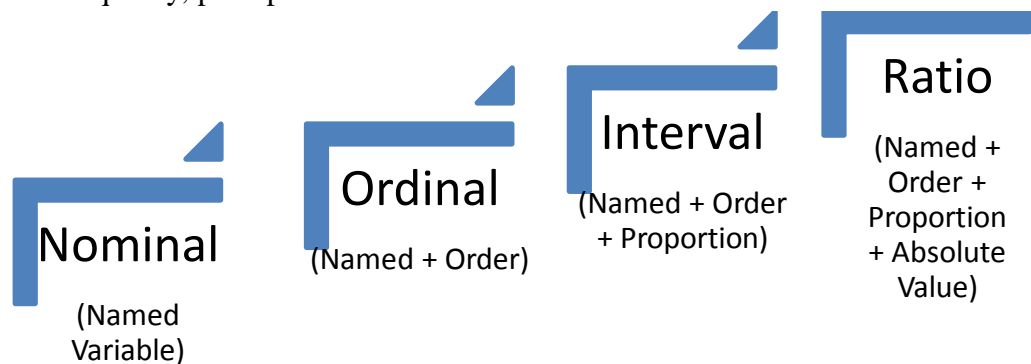


Figure 3 : Measurement Scaling Diagram

There are four measurement scales: Nominal, Ordinal, Interval and Ratio. We shall discuss the basics of each scale here and the detail shall be explained in the case of data analysis unit.

Nominal is a measurement scale that attaches a number, which is just a number for identification, to an object or event. For example, in the MBA admission process, the form number is attached to each student. This

form number is just for identification purposes and does not reveal any specific information helpful for admission.

Ordinal is a measurement scale that arranges the object or event in a sequence. For example, in the MBA admission process, the merit number is an example of the same.

Interval is a measurement scale that both arrange the objects or event and also measure the magnitude difference between them. For example, in the MBA admission process, the marks difference between 1st-rank and 2nd rank students is an example of an interval scale.

The ratio is a measurement scale that has an absolute measurement number attached to an object or event. For example, in the MBA admission process, the marks of each student in the MBA entrance examination are an example of ratio data.

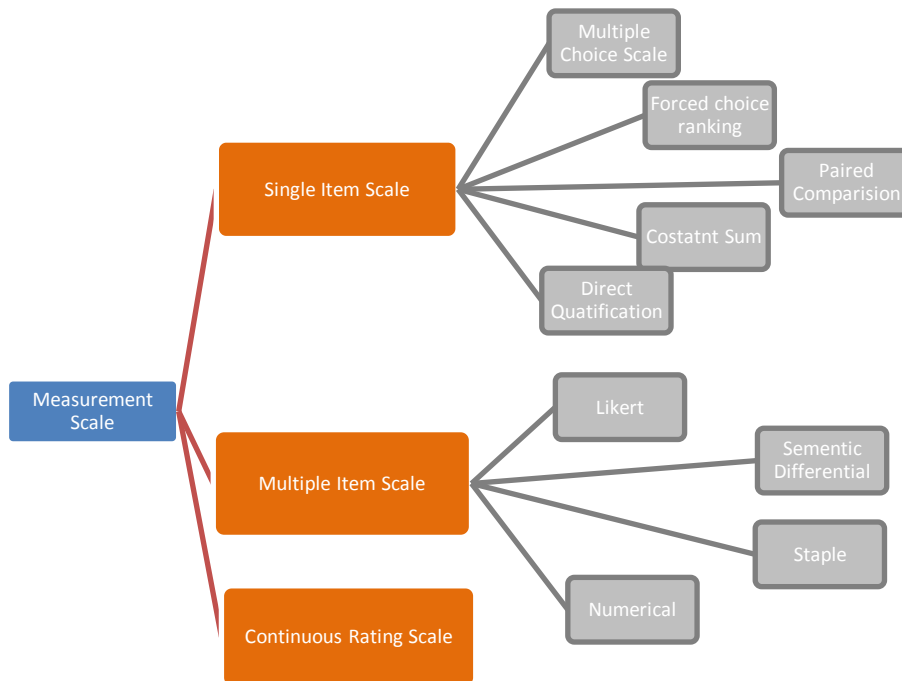
5.6 IMPORTANCE OF MEASUREMENT SCALING

Measurement scaling is an essential component of the research and a basic need for any research. Exact, careful and precious work of measurement leads to concrete results. The usage of a proper measurement scale leads to achieving the research objectives. For example, a researcher wants to understand the impact of age on the usage of technology. If she asks a question related to age in a group data (20 to 40 years), he probably is not able to understand the impact of age on the usage of technology exactly as the age is a range of data rather than exact values.

Additionally, statistical analysis is a part of qualitative research and there are several statistical tests that are applicable to a certain type of data only. Thereby, it is essential to understand the correct measurement scale.

5.7 TYPES OF MEASUREMENT SCALING

In a social science, there are several measurement scales used to measure the social attitude or stimulus changes for social phenomenon. We shall divide the measurement scale as single item scale, multi item scale and continuous rating scale. The further session shall discuss each in details.



Measurement scales can be divided into three types based on the responses to be collected; Single Item scale, Multiple Item scale and Continuous Rating scale. Let us understand the same in detail.

A) **Single Item Scale**

The scale that is designed to measure a single or one characteristic/perspective is called single-item scale. There are several single-item scales described as under:

1) **Multiple Choice Scale**

Under this scale, the respondents are asked to choose any one of the options out of given options.

Example

In which of the following state you reside?

- (A) Gujarat (B) Maharashtra (C) Madhya Pradesh (D) Rajasthan

There is a sub-class of multiple choice scale which is known as a dichotomous scale. Under this scale, the respondents are asked a question with two choices, such as Yes or No

Example

Have you ever visited China?

- (A) Yes (B) No

2) **Forced Choice Ranking**

Under this scale, the respondents are asked to rank the choice (It means the respondents do not have a choice to rank two options with the same rank) and each option must be given a different rank.

Example

From the following brand of soft drinks, mark your choices based on your liking to order them (Mark 1 for a soft drink that you would like to order first and 4 for a soft drink that you would like to order last)

Coca-Cola _____ *Pepsi* _____ *Limca* _____ *Sosyo* _____

3) Paired Comparison

Under this scale, the respondents are asked to compare one option with the other option. If the respondent finds row Item is superior to column item, she will mark it with +ve sign otherwise with -ve sign

Example

Compare the pair of soft drinks on the basis of your liking to order. (If you prefer row soft drink over column soft drink, mark it with +ve otherwise mark it with -ve).

	<i>Coca-cola</i>	<i>Pepsi</i>	<i>Limca</i>	<i>Sosyo</i>
<i>Coca-cola</i>	-----	+	+	+
<i>Pepsi</i>	-----	-----	-	+
<i>Limca</i>	-----	-----	-----	-
<i>Sosyo</i>	-----	-----	-----	-----

If a respondent prefers to order Coca-cola over Pepsi, she will mark +ve sign in a cell comparing Coca-cola with Pepsi (See above table)

4) Constant Sum

Under this scale, respondents are asked to mark each option with scores such that the total score would be 10 (in some cases even 100).

Example

Assign a score to each of the soft-drink given below, based on your liking to order it. The total score should be 10

Coca-cola _____ *Pepsi* _____ *Limca* _____ *Sosyo* _____

A respondent needs to enter some score for each of the options and total of the score should be 10.

5) Direct Quantification

Under this scale, the respondents are asked to mark each option with some score (in case of constant sum, the respondents are required to ensure that the sum of all options should be 10 while in case of Direct quantification, there is no such limit)

Example

Assign a score to each of the soft-drink given below, based on your liking to order it.

Coca-cola _____ *Pepsi* _____ *Limca* _____ *Sosyo* _____

(B) Multiple Item Scale

The scale that is designed to measure the multiple or more than one characteristic/perspective is called the multiple item scale. There are several multiple-item scales described as under:

1) Likert

The Likert scale is a five (or seven) point scale which is used to allow the respondents to express how much they agree or disagree with a particular statement. Likert scale (typically) provides five (or seven) possible answers to a statement or question that allows respondents to indicate their positive-to-negative strength of agreement or strength of feeling regarding the question or statement.

Example

Rate your agreement on the following on a scale of 1 to 5 (Mark 1 if you disagree most and 5 if you agree most)

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
Indian have strong respect for their national anthem					
Indian have respect for their freedom fighter					
Indian have respect for their tricolours (National flag)					
Indian have respect for their constitution					

1) Semantic Differential

Under this scale, the respondents are asked to rate the statements on a series of bipolar adjectives.

Example

Rate your agreement on the following on a scale of 1 to 5 (Mark 1 if you disagree most and 5 if you agree most)

	1	2	3	4	5
Indian have strong respect for their national anthem					
Indian have respect for their freedom fighter					
Indian have respect for their tricolours (National flag)					
Indian have respect for their constitution					

1) Staple

Generally, this scale is presented in a vertical form with a neutral point in the middle of the response and several positive and negative points around it.

Example

Rate the satisfaction and effectiveness of the latest advertisement of “Fevicol”

+4	+4
+3	+3
+2	+2
+1	+1
<i>Satisfied</i>	<i>Effectiveness</i>
-1	-1
-2	-2
-3	-3
-4	-4

4) Numerical

Under this scale, the respondents are asked to mark their choices on several items through a scale provided with equal intervals separated by numbers.

Example

Rate your agreement on the following on a scale of 1 to 5 (Mark 1 if you disagree most and 5 if you agree most)

	<i>Strongly disagree</i> 1	2	3	4	<i>Strongly Agree</i> 5
<i>Indian have respect for their national anthem</i>					
<i>Indian have respect for their freedom fighter</i>					
<i>Indian have respect for their tricolours (National flag)</i>					
<i>Indian have respect for their constitution</i>					
<i>Indian have respect for their national anthem</i>	<i>Most Agree</i> _____ <i>Most Disagree</i> 50 40 30 20 10				
<i>Indian have respect for their freedom fighter</i>	<i>Most Agree</i> _____ <i>Most Disagree</i> 50 40 30 20 10				
<i>Indian have respect for their tricolours (National flag)</i>	<i>Most Agree</i> _____ <i>Most Disagree</i> 50 40 30 20 10				
<i>Indian have respect for their constitution</i>	<i>Most Agree</i> _____ <i>Most Disagree</i> 50 40 30 20 10				

5.8 CHARACTERISTICS OF GOOD SCALE

Any good measurement scale is one that is valid, reliable and sensitive enough to capture the responses. The ultimate goal for any measurement is generalisability of the same and it can be ensured with validity, reliability and sensitivity.

A) **Validity**

Validity is the extent to which a test measures what it is supposed to measure. It is vital for a test to be valid in order for the results to be accurately applied and interpreted. Validity isn't determined by a single statistic, but by a body of research that demonstrates the relationship between the test and the behaviour it is intended to (also including Face Validity), Construct Validity and Criterion Validity. The detailing of these validities is beyond the scope of this unit.

B) **Reliability**

Reliability is the consistency of the measurement or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects. Simply speaking, it is the repeatability of the measurement. For example, if a person/respondent marks the same responses, if measured twice, it is considered to be reliable. It is important to remember that reliability is not measured, it is estimated. A good instrument will produce consistent scores. An instrument's reliability is estimated using a correlation coefficient of one type or another.

C) **Sensitivity**

It is considered as the scale's ability to accurately measure variability in measurement. Generally, sensitivity changes with several parameters such as no. of responses, no. of questions, no. of options, and scale size (5 point scale of 7 point scale).

CHECK YOUR PROGRESS :

Detail / Descriptive Answer

1. Explain probability sampling methods in detail
2. Explain non-probability sampling methods in detail
3. Explain the types single item scale
4. Describe and detail different types of multiple item scale
5. Explain the characteristics of good measurement scale

MCQ

1. Any measurement scale that provides equal chances to each element of the population for selection is known as _____
A. Probability sampling B. Sample C. Population D. Non-probability sampling
2. Which of the following is not non-probability sampling?
A. Convenient Sampling B. Cluster sampling C. Snowball sampling D. Quota sampling
3. Your car registration number is an example of _____
A. Ordinal data B. Nominal data C. Interval data D. Ratio data
4. The following is an example of Ratio data
A. Mobile No. B. Aadhar No. C. Age D. Gender
5. Selecting a sample based on reference from earlier sample is known as _____
A. Convenient Sampling B. Cluster sampling C. Snowball sampling D. Quota sampling
6. Sample selection did not give which of the following benefit
A. Save Money B. Save Time C. Save exergy D. Accurate results

Answer

- (1) A (2) B (3) B (4) C (5) C (6) D

Difference

1. Differentiate between Sample and Population
2. Differentiate between Single Item scale and Multi item scale
3. Differentiate between Probability and Non-probability sampling

MBA
SEMESTER-2
RESEARCH METHODOLOGY
BLOCK: 2

Authors' Name: Dr. Hiren Patel
Dr. Rupal Chaudhary
Dr. Hitesh Parmar

Review (Subject): Prof. (Dr.) Manoj Shah
Dr. Gurumit Singh
Dr. Ravi Vaidya
Dr. Maulik Desai

Review (Language): Dr. Dushyantbhai Nimavat

Editor's Name: Prof. (Dr.) Manoj Shah,
Professor and Director,
School of Commerce and Management,
Dr. Babasaheb Ambedkar Open University, Ahmedabad.

Co-Editor's Name: Dr. Dhaval Pandya
Assistant Professor,
School of Commerce and Management,
Dr. Babasaheb Ambedkar Open University, Ahmedabad.

Publisher's Name: Dr. Ajaysinh Jadeja,
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Gujarat, India.

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- 6.1 Introduction
 - 6.2 Meaning and Example
 - 6.3 Objectives
 - 6.4 Data and its analysis
- ❖ Check Your Progress

6.1 INTRODUCTION

Now you have completed understanding of the Research Design, Data collection tool designing the questionnaire and selecting sample it's time for understanding how to analyse close data. The first question that arises to our mind is about the nature of data and applicable statistical methods to analyse it. The present unit deals with answering questions related to the nature of data and applicable statistical methods.

Before we start with any concept of the chapter, let us understand the variable. In the world of data analysis, any information can take the form of any one of the two (1) Constant and (2) Variable.

Constant: Constant are those whose value does not change from person to person/situation to situation/time to time. For example, the value of Gravitational constant or the size of Earth or the distance between Delhi to Agra. In above all example, the value that one receives does not change with the phenomenon. Many times researcher believes that the values that questions of questionnaire always brings are variable (opposite of constant). It is not really the truth. If you ask to your respondent a question “*From which direction sun will arise tomorrow?*” And you provide the respondent with four options: East, West, South and North. Obviously, all your respondent will reply you only one value (East) and therefore even such question does not bring variable response.

Variables: Variables are opposite to constant and it can different value and changes from person to person or situation to situation. You may try to reconnect to several variables of day-to-day life. To provide with few examples; Age of person you meet today, No. of minutes you talk on each call today or no. of people you meet daily during last 5 days. They all are variables. To elaborate the unit further, the understating of difference was essential.

Variate : Variate means a weightage combination of the variables. It represents the groups of variable.

Univariate: Any research or study that considers only one variable/ariate to describe or represent the phenomenon is called a univariate study.

Bivariate: Any research or study that considers two variables/ariates to describe orrepresent the phenomenon and also to establish a relationship between those two variables is called a bivariate study.

6.2 MEANING AND EXAMPLE

To understand the meaning of Univariate and Bivariate analysis of data, the understanding of the purpose of these studies are important.

Univariate analysis is the simplest form of analyzing data. “Uni” means “one”, so in other words, the data has only one variable. It doesn’t deal with causes or relationships (unlike multivariate) and its major purpose is to describe. These types of analysis are restricted with just summarizes and pattern identification only. For Ex. If a retail store collects data about the bill amount for every bill generated. It is just one variable under the study and the store manager can get descriptive analysis values such as mean, median, mode, and standard deviation or further can get the pattern of the bill amount or can be extended to compare bill amounts of one day with the other.

Here the reader should take a note that the store would not be able to come to know the effect of income (of the buyer) on their bill amount. It means the cause of bill amount is not available with the store.

Bill amount (in Rs.)	150	395	395	964	150	846
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Bivariate analysis is the moderately complex form of analyzing data. “Bi” means “two”, so in other words the data has two variables to study. It does deal with causes or relationships along with description. These types of analysis are not restricted with just summarizes and pattern identification but extend its utility to establish relationship between two variables. For Ex. If a retail store collects the data about the bill amount for every bill generated and the monthly family income of each buyer. Under this study, the store collects two data, and the store manager can get not only descriptive analysis values such as mean, median, mode,

standard deviation or further can get the pattern of the bill amount but also understand the impact of monthly family income on the bill amount generated.

Bill amount (in Rs.)	150	395	395	964	150	846
Monthly family income (in Rs. thousand)	20	28	55	76	20	55

Here the reader should take a note that the store would now be able to come to know the effect of income (of the buyer) on their bill amount. It means the cause of bill amount is available with the store. However, there is one more problem with this data analysis method. Does it mean that only monthly family income affects the bill amount generated? The practical answer is no. There may be some other variables that affects the bill amount generated. But Bivariate study deals only with two variables, the effect of other variables would be beyond the scope of bivariate analysis.

6.3 OBJECTIVES

The basic objective of collecting univariate data is to analyse the nature of data to describe its characteristics such as mean, median, mode, range, standard deviation, kurtosis, skewness etc. Whereas the basic objective of collecting bivariate data is to establish relationship between two variables. This relationship can take either of the two form, correlation or causality. However, with the progress of this unit, the understanding about various statistical tool would be for the detailed.

6.4 DATA AND ITS ANALYSIS

There are three steps to deal with univariate and bivariate data. These are (1) frequency distribution or tabulation, (2) graphs and charts, and (3) statistical measurement. The further part of the unit would explain the above three steps in detail.

Step 1: Frequency distribution/Tabulation

A) Tabulation of Raw data: It is assumed that the retailer Store has collected information about the bill amount (in Rs.) along with name of the buyers and their mobile number. The collected data is presented using the following table.

Name of Buyer	Mobile No.	Bill amount (in Rs.)
Mr. Shishir Mehta	90245xxxx9	150
Ms. Dhruvi Joshi	90585xxxx9	395
Ms. Shalini Varma	89545xxxx9	395
Ms. K M More	94345xxxx6	964
Mr. Kiran Kumar	90291xxxx3	150
Mr. George Peter	90111xxxx4	846

The above table indicates only one variable (the reader may think like name and mobile numbers are also variable as it changes in every observation. However, the name and mobile number are just indication, and it does not produce any further statistical results). The major issue with the above table is to deal with large numbers of data and understand the same. Assume if the above table includes list of 6000 buyers in a day, what would be nature of data? It may not be possible to see the picture that is available at present. Univariate descriptive statistics can summarize large quantities of numerical data and reveal patterns in the raw data. In order to present the information in a more organized format, start with univariate descriptive statistics for each variable. Therefore, the above table is called raw data and it is important to convert the raw data in more structured data set for better grasping.

B) Frequency Distribution: It is refined form of raw data and it yields better understanding. It can handle the large number of data set also.

The following table indicates frequency distribution.

Bill amount (in Rs.)	No. of bills
150	2
395	2
964	1
846	1

Consider the above table. It gives better sense of understanding. Now, even the large data can be presented with more meaningful way through frequency distribution. Still, the large set of data requires further simplification for understanding and therefore, there is one more simplification method handles the problem of large data.

C) Grouped data: It is the method of grouping the entire data set in

some meaning groups. Researcher is free to decide the groups of his/her choice (or in several cases, standard group limits are available). The bill amount (in Rs.) can be collapsed into few categories or groups. Grouped data usually have 3 to 10 groups. One way to construct groups is to have equal class intervals – Case A (e.g., 0-300, 300-600, 600-900, 900-1200). Another way to construct groups is to have about equal numbers of observations in each group (Group class interval may be different in this case – Case B). Remember that class intervals must be both mutually exclusive and exhaustive.

Bill amount (in Rs.)	No. of bills
0 – 300	2
300 – 600	2
600 – 900	1
900 – 1200	1

Case A : Equal class interval

Bill amount (in Rs.)	No. of bills
0 – 300	2
300 – 600	2
600 – 1200	2

Case B : Equal frequency

Though case B is not much popular in real world due to its lack of ability to explain further statistical analysis, it could be useful in the situation where the researcher wants to have equal frequency for further analysis. The need for further understanding about the data leads to further expanding the grouped data table with calculation of cumulative distribution and percentage distribution.

D) Grouped data with cumulative and percentage distribution: The following table further helps the researcher understand the nature of distribution by cumulating the frequency and calculating percentage of contribution of each class interval.

Bill amount (in Rs.)	No. of bills (Frequency)	Cumulative Frequency	Percentage	Cumulative Percentage
0 – 300	2	2	33.33	33.33
300 – 600	2	4	33.33	66.66
600 – 900	1	5	16.67	83.33
900 – 1200	1	6	16.67	100

Limitations of Frequency distribution/Tabulation: Though the grouped data seems to provide seamless understanding of the data, it is not free from limitation. One of the major limitations is data distortion. It means classifying the data in different groups, would lose its original value. Assume that you only have grouped data table, would you answer the original value of data set? No. Another limitation includes the non-availability of standardize mechanism of making classes (different researcher have different though about the class range, no. of classes etc.). This makes analysis tailor made and loose the essence of data. Plotting large data on graphs can be possible solution to delimit the above issues.

Step 2 : Graphs and Charts

Graphs are visual depiction of the data. Generally, people grasp the presented information easily using graphs than in a text or table format. Additionally, the basic purposes of the graph includes

- Presentation of data
- Summarization of data
- Enhancement of textual descriptions
- Description and exploration of the data
- Comparison of data sets
- Distortion avoidance (through not losing of information)

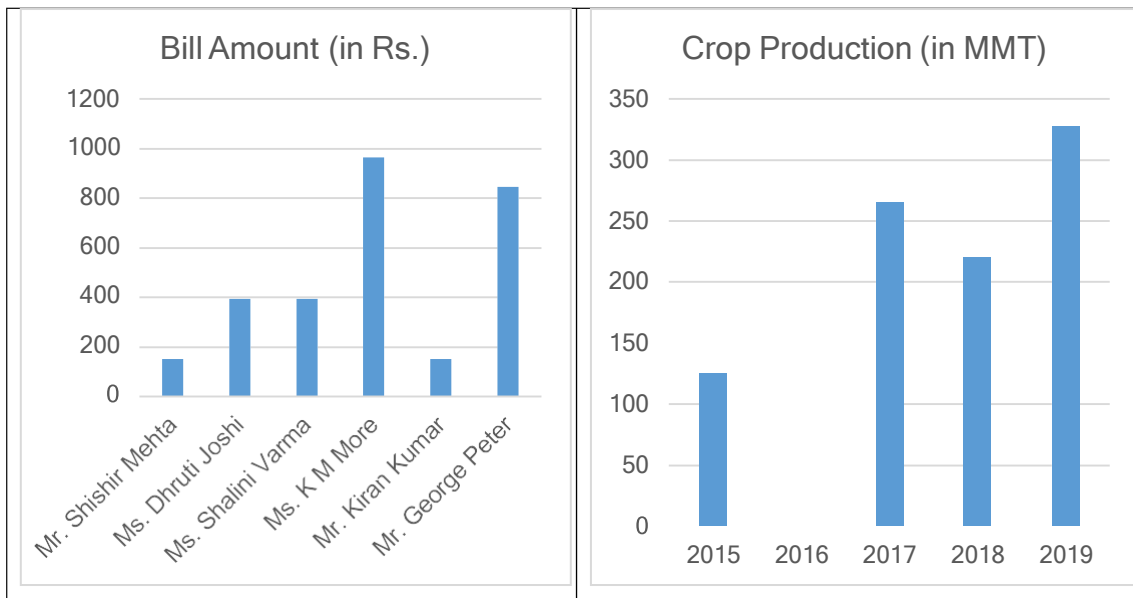
There are basically two categories of graphs. One dimensional graphs and two-dimensional graphs.

A) **One dimensional Graphs:** These are graphs where only one dimension is used to read the graph. The other dimension usually does not make sense (orrepresent only category of the data and not any value). The followings are popular one-dimension graphs:

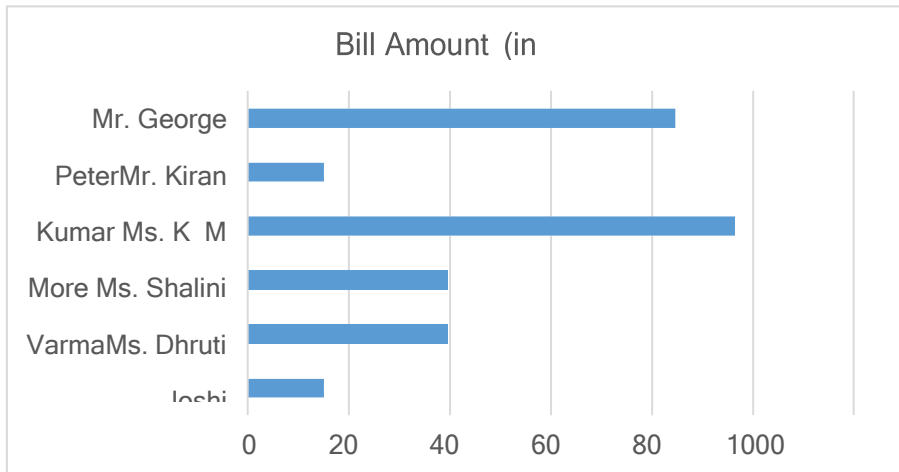
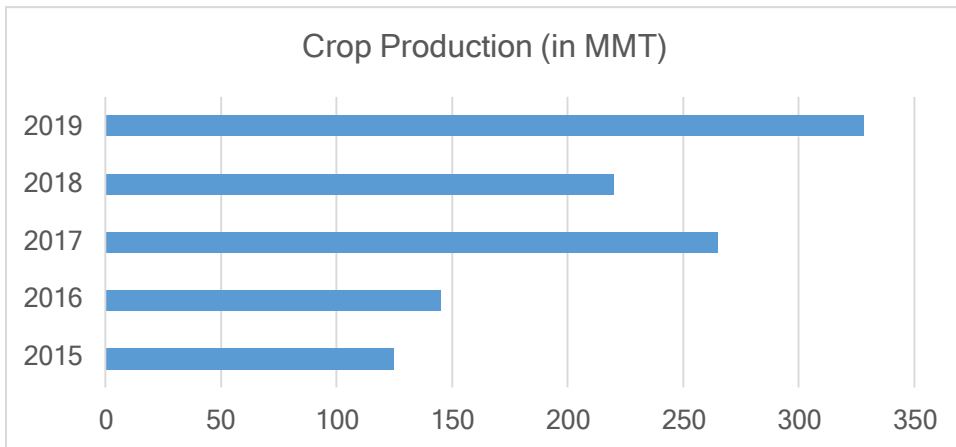
A 1) Bar Graph: A bar chart is a graph with rectangular bars of different

height or length. The graph usually compares different categories. Although the graphs can be plotted vertically (bars standing up) or horizontally (bars laying flat from left to right), the most usual type of bar graph is vertical. Bar graphs should be used when you are showing segments of information. From the information given in the section on graph types, you will know that vertical bar graphs are particularly useful for time series data. It is one dimensional representation and consider as primary and one of the most appropriate form of data visualization. It can take form of Vertical, Horizontal, Vertical/Horizontal with comparison, stacked bar graph, Segmented bar graph.

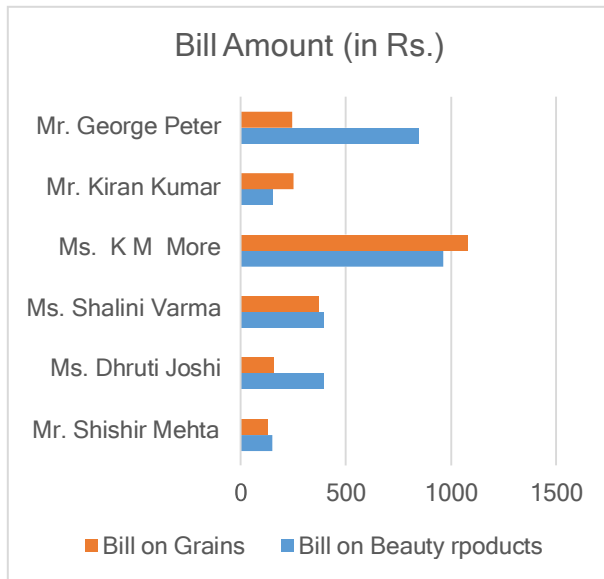
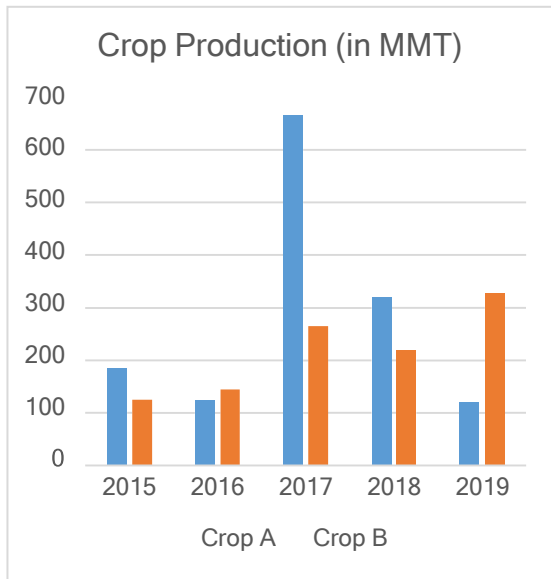
A 1.1) Vertical Bar graph: The space for labels on the x-axis is small, but ideal for category or time dimension (Days, months, years). At a glance you can see from the graph that only y-axis indicates value where x-axis just label the category or time period.



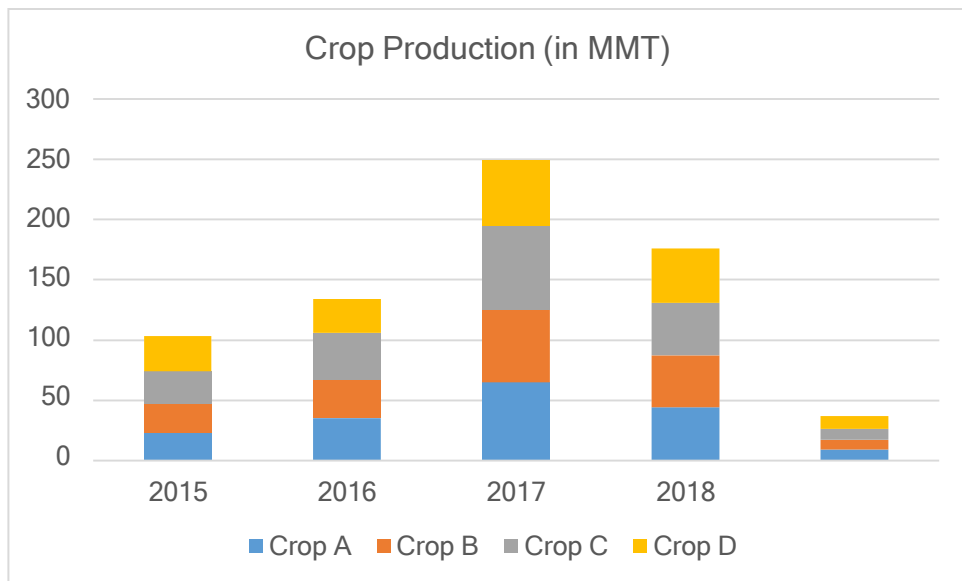
A 1.2) Horizontal Bar graph : The space for labels on the y-axis is small, but ideal for category or time dimension (Days, months, years). At a glance, you can see from the graph that only the x-axis indicates value where y-axis just label the



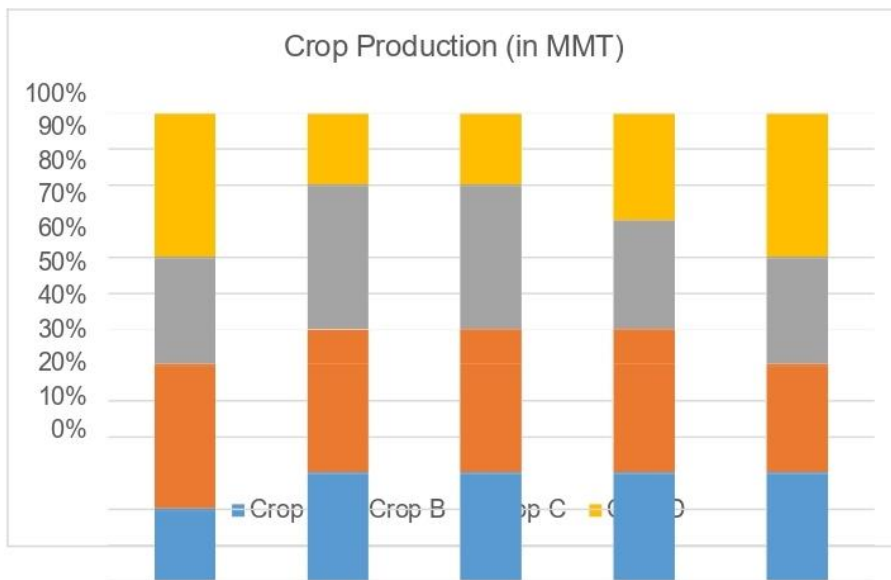
A 1.3) Vertical/Horizontal Bar graph with comparison : It includes several labels on single graphs and have the purpose of comparison of the values. The following graphs facilitates the comparison of Crop A and B or Bill on Grains and Beauty Products. Though the present graphs compares only two categories, the graphs can accommodate more than two categories also.



A 1.4) Stacked Bar graph : It includes several categories under single bar and it is used to show the totality of given time period in single bar. For Ex. Five crops produced during given year and presentation of such four years can be indicated using stacked bar graph. The graph not only facilitates crop-wise comparison, it also help in comparing the production year wise.

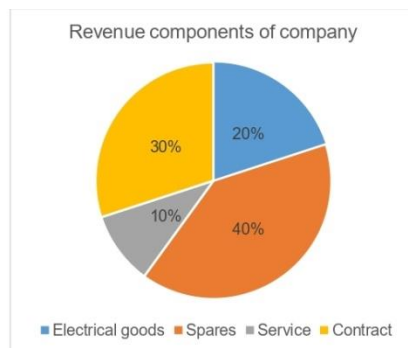


A 1.5) Segmented Bar graph: It includes several categories under single bar and it is used to show the totality of a given time period in the single bar but the height of each bar is same. /the segmented bar graph is prepared by considering the percentage contribution of each category in total 100% contribution. The graph not only facilitates crop-wise percentage comparison, it also helps in comparing the production year-wise. However, such graphs do not compares total crop production of one year with the other.



A 2) Pie Chart : This is a classical graph pattern to show a pie for each category from the total of 100% (or in other words from total of 360°). In order to understand the percentage contribution from each category, this graph is most useful and easy to understand by a non-managerial person as well.

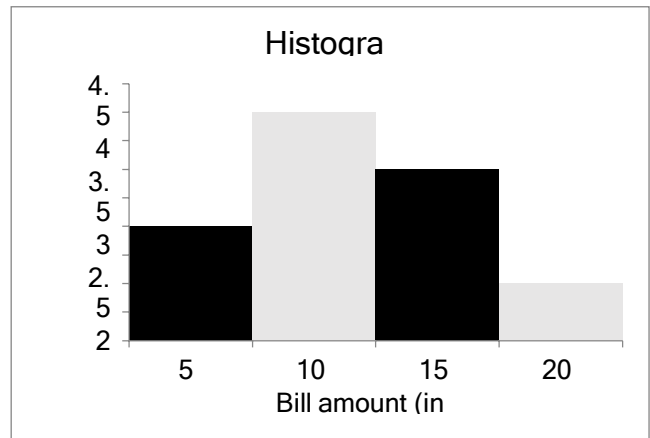
Revenue components of company	% of contribution
Electrical goods	20%
Spares	40%
Service	10%
Contract	30%



A 3) Histogram : It is an approximate representation of the distribution

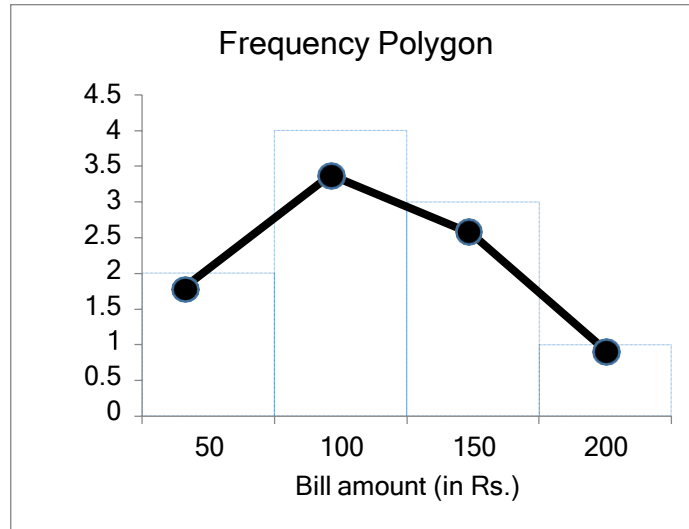
of categorical and numerical data. It was originated by Karl Pearson and it was constructed using buckets of value on the x-axis. Buckets are often (not required to be) of equal width. Equal-width buckets are relatively easy for the reader to understand. Each bucket is consecutive, non-overlapping interval of variables presented, usually, on x-axis. In simple words, Histogram is constructed when the researcher has grouped data, to be plotted on the x-axis and frequency under each class, to be plotted on the y-axis. The histogram indicates the weightage value for each basket. The following is an example of the histogram for electricity consumption (in units) by several families.

Electricity consumption (in units)	No. of families
0 – 50	2
50 – 100	4
100 – 150	3
150 – 200	1



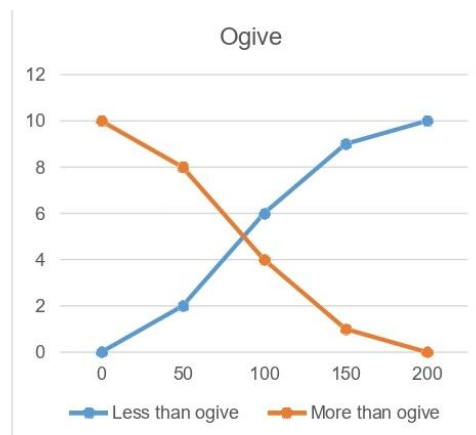
A 3) Frequency Polygon : It is a polygon presentation of the grouped data. It is constructed by joining the middle value of each bucket using straight line. Buckets are often (not required to be) of equal width. The frequency polygon reflects the linear presentation of the grouped data and its frequency. The following is an example of a frequency polygon for electricity usage by several families (refer to the table given along with). Understanding of the following graphs clarifies that a frequency polygon is another version of a histogram. However, here the point of focus is a polygon (not the rectangle bars) and it depicts the shape of the polygon based on frequency.

Electricity consumption(in units)	No. of families
0 – 50	2
50 – 100	4
100 – 150	3
150 – 200	1



A 4) cumulative Frequency Polygon (OGIVE) : It is depiction of cumulative frequency through polygon. Ogives represents the graphs that estimate the the numbers (frequency) lie below or above a particular variable or value in data. The three steps are considered to construct an Ogive; first, calculate the cumulative frequency of the variables, second, plot the points to connect the middle point of the histogram and third connect dots to construct the polygon. There are two types of Ogive; Less than ogive and more than ogive. Using the following data set, ogives are explained and plotted.

Electricity consumption (in units)	No. of families	Cum. Fr.
0 – 50	2	2
50 – 100	4	6
100 – 150	3	9
150 – 200	1	10



B) Two dimensional Graphs : These are graphs including two dimensions under study. The points on the graphs are indication of both dimensions and can be read accordingly. Such graphs are used only for bivariate data. Unlike one dimension graphs, here both the x-axis and y-axis represent one variable each. Scatter plots and line diagrams are the

two most popular two-dimensional graphs. For Ex. If the retail store has measured the bill amount (in Rs.) and Monthly family income (in Rs. Thousand) and the store would like to see the relationship between them.

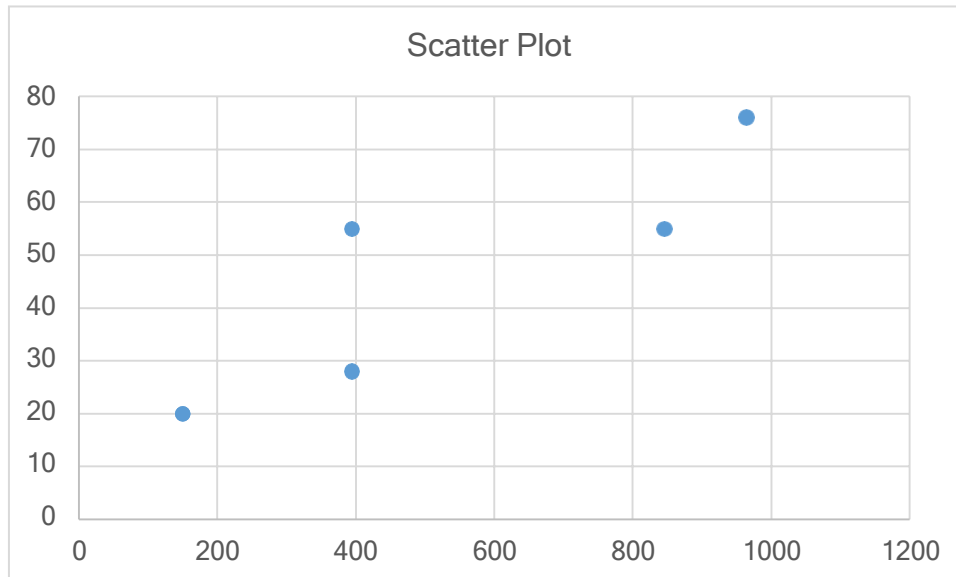
Bill amount (in Rs.)	150	395	395	964	150	846
Monthly familyincome (in Rs. thousand)	20	28	55	76	20	55

Here the reader should take a note that the store would now be able to come to know the effect of income (of the buyer) on their bill amount. It means the cause of bill amount is available with the store. However, there is one more problem with this data analysis method. Does it mean that only monthly family income affects the bill amount generated? The practical answer is no. There may be some other variables that affects the bill amount generated. But Bivariate study deals only with two variables, the effect of other variables would be beyond the scope of bivariate analysis.

- C) **Two dimensional Graphs:** These are graphs including two dimensions understudy. The points on the graphs are indication of both dimensions and can be read accordingly. Such graphs are used only for bivariate data. Unlike one dimension graphs, here both the x-axis and y-axis represent one variable each. Scatter plots and line diagrams are the two most popular two-dimensional graphs. For Ex. If the retail store has measured the bill amount (in Rs.) and Monthly family income (in Rs. Thousand) and the store would like to see the relationship between them.

Bill amount (in Rs.)	150	395	395	964	150	846
Monthly familyincome (in Rs. thousand)	20	28	55	76	20	55

B 1) Scatter plot: It locates the point value of the relationship between x and y values. In general, the point value is depicted by (x,y) value. It means (3,5) is read as a three unit value on the x-axis and a five unit value on the y-axis. For above example the scatter plot diagram would look like as under.



It is clear from the interpretation of the above graph that it does not show the trend plotted through line/curve. Joining the dots and creating a line diagram would provide better sense of trend of the data. However, the utility of the scatter plot is limited to only bivariate data (As two-dimension data are required to plot this graph). Therefore, the researcher should use the scatter plot when the purpose of plotting the graph is to show the moment of one variable with respect to the other.

Limitations of Frequency distribution/Tabulation: The data depicted by graphs just facilitates the visual inspection of the data set. The technique suits only when the researcher deals with small amount of data. However, with increase size of data makes visual inspection, literally, impossible and non-conclusive. Additionally, deals with large amount of data would not bring concrete interpretation and managerial decision just on the basis of graphical representation of the data. The above reasons compelled the researcher to bring in furthermore concrete measurement tool.

Step 3 : Statistical measurement

As of now, the discussion was limited to either arrangement of raw data and tabulation of the raw data or plotting the row data on graph paper either using one dimensional or two-dimensional graphs. However, their inability to deal large data set to bring in practical conclusion, leads to usage of statistical measurements.

In a broader sense, the statistical measurement depends upon the objective of the research. Based on the objective of the study, the statistical measurements can be divided into two titles. (1) Descriptive measurement of the data (2) Inferential measurement of the data

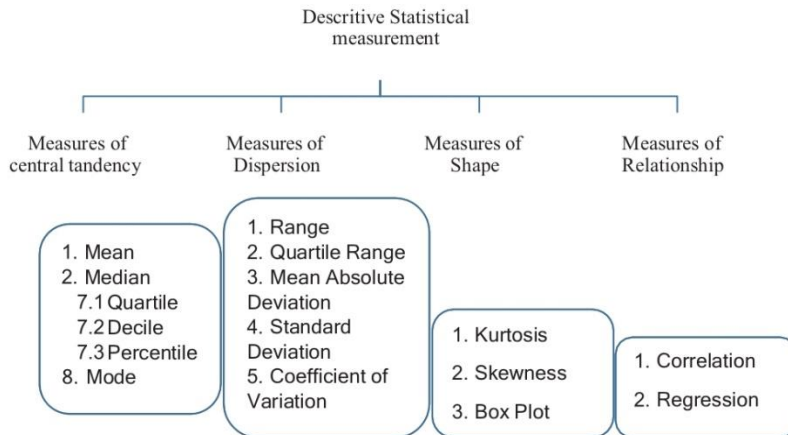
Descriptive measurement: If the researcher is interested in concluding/describing/ interpreting the characteristics of the population

based on the data collected from the same population, it is known as descriptive measurement. For ex. If MBA faculty wants to measure the average height of the students' in a class room (Assume 60 students in a classroom). She measures the height of each one of them (All 60) and then sum it up. After that she divides that total with numbers of students (60) in a classroom and concludes that the average height of the students in classroom is say 64.4 inches. This is classical way of measurement and relatively easy to grasp. **Inferential measurement** : If the researcher wishes to conclude/infer/generalize the characteristics of the population based on the sample selected from the same population, it is termed as inferential measurement. For ex. If MBA faculty wants to measure the average height of the students in a classroom (Assume 60 students in a classroom). She, rather measuring height of each of them, randomly selects (Using roll numbers) 8 students from classroom and measures height of only selected 8 students. The average height of 8 students is found at 67.6 inches. Can she conclude that the average height of the students is 67.6 inches? You may think of answering "NO", as she has not measured each and every element of the population (In our example each and every student of the class).

If your mind is not ready to accept her conclusion (Average height of classroom is 67.6 inches, how would we believe when a smartphone maker claims that the average battery life of the smartphone is 4.5 hours? Or bike manufacturer claims for 89 Km/Litre mileage? Do you think that the smartphone maker has checked each and every smartphone or bike manufacturer has measured mileage for each, and every bike produced by them? Again, your answer is "NO". It means what smartphone maker or bike manufacturer would have done to bring the above conclusions? They must have taken a sample (of 100 or 500 or 5000 smartphones and bikes) to measure its performance (battery life or mileage) and concluded for the entire population (All the smartphones and bikes produced by them).

Of course, the concept of inferential measures is more complex to understand as the entire population is not studied but concluded at the end of the research. With this understanding the conclusion (inference) about the population from just a sample taken, would not bring 100% results (In statistics, it is called confidence level). Therefore, in order to prove the generalizability of the sample result on population, must pass through basic assumption that the sample is true representative of the population. The further discussion about the inferential measures of statistics is beyond the scope of present unit and will be discussed in detail with unit no. 7.

The descriptive measures of statistics would be discussed in detail in following part of the part.



Measurement of Central Tendency : It measures a single value to attempt to represent the entire data set by identifying the value showing the central position. The measure of central tendency is also known as measures of central location and classified as summary statistics. Mean (Popularly termed as average) is the most popular measures of central tendency along with median (Positional value) and mode (frequency value) also occupies simple but sincere application in real world.

Mean : Mean (Average) is the most popular and common measure of central tendency. It can be used to represent the central value for entire data set and is more popular to calculate the central value for the continuous data set. Statistically, the mean is equal to the sum of all values in the data set divided by a number of values in the data set. So, if the researcher has n numbers of the values in the data set and they have values x_1, x_2, \dots, x_n , the sample mean, usually denoted by \bar{x} (pronounced "x bar", if used for sample) or by μ (pronounced "Mu", if used for population), and is equated as.

$$X = x_1 + x_2 + \dots + x_n / n \text{ (For ungrouped data)}$$

$$= \sum (f_i * x_i) / \sum f_i \text{ (For Grouped data)}$$

Where, f_i = Frequency of class i, x_i = Mid-point of class i)

For Ungrouped data : If the researchers has bill amount (in Rs.) for six buyer in a retail store are 150, 395, 395, 964, 150 and 846 respectively.

The mean bill amount (in Rs.) can be calculated as

$$X_{\text{(bill amount)}} = (150 + 395 + 395 + 964 + 150 + 846) / 6 = 2900 / 6 = \text{Rs. } 483.33$$

For Grouped data : If the researcher has tabulated the raw data as under

Bill amount (in Rs.)	No. of bills (Frequency)
0 – 300	2
300 – 600	2
600 – 900	1
900 – 1200	1

The sample calculation for mean of the grouped data is as under:

Bill amount (in Rs.)	No. of bills (Frequency) - f_i	Mid-point of the class (x_i)	$f_i * x_i$
0 – 300	2	150	300
300 – 600	2	450	900
600 – 900	1	750	750
900 – 1200	1	1050	1050
	$\sum f_i = 6$		$\sum (f_i * x_i) = 3000$

$$X = \frac{\sum(f_i * x_i)}{\sum f_i} = \frac{3000}{6} = \text{Rs. } 500$$

It is to note that for the same data set, two different values of mean are produced (For Ungrouped data and grouped data). The researcher must understand that the conversion of ungrouped data into group data leads to a loss of accuracy. The mean value of Rs. 483.33 (Ungrouped data) is the answer without losing any accuracy, while the mean value of Rs. 500 (Grouped data) is not an accurate mean value. However, the advantage of grouping (especially for large data) is always retained with the mean value for grouped data.

Median : It indicates the positional value of the dataset. It indicates the value of middle most position in the data and the objective is to identify the value of middle most position, it is essential to arrange the data in ascending or descending order. It is more popular for discrete (Non-continuous) data. It is represented by “Med” and equated as

Median = Value of middle most position (For ungrouped data)

Where, L = Lower limit of Median Class, n = Total frequency,

f = frequency of median class, pcf = Previous cumulative frequency c = Class interval of median class

For Ungrouped data : If the researchers has bill amount (in Rs.) for six buyer in a retail store are 150, 395, 395, 964, 150 and 846 respectively.

The median bill amount (in Rs.) can be calculated as

Arrange the data in ascending order : 150, 150, 395, 395, 86, 964

Middle most position = $(n/2)^{\text{th}}$ Observation (For Odd no. of frequency)

Or $(n+1/2)^{\text{th}}$ observation (For even no. of frequency)

Middle most position = $(n+1 / 2)^{\text{th}}$ observation = $(7/2)^{\text{th}}$ observation = 3.5^{th} observation

Median = Value of middle most observation = Value of 3.5^{th} observation = $(3^{\text{rd}}$ observation + 4^{th} observation) / 2 = $(395 + 395) / 2 = \text{Rs. } 395$

For Grouped data : If the researcher has tabulated the raw data as under

Bill amount (in Rs.)	No. of bills (Frequency)
0 – 300	2
300 – 600	2
600 – 900	1
900 – 1200	1

The sample calculation for mean of the grouped data is as under:

Bill amount (in Rs.)	No. of bills (Frequency) - f_i	Cumulative Frequency
0 – 300	2	2
300 – 600	2	4
600 – 900	1	5
900 – 1200	1	6

Middle most position = 3.5^{th} Observation (Using the above steps)

First of all let us decide the median class. Median class means a class with middle most position. It can be identified by cumulative frequency.

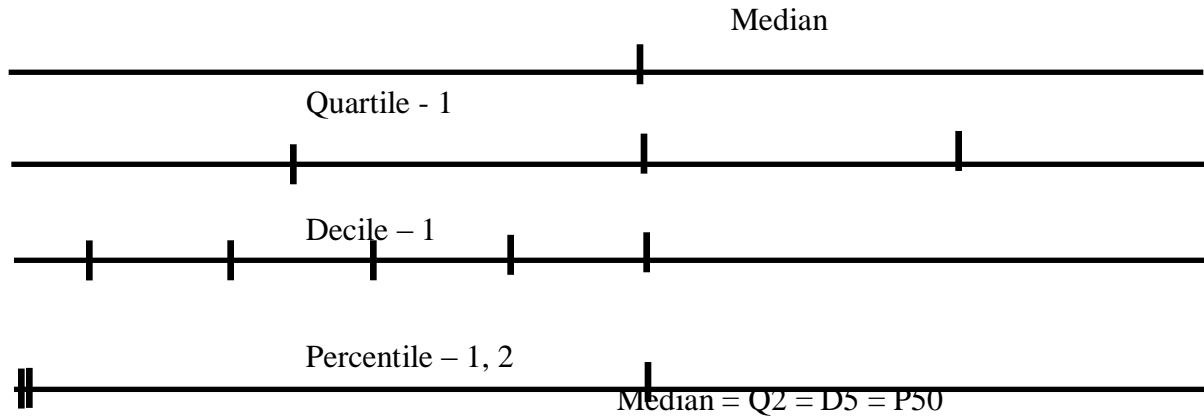
For class 1, the cumulative frequency was 2, then for class 2, cumulative frequency is 4. The middle

most position was 3.5 and therefore, it belongs to class 2. So, class 2 is median class.

$L = 300$ (Lower limit of median class - Class 2), $n = 6$, $pcf = 2$ (Previous class cumulative frequency – Class 1), $f = 2$ (Frequency of median class - Class 2), $c = 300$ (Class interval of median class - Class 2)

Again, the difference is found between ungrouped data median value and the grouped data median value. The reason is same as explained in case of mean.

In nutshell, the median is understood as a value that cuts the data set into two equal parts. It means, exactly 50% of the data are below the median value and 50% are above median value. This conceptual clarity leads to further investigation and concepts of quartile, decile and percentile emerged. As the name suggests, the quartile cuts the data set into four equal parts, the decile cuts into 10 equal parts and the percentile cuts into 100 equal parts. The pictorial representation of the same is as under:



The above figure clarifies two major aspects:

One, except median, all other measures have more than one value (For Quartile, there are 3 values) and these value needs to be specified as Quartile 1 (to be denoted by Q1) and likewise.

Second, the value of median, Quartile 2 (Q2), Decile 5 (D5) and Percentile 50 (P50) would be the same as they all have the same position on the given data set.

Therefore, the method of calculation of quartile, decile and percentile are same except the value of divisibility changes.

For Quartile (Q_m)

Quartile Position = $(mn/4)^{th}$ Observation {Means for Q3 = $(3 * n / 4)^{th}$ Observation} Quartile = Value of $(mn/4)^{th}$ Observation (For Ungrouped data)

For Decile (D_m)

Decile Position = $(mn/10)^{th}$ Observation {Means for D6 = $(6 * n / 10)^{th}$ Observation} Decile = Value of $(mn/10)^{th}$ Observation (For Ungrouped data)

For Percentile (P_m)

Percentile Position = $(mn/100)^{th}$ Observation {Means for P64 = $(64 * n / 100)^{th}$ Observation}

Percentile = Value of $(mn/100)^{th}$ Observation (For Ungrouped data)

Mode : Mode represents the value that repeats for the maximum no. of

times in given data set. Mode is the only measures which can have more than one value.

For Ungrouped data : If the researchers has bill amount (in Rs.) for six buyer in a retail store are 150, 395, 395, 964, 150 and 846 respectively. The mode of the bill amount (in Rs.) can be calculated as

Mode = Observation repeat the most no. of times
 = 150 and 395 (Both repeats for two times)

Therefore, the mode value for given data set is Rs. 150 and Rs. 395. As discussed above, mode can have more than one value. If for a dataset, there is only one value of mode, it is called unimodel data. If the dataset has two modes, it is referred as bimodal data and dataset with more than 2 values of mode is called multimodal data.

For Grouped data : If the researcher has tabulated the raw data as under

Bill amount (in Rs.)	No. of bills (Frequency)
0 – 300	2
300 – 600	2
600 – 900	1
900 – 1200	1

Mode (For grouped data) = Mid-point of the class having the highest frequency

Mode = Rs. 150 and Rs. 450 (Class 1 and 2 have the equal and highest frequency of 2).

Measurement of Dispersion: It measures a value to what extent data are distributed. It also measures the stretch or squeeze of the data. The measure of dispersion is also known as the measures of deviation. The range is the simple most measures of dispersion along with quartile range, mean absolute deviation and Standard Deviation occupies significant application in real world.

Range : It is simple for most measures of dispersion. It measured the highest value of the dispersion. Mathematically, it is defined as the difference between highest value and lowest value of the data set.

For Ungrouped data : If the researchers have bill amount (in Rs.) for six buyers in a retail store are 150, 395, 395, 964, 150 and 846 respectively. The range value of the bill amount (in Rs.) can be calculated as

Range = Highest value – Lowest value = 964 – 150 = 814

For Grouped data : If the researcher has tabulated the raw data as under

Bill amount (in Rs.)	No. of bills (Frequency)	Upper limit – Lower limit of Last class of first class
0 – 300	2	= 1200 – 0 = 1200
300 – 600	2	
600 – 900	1	
900 – 1200	1	

Limitation: As the range depends the highest and lowest value of the data set, it is affected by outliers (It means for data set 2, 340, 345, 344, 346, the range is affected by only one value i.e. 2. If 2 is absent from data set, the range will be dramatically different value than the present).

Quartile Range : Quartile range overcomes the limitation of range by not considering the dataset below the first quartile value (Q_1) and above the third quartile value (Q_3). It is also known as the Interquartile range (IQR). Mathematically, it is defined as the difference between Q_1 and Q_3 of the data set. For both the Ungrouped and Grouped datasets, the equation of the Quartile range is as under:

$$\text{Quartile Range (QR)} = Q_3 - Q_1$$

Limitation : QR suffers from major limitation of non-consideration of the base of dispersion. It means it only measures the value between two points of the data set. However, good measure of dispersion always measures the dispersion of any single data with respect to a standard value.

Mean Absolute Deviation: Mean Absolute Deviation (MAD) delimits the quartile range and measures dispersion from the mean value. Mathematically, it is defined average of the absolute deviation of each data point value from the mean of the data set. For Ungrouped data: If the researchers have bill amount (in Rs.) for six buyers in a retail store are 150, 395, 395, 964, 150 and 846 respectively. The MAD value of the bill amount (in Rs.) can be calculated as

$MAD = \frac{\sum |X - \bar{X}|}{n}$ (Where \bar{X} is mean value of data set). For our example, mean value of the data set is Rs. 483.33.

$$\begin{aligned} MAD &= \frac{1|150 - 483.33| + 1|395 - 483.33| + \dots + 1|846 - 483.33|}{6} \\ &= \frac{1686.66}{6} = 281.11 \end{aligned}$$

For Grouped data : If the researcher has tabulated the raw data as under

Bill amount (in Rs.)	No. of bills (Frequency)	
0 – 300	2	$\text{MAD} = \frac{\sum f_i X_i - \bar{X} }{\sum f_i}$ <p>X_i is midpoint of the class and mean value for the data set is Rs. 500 (For Grouped data)</p> $= \frac{2 150 - 500 + 2 450 - 500 + 1 750 - 500 + 1 1050 - 500 }{6}$ $= \frac{700 + 100 + 250 + 550}{6}$ $= \frac{1600}{6} = 266.66$
300 – 600	2	
600 – 900	1	
900 – 1200	1	

Limitation: It operates on the principle of the absolute deviation from the standard value. However, the concept of the least square yields better result of the deviation and therefore the need arises for improved version of the measures of the dispersion.

Standard Deviation: Standard Deviation (SD) delimits the Mean Absolute Deviation and measures dispersion from mean value using least square principle. Mathematically, it is defined square root of square of average deviation of each data point from mean value of the data set.

For Ungrouped data : If the researchers has bill amount (in Rs.) for six buyer in a retail store are 150, 395, 395, 964, 150 and 846 respectively. The MAD value of the bill amount (in Rs.) can be calculated as

$$SD = \sqrt{\frac{\sum (x_i - \bar{x})^2}{N}}$$

For our example, mean value of the data set is Rs. 483.33.

$$SD = \sqrt{\frac{(150 - 483.33)^2 + (395 - 483.33)^2 + \dots + (846 - 483.33)^2}{6}}$$

$$= \sqrt{100065.89} = 316.33$$

For Grouped data : If the researcher has tabulated the raw data as under

Bill amount (in Rs.)	No. of bills (Frequency)	
0 – 300	2	$SD = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}}$ <p>X_i is midpoint of the class and mean value for the data set is Rs. 500 (For Grouped data)</p> $SD = \sqrt{\frac{2(150 - 500)^2 + 2(450 - 500)^2 + 1(750 - 500)^2 + 1(1050 - 500)^2}{6}}$ $= \sqrt{615000/6}$ $= 320.15$
300 – 600	2	
600 – 900	1	
900 – 1200	1	

Addition to the concept of standard deviation, a concept of variance become very popular, and variance is measured as square of standard deviation (irrespective of ungrouped or grouped data).

$$\text{Variance} = (\text{SD})^2 = 320.15 * 320.15 = 102500 \text{ (For grouped data)}$$

Coefficient of Variation: It is a combined measures of central tendency and dispersion. It is used for to compare one series of the data set with the other series. Mathematically, it is defined as ratio of standard deviation to mean.

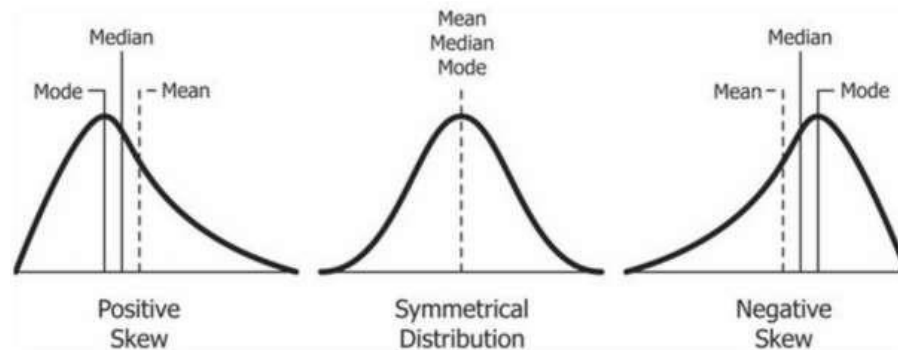
$$\text{CoV} = \text{SD} / \text{Mean} * 100$$

$$\text{For ungrouped data CoV} = 316.33/483.33 * 100 = 65.45 \% \text{ For Grouped}$$

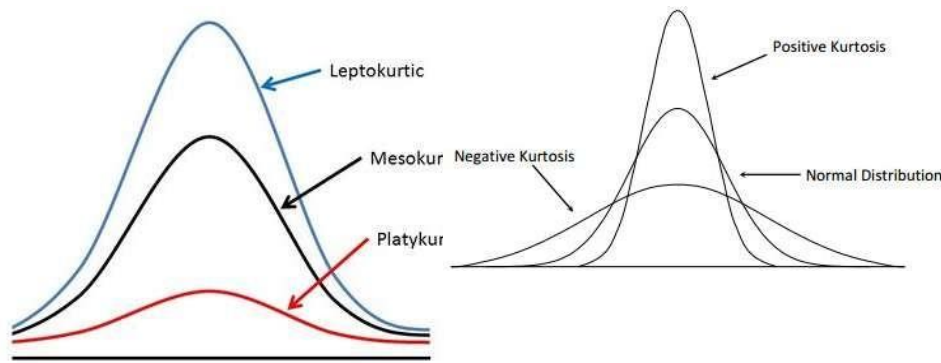
$$\text{data CoV} = 320.15/500 * 100 = 64.03 \%$$

Measurement of Shape: It is a graphical presentation of the shape of the data set. The basic utility of the graphical presentation of the data set is to visualize the distribution shape and putting an effort to understand whether the shape follows normal distribution or not. Skewness is a measure of deviation of the shape from normality. Kurtosis depicts the height of the distribution and box plot helps understand existence of normality of the data set.

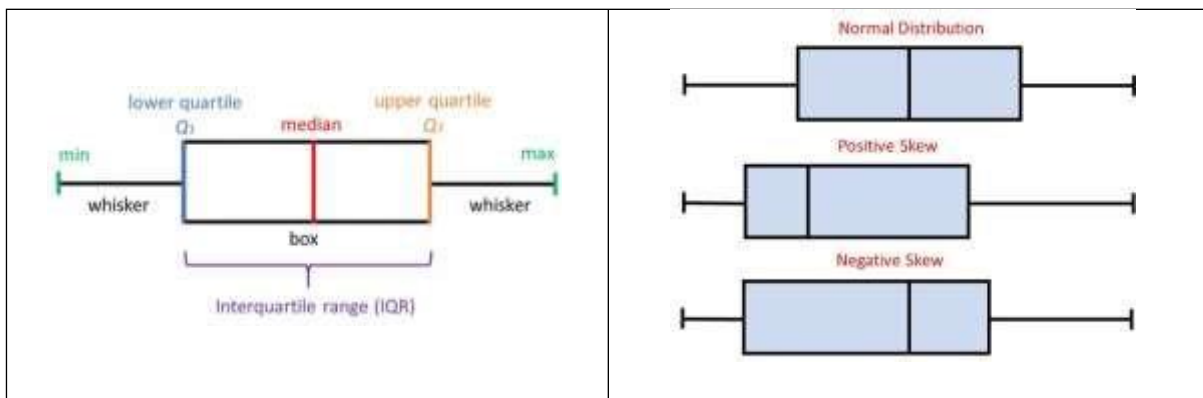
Skewness: There are three types of skewness of the data set: Left Skew, Right Skew and no skew (Symmetric Distribution or Normal Distribution).



Kurtosis : Any data set can take any one of the following three types of distribution; Letokurtic (Positive kurtosis), Mesokurtic (Normal distribution/Zero kurtosis), Platykurtic (Negative kurtosis).



Box Plot : A box plot (also known as box and whisker plot) is a type of chart often used in explanatory data analysis to visualize the distribution of numerical data and skewness through displaying the data quartiles (or percentiles) and averages. Box plot summarizes the five analytical values of a data set of data: including the minimum score, first (lower) quartile, median, third (upper) quartile, and maximum score. Box plot indicates normality of the data. When the lengths of both whiskers are equal and the median line in the box is exactly in the middle of the box, it indicates the normality of the data set. Any deviation from the above condition should be read as non-normal data set.



Measures of Relationship : It measures the relationship between two or more variables. However, the scope of the unit is limited to understand the relationship between only two variables. Relationship measures is possible only under the case of presence of minimum two variables. It means it is basically, bivariate or multivariate method of data measures. There are two measures of relationship: Correlation and Regression.

Correlation: The measures of correlation indicates the a relation existing between two phenomena or things or between mathematical or statistical variables which tend to vary, be associated, or occur together in a way not expected on the basis of chance alone. It is measured through coefficient

of correlation. The value of the correlation coefficient varies from -1 (highest negative correlation) to +1 (Highest positive correlation), while Zero value of coefficient of correlation indicates the absence of correlation.

Regression: The measures of regression indicates the impact of independent variable on dependent variable. In real world one dependent variable is affected by several dependent variables. For ex. The bill amount at retail store depends on independent variables such as income level of buyer, no. of family members in family, type of goods purchase, availability of credit, price of various products etc.

When the effect of only one independent variable on dependent is measured, it is termed as simple regression and the effect of several Independent variables on dependent variable is termed as multiple regression.

CHECK YOUR PROGRESS :

Detail / Descriptive Answer

1. Differentiate univariate and bivariate
2. Explain benefits of converting raw data into table
3. Explain the types of graphs for univariate data set
4. Describe and detail the types of bivariate data set
5. Which are measures of relationship? Explain with examples.

MCQ

1. Any measure indicating the centre of a set of data, arranged in an increasing or decreasing order of magnitude, is called a measure of _____
 A. Central Tendency B. Dispersion
 B. C. Shape D. Relationship
2. It is essential to arrange the data in ascending or descending order before calculating ____
 A. Mean B. Median C. Mode D. Variance
3. If a set of data has one mode and its value is less than mean, then the distribution is called _____
 A. Positively skewed B. Negatively skewed
 C. Symmetric D. Normal
4. A graph used to plot two variable is popularly known as _____
 A. Histogram B. Bar chart C. Pie chart D. Scatter plot
5. Use of table helps in which of the following
 A. To compute the frequency
 B. To convert raw data into arranged classes
 C. To have clear picture about the data range
 D. All of the above

Answer

(1) A (2) B (3) B (4) D (5) C (6) D

Difference

1. Differentiate between skewness and kurtosis
2. Differentiate between one-dimensional graphs and two-directional graphs
3. Differentiate between Histogram and Scatter plot
4. Differentiate between Correlation and Regression

Sums (Practical)

1. Prepare Histogram and Frequency polygon for the following data set

Class	Frequency
0 – 400	8
400 – 800	12
800 – 1200	10
1200 – 1600	5

2. You are required to calculate the mean, median and quartile range for the following data

Class	Frequency
0 – 400	8
400 – 800	12
800 – 1200	10
1200 – 1600	5

3. You are required to calculate the Coefficient of variation and compare company X with Y for the following data

Profit of Co. X (in Rs. Millions)	No. of quarters	Profit of Co. Y (in Rs. Millions)	No. of quarters
0 – 400	8	0 – 600	3
400 – 800	12	600 – 1200	4
800 – 1200	10	1200 – 1800	6
1200 – 1600	5	1800 – 2400	2

- 7.1 Introduction
- 7.2 Types of Hypothesis
- 7.3 Process/steps of Hypothesis Testing
- 7.4 Important Concepts
- 7.5 Scope of Hypothesis
- ❖ Check Your Progress

7.1 INTRODUCTION

In unit 6, a detailed discussion is carried out about the statistical analysis of the data. The statistical analysis is broadly categorized, on the basis of the research objective, into the descriptive measurement of data and inferential measurement of data.

Descriptive measurement: If the researcher is interested in concluding/describing/ interpreting the characteristics of the population based on the data collected from the same population, it is known as descriptive measurement. For example, a college wants to find the average Height of the students in an MBA College. The simple way of measurement is that the college collects the height of each student, sums it up and divides it by the total no. of samples to calculate average height. It is called Descriptive measurement.

Inferential measurement: If the researcher wishes to conclude/infer/generalise the characteristics of the population based on the sample selected from the same population, it is termed an inferential measurement. In simple words, with inferential statistics, the research tries to reach conclusions that extend beyond the immediate data alone. For instance, researchers use inferential statistics to try to infer from the sample data what the population might think or to make judgments of the probability that an observed difference between groups is a dependable one or one that might have happened by chance in this study. Therefore inferential statistics are used to make inferences from the data set to more general conditions. For example, a college wants to find the average height of the students in an MBA college but does not consider the height

of each student. What the college can do? College can select the sample and measure their height. Now based on the same, the college estimates the average height of the population (all students) on the basis of the sample.

There are two main areas of inferential statistics:

1. **Estimating parameters.** This means taking a statistic from your sample data (for example the sample mean, median, mode, and standard deviation) and using it to say something about a population parameter (i.e. the population mean, median, mode, and standard deviation) to estimate the probability of the sample being within given limit of population. The first, as mentioned in the weight example above, is the estimation of the parameters (such as mean, median, mode, and standard deviation) of a population based on those calculated for a sample of that population. The estimation of parameters can be done by constructing confidence intervals—ranges of values in which the true population parameter is likely to fall.
2. **Hypothesis Tests:** This to measure the sample parameter and infer the population parameter from it. For example, you might be interested in knowing if a new cancer drug is effective. Or if breakfast helps children perform better in school. The second method of inferential statistics is hypothesis testing also known as significance testing. Often, this involves determining whether the difference in means of two samples is statistically significant. Such testing is often used by pharmaceutical companies that wish to learn if a new drug is more effective at combating a particular symptom than no drug at all.

However, the present unit focuses on Hypothesis tests and therefore lets us understand hypothesis testing in detail. Hypothesis means a proposed explanation made on the basis of limited evidences collected from samples. A hypothesis is an assumption or an idea that is proposed with the argument with the objective that it can be tested to see if it might be true. In the scientific method, the hypothesis is constructed before any applicable research has been done, apart from a basic background review. You ask a question, read up on what has been studied before, and then form a hypothesis.

7.2 TYPES OF HYPOTHESIS

There are three types of Hypothesis:

1. Research Hypothesis
2. Statistical Hypothesis
3. Substantive Hypothesis

In academic field, statistical hypothesis is highly popular. However, the

business needs to understand the research and substantial hypothesis as well in order to take business decisions. The detailing of each of these types are as under:

Research Hypothesis: The general understanding of the common people is reflected through the research hypothesis and the research hypotheses seem like hypotheses defined earlier. In simple words, a research hypothesis is a statement of what the researcher believes will be the outcome of a study/ an experiment/an observation. That means research in business, generally, often has some idea or theory based on prior experience or earlier research about the relationship among the phenomenon. These ideas, theories, or notions established before an experiment or study is popularly rearmend as research hypotheses. For ex. MBA attracts more heightened candidates or Female MBA students are more heightened than male MBA students.

Virtually all business thinking and inquiries have research hypotheses concerning relationships, approaches, and techniques used in business/to be used in business. Such hypotheses can lead decision-makers to new and better ways to reach business decisions. However, the formal testing of research hypotheses requires them to be stated in terms of statistical hypotheses.

Statistical Hypothesis: In order to scientifically test research hypotheses, a more formal hypothesis structure needs to be set up using statistical hypotheses. Suppose business researchers want to “prove” the research hypothesis that Female MBA students are more height than male MBA students, the researcher is subjected to measure the height of female and male MBA students and measure the difference. Here the question arises if the measurement of the sample height can be generalized to the entire population. In order to answer the question, the researcher converts the research hypothesis into statistical hypothesis and measures it using an established statistical procedure.

All statistical hypotheses consist of two parts, a null hypothesis and an alternative hypothesis. Combining together, these two parts contain all possible outcomes of the research. The null hypothesis states that the “null” condition exists. In simple words, the old decision holds true or the old theory/concept holds true or there is nothing new happening, or the system is under control. The alternative hypothesis, on the other hand, advocates the need for new theory, and new standards or mention that the system is out of control, and/or something new is happening.

The null hypothesis is, generally referred as H_0 and the alternative hypothesis is referred as H_a/H_1 . For ex. With our research hypothesis of

more height of female MBA students than male, the typical null hypothesis can be framed as

H₀ : There is no significance difference between the height of female MBA students and male MBA students

$$H_0 : \mu_f = \mu_m$$

μ_f indicates the population height of female MBA students and μ_m indicates the population height of male MBA students.

It is noted that the null hypothesis can take any of the three possible outcomes (<, >, and =). One could say that the null and alternative hypotheses are mutually exclusive (no overlap) and collectively exhaustive (all cases included). It means if the null hypothesis is true, the alternative must not be true. On the basis above three possibilities of the outcome of the hypothesis, a test of the statistical hypothesis can be divided into two types:

Two-tailed test: It always consists of = or \neq sign in null hypothesis and it establishes a directionless relationship. It only assesses whether the sample value is equal to the population value or not (or whether two population values are equal to each other or not).

One-tailed test: It always consists of a greater than (>) or less than (<) sign in the null hypothesis and it establishes a directional relationship. This method is used for the research when the researcher is interested in only one direction of the research results (For ex. In our case, the researcher is not interested in only one direction. It rarely makes difference to college authority whether the height of female MBA students is more or not than that of male MBA students and therefore for such cases, the two-tailed test should be applied).

Substantive Hypothesis: In testing a statistical hypothesis, a business researcher reaches a conclusion based on the data obtained in the study. If the null hypothesis is rejected and therefore the alternative hypothesis is accepted, it is common to say that a statistically significant result has been obtained. For researchers and statisticians, the word “*significant*” reflects the meaning that the result of the experiment is unlikely due to chance and a decision has been made to reject the null hypothesis. Against this, the business interprets the word “*significant*” as “*important*” or “*something larger in size/volume*”. Therefore, the substantive hypothesis means a true sense of business understanding about the importance of the research results. For ex. A retail store is very happy as the null hypothesis (There is no significant improvement in profits) is rejected as statisticians found the results as “*significant*” results. However, the data shows that the profit of the retail store

increases from INR 4.56 mn to INR 4.58 mn. Does it truly “*significant*” from the business point of view? The answer to this question can be achieved through substantive Hypothesis.

7.3 PROCESS/STEPS OF HYPOTHESIS TESTING

Under the process of testing the hypothesis, four tasks are to be performed by the researcher; **H**ypothesize, **T**esting, **A**ction and **B**usiness implication (shortly and popularly known as HTAB system). Task 1 establishes the hypothesis to be tested using the given data set collected through survey/observation/experiment. Task 2 performs the appropriate tests on the data set to bring out results for further actions. Task 3 marks the statistical actions on whether to reject or not to reject the null hypothesis. Task 4 determines the business implication of the statistical actions.

Additionally, the researchers or statisticians use eight steps process to test the hypothesis which is narrated as under:

1. Establish null hypothesis and alternative hypothesis
2. Determine appropriate statistical test
3. Set the value of alpha, type I error rate
4. Establish the decision rule
5. Collect the sample data
6. Analyze the data
7. Establish a statistical conclusion
8. Make a business decision

Step 1 includes the establishing of the null and alternative hypotheses. Business research, actually, identifies the aspect/theory/phenomenon to be tested whether the hypotheses are one tailed or two-tailed. In the hypothesis testing process, it is always assumed that the null hypothesis is true at the beginning of the study. In other words, it is assumed that the process is in control/no problem/no changes are required. Step 2 indicates the appropriate test to be used to analyse the given business data set. For selecting such a test, the business researcher considers the type, number, and level of data being used in the study along with the statistic used in the analysis (mean, proportion, variance, etc.). Also, the researcher considers the suitable assumptions for the selected test.

Under step 3, the value of alpha is set. Alpha is the probability of committing a Type I error. Common values of alpha include 0.05, 0.01, 0.10, and 0.001. The detailing about the Type I and type II error will be covered as following section. Step 4 includes the establishment of a decision rule before the study is undertaken. Using alpha and the test

statistic, critical values can be determined. These critical values are used at the decision step to determine whether the null hypothesis is rejected or not. If the p-value method (where the p-value would be calculated as compared with established standard 0.05, 0.01, 0.10 or 0.001) is used, the value of alpha is used as a critical probability value. Further detail about the rejection and non-rejection regions will be discussed in the coming paragraphs. The researcher collects appropriate data from the sample under step 5 and analyses the data to calculate the value of the test for step 6.

Lastly, step 7 concludes the sample statistically. The decision rule indicates that the null hypothesis is rejected if the calculated value is greater than the critical value and is failed to reject otherwise. Based on the above statistical conclusion, the business takes the decision.

For earlier ex. Female MBA students are more heightened than male MBA students, let us understand the above steps. The null hypothesis would be established as

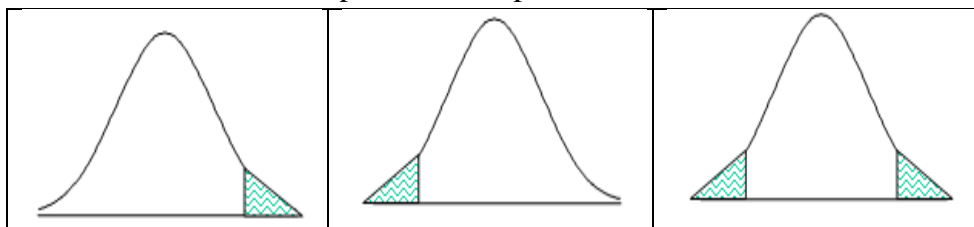
H_0 : There is no significant difference between the average height of female students and male students

For the present example, a statistical test that compares two sample mean (t test with two sample mean) is appropriate to analyse the situation. For the study, an alpha value can be set at 5% (0.05). The decision rule indicates if the calculated value is greater than the critical value, the null hypothesis would be rejected. After the above steps, data about the heights of the selected sample of female and male students are collected and the value of test-statistic is analyzed. Based on the above decision rule and analysis, a statistical decision (of rejecting or failing to reject) is carried out. On the basis of the above statistical conclusion, a business (in our case MBA college) takes a decision if female students are more heightened than male students or not.

7.4 IMPORTANT CONCEPTS

One-tailed and two-tailed tests

When the rejection region is specified on both side of the normal distribution curve, it is known as two-tailed tests. For business decisions, when the researcher compares the sample



Right tailed Test	Left tailed Test	Two tailed Test
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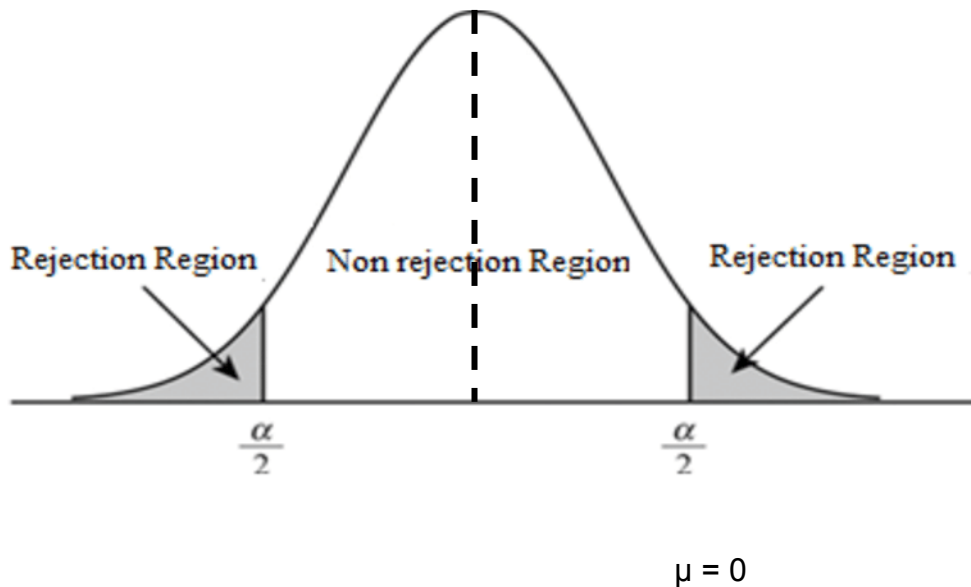
with population to measure the equality (non-equality) between them, two tailed test used to be applied. On the other hand, when the rejection region is speeded only on a single side of the normal distribution curve, it is known as one-tailed test. For business decisions, when the researcher compares the sample with population to measure greater than or lower than measures of sample from a population, one-tailed test is applied.

Rejection and Non-rejection Regions

To discuss step 4 in detail, the critical values established for hypothesis testing process, the possible statistical outcomes of a study can be divided into two groups:

1. Those that cause the rejection of the null hypothesis
2. Those that do not cause the rejection of the null hypothesis.

Conceptually and graphically, statistical outcomes that result in the rejection of the null hypothesis lie in what is termed the rejection region and are presented in the following figure. It is considered as the portion between $\alpha/2$ values on either side. Statistical outcomes that fail to result in the rejection of the null hypothesis lie in what is termed the non-rejection region, usually outside the value $\alpha/2$.



Type I and Type II Errors

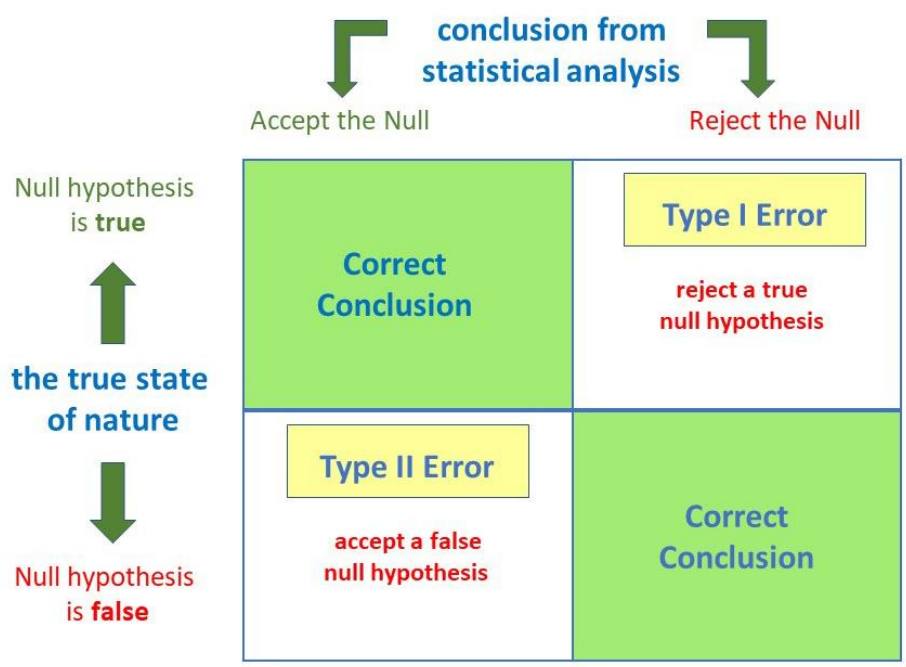
The base of inferential statistics is founded on the assumption that the sample statistics concludes the population parameter. Therefore, while reaching to conclusion about the population based on a sample, it is possible to make an incorrect decision about the null hypothesis. In

particular, two types of errors can be made in testing hypotheses: Type I error and Type II error (Refer to the following matrix)

A Type I error is committed by rejecting a true null hypothesis and is mathematically reflected by α (Alpha) value. With a Type I error, the null hypothesis is true, but the business researcher decides that it is not. The notion of a Type I error can be used outside the realm of statistical hypothesis testing in the business world.

A Type II error is committed when a business researcher fails to reject a false null hypothesis. In this case, the null hypothesis is false, but a decision is made to not reject it. The probability of committing a Type II error is denoted by β (Beta) value. Unlike alpha (α), beta is not usually stated at the beginning of the hypothesis testing procedure. Actually, because beta occurs only when the null hypothesis is not true, the computation of beta varies with the many possible alternative parameters that might occur.

In order to understand the relationship between alpha and beta, one should understand that the researcher do not commit both the mistakes of rejecting the true hypothesis and



non-rejecting the false hypothesis for single test data. Therefore, the values of alpha and beta are inversely related. If alpha is reduced, then beta is increased, and vice versa. Also, the power of statistical test Power, which is equal to $1 - \beta$ indicates the probability of a statistical test rejecting the null hypothesis when the null hypothesis is false (According

to Prof. Karl Popper's every statistical test works on the basic principle of falsification. It means rejecting the false result. Dr. Popper never advocated non-rejection of the true hypothesis).

For our earlier example of comparison of the height of female MBA students with male MBA students, if the correct hypothesis is rejected, the researcher ends up with the type of I error. However, one question always arises in the mind of students how we shall come to know the hypothesis was true but still it rejected?

By true hypothesis we mean by in population, it was true that the height of the female MBA students is more than that of male MBA students but the sample that we selected did not reflect the same and based on the sample we rejected the hypothesis. This is the meaning of committing the Type I error. Similarly, you can understand the Type II error as well.

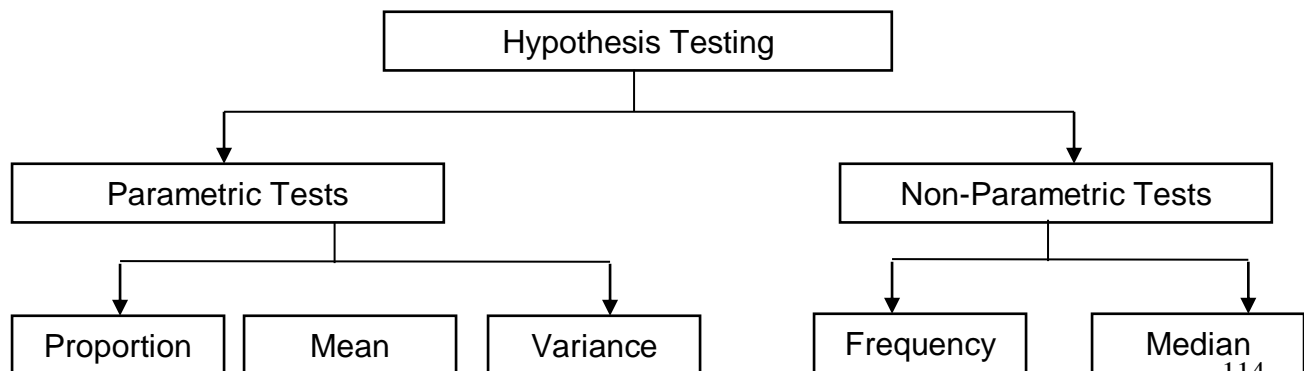
7.5 SCOPE OF HYPOTHESIS

The scope of the hypothesis testing is beyond the simple understating of the sample. As explained earlier that hypothesis testing can be carried out on the basis of comparing sample and population using frequency, proportion, mean, median, mode and variance. On the basis of the comparison, the family of statistical tests (hypothesis test) can be divided into two major parts

1. **Parametric Tests:** All those hypothesis tests that are carried out by comparing proportion, mean and variance are known as parametric tests.
2. **Non-parametric Tests:** All those hypothesis tests that is carried out by comparing frequency, median and mode are known as non-parametric tests.

Also, parametric tests require the data set to be metric data (in other words it should be interval or ratio data) while, the non-parametric tests are applied on both parametric and non-parametric data types (in other words it should be either Nominal, Ordinal, Interval or Ratio).

Parametric tests can, further, be divided into three types of tests based on the parameter of comparison. Let us understand the details.



Proportion Tests: When the business researcher tries to compare sample and population or two populations on the basis of proportion, he/she applies the proportion tests. The proportion test is also popularly known as Z test with proportion. When a sample proportion is compared with a population proportion, it is known as one proportion test and when two populations are compared (using data from samples) it is known as z test with two proportions. The statistical equations for the z-test with one and two proportions are as under:

$Z_{calc} = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$	$Z = \frac{p_1 - p_2}{\sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$
Z test with one proportion	Z test with two proportions

Where p = Sample Proportion

1

p₀ = Population Proportion

2

n = Sample size

p₁ = sample proportion

p₂ = Sample proportion

n₁ = sample size 1

n₂ = sample size 2

p = (n₁p₁ + n₂p₂ / n₁ + n₂)

Mean Tests: When the business researcher tries to compare sample and population mean or two populations on the basis of the mean, he/she applies the mean test. The mean test can further be divided into Z test and test-test, on the basis of sample size. When the large sample is taken (sample greater than 30), it is termed as Z test otherwise as test-test. Also, when a sample proportion is compared with population proportion, it is known as one mean Z test or test-test and when two populations are compared (using data from samples) it is known as two mean Z test or test-test. Above this means can be compared for the same sample taken before and after the phenomenon, it is known as paired test-test (also popularly known as before-after test-test).

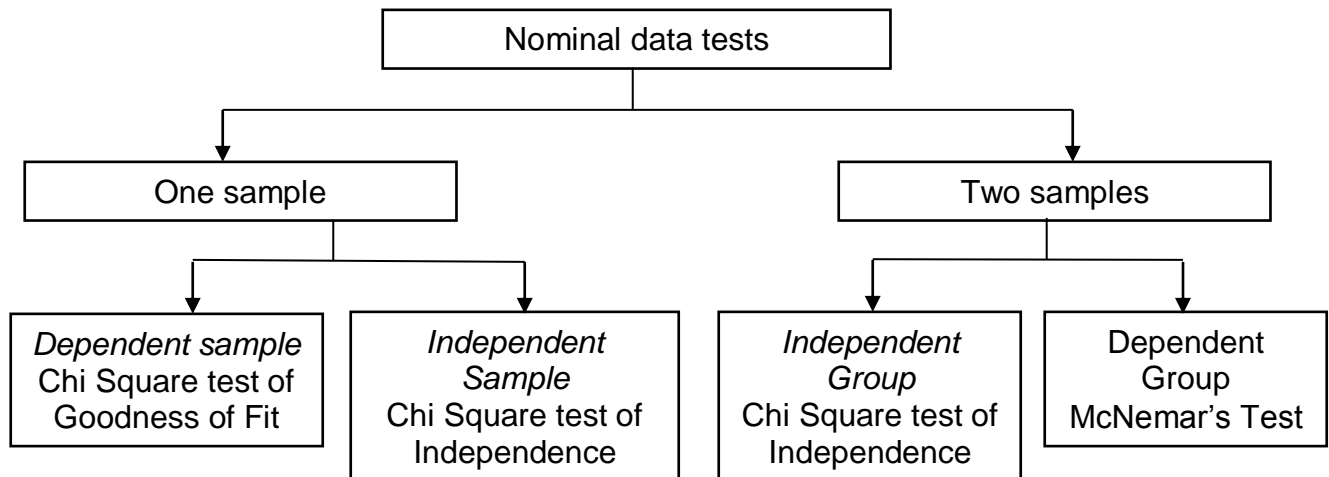
Additionally, when more than groups are to be compared for equality of mean (analyzed through variance), the Analysis of Variance, popularly known as ANOVA, the test is applied. There are two types of ANOVA tests; a test that compares more than two variances of the group based on

only category is known as One Way ANOVA. Where a test that compares more than two variances of the group based on only one category is known as Two-way ANOVA.

Variance Tests: When the business researcher tries to compare two populations (using two samples) on the basis of variance, he/she applies the variance test. The variance test is also popularly known as F – the test. An F-test is used to test if the variances of two populations are equal. This test can be a two-tailed test or a one-tailed test. The two-tailed version tests against the alternative that the variances are not equal. The one-tailed version only tests in one direction, which is the variance from the first population is either greater than or less than (but not both) the second population variance. The choice is determined by the problem.

Non-parametric tests can, further, be divided into two types of tests based on the nominal comparison and median comparison. It is said that for every parametric test, there is a non-parametric version of the same. Let us understand the details.

Nominal data Tests: When the business researcher tries to compare the sample with the population or between two populations (using sample) on the basis of frequency (It reflects nominal data), he/she applies any one of the following tests.



One sample dependent sample test – Chi Square test of Goodness of Fit: When the researcher compares sample with population to assess the fitment of the data to the assumed distribution or expected data value, he/she applied Chi-Square test of Goodness of Fit.

One sample independent sample test – Chi-Square test of independence: When the researcher compares the sample with the population to assess the dependency of the data to the assumed value of the population, he/she

applied Chi-Square test of Independence for the sample. On another hand when the dependency of the sample is considered on the other parameter of the sample, it is known as chi-square test of independence for the group.

McNemar's test: It is used to assess the before and after a difference of the nominal proportion of the data set.

Median Tests: When the business researcher tries to compare the sample with a population or between two populations (using the sample) on the basis of the median, he/she applies any one of the following tests.

Mann-Whitney test: It is similar to one sample z-test or test-test, where the researcher compares the sample with the population. But Mann Whitney test compares the sample with the population using the median value while one sample Z test or test-test compares using the mean value.

Wilcoxon-Signed Rank test: It is similar to paired test-test, where the researcher compares two dependent samples (The same sample measured two times, before and after the phenomenon). But the Wilcoxon-Signed Rank test compares samples using median value as a contrast to paired test-test that compares using mean value.

Kruskal-Wallis test: It is similar to the One Way ANOVA test, where the researcher compares more than two groups of the sample. But the Kruskal-Wallis test compares samples using median value in contrast to One Way ANOVA.

Friedman's test: It is similar to the Two Way ANOVA test, where the researcher compares more than two groups of the sample. But Friedman's test compares samples on the principle of Chi-square value.

CHECK YOUR PROGRESS :

Detail / Descriptive Answer

1. Explain the steps of "Hypothesis Testing" with example
2. What are the different types of hypotheses? Explain Research Hypothesis in detail
3. What is the null and alternative hypothesis?
4. Explain Type I and Type II error
5. Detailed the different types of mean tests.

MCQ (Minimum 5)

1. When a business understands the hypothesis in the real world, it is known as _____
A. Research Hypothesis B. Statistical Hypothesis

- C. Substantive Hypothesis D. None of these
2. Null hypothesis is rejected under which of the following situation?
 - A. When the calculated value is less than the critical value
 - B. When the calculated value is more than the critical value
 3. Parametric tests, unlike non-parametric tests, make certain assumptions about _____
 - A. Normality B. Sample size C. Popularity D. None of these
 4. A statement made about a population for testing purposes is called _____
 - A. Hypothesis B. Significance value C. Statistics D. Research
 5. If the null hypothesis is false then which of the following is accepted?
 - A. Negative Hypothesis B. Positive Hypothesis
 - C. Alternative Hypothesis D. None of these
 6. The power of statistical tests is measured as
 - A. Alpha (α) B. Beta (β) C. $1 - \alpha$ D. $1 - \beta$

Answer

- (1) C (2) B (3) A (4) A (5) C (6) D

Difference

4. Differentiate between the null hypothesis and alternative hypothesis
5. Differentiate between on tailed test and two-tailed test
6. Differentiate between sample and population
7. Differentiate between parametric tests and non-parametric tests

8.1 Introduction

8.2 Characteristics of a Good Report

8.3 Types of Research Report

8.4 Components of Research Report

8.5 Conclusion

❖ Check Your Progress

8.1 INTRODUCTION

For the researcher, communicating the research is as important as conducting the research. The major objective of any research is to add to the existing body of knowledge and therefore, it is important to document the process and findings/outcomes of the research. No matter how good the research conducted, the findings are of less value unless they are reported and communicated effectively. Thus, the utility of the research conducted depends on the way it is represented, and it becomes the source of preservation of the good research work for future references. Writing a research report is the last stage of the whole research process.

The research material/report is to be presented in a systematic and predefined manner, so that the common person (without any research background) also is able to understand the contents of the project without any difficulty. The poor presentation can destroy the value of the whole research. The research project must include all the important ingredients of the research mentioned in a systematic manner. There can be short project reports or long reports.

Definitions

A research report is a condensed form or brief description of the research work conducted by the researcher.

A document containing basic aspects of the research study is called a research report.

It is the systematic presentation of relevant information about the research work in a written form. It may be hand-written, typed, or computerized depending upon the requirement.

A research report is a document that summarizes the processes, data, methodology and findings of the systematic investigation which becomes an important source of information.

Research report is a summary of recorded information after analyzing data gathered by the researcher on the specific topic of the investigation.

8.2 CHARACTERISTICS OF A GOOD REPORT

The report can be considered a source of factual information that can help in the decision-making process. Thus, having a good quality research report is essential for the researcher. It is obvious that report writing differs from person to person depending upon the skills and abilities of the person, experience and training. However, following some general principles produce a better research report. Following are some of the characteristics of a good research report:

Selectiveness

Selecting the matter to be included in the report is as vital as writing the report. In order to save time, cost and energy, only necessary content should be included and the information which is known to all, can be excluded.

Accurate Facts

The information included in a report must be based on accurate facts. As decisions are taken on the basis of the information provided in the report, any inaccurate information may lead to wrong decision.

Language

Proper care should be taken on the language of the report, it should be as simple as possible to make it more understandable. Use of jargons (technical words) may make it more difficult for the laymen to read the report. Preparing the report by keeping the reader in mind, shall help to prepare a good report. In short, the report should be reader-oriented.

Free from Grammatical Errors

The report must be free from any grammatical errors. Grammatical errors may lead to ambiguity and confusion in reader's mind.

Readability

The report must be prepared in such a way that the presentation of the facts, data and information, the use of words, attracts the reader to read the whole report. The same subject matter can be written differently for the different types of readers.

Sequence

All the points in the report must be arranged in a logical sequence and not in a random manner. Proper planning is required by the researcher before beginning with writing of the report.

Objectivity

The report must not reflect the biasness of the researcher on the subject matter. This will ensure a positive effect on the reader's mind. The language or presentation of facts should not lead to a biased opinion of the researcher. They must be impartial and objective and should be explained as a logical conclusion for investigation and analysis.

Clarity

The researcher should make the purpose of the research clear, define the sources, present the findings and make a necessary recommendation. The report must provide clarity of the facts for the reader to understand.

Presentation

A good presentation makes the report better. The content of the report should be presented in an attractive manner to create an impression in the mind of the reader.

The presence of the above characteristics, makes the report to be effective and fruitful.

8.3 TYPES OF RESEARCH REPORT

Research reports vary in length and type depending on the subject/topic/area of study. The report can be a short or long report or it can be a technical or management report. A short report has a well-defined problem, limited scope and simple and straightforward methodology. The format of the report includes, a brief statement about authorization for the study, the problem studied, findings, conclusions and recommendations. Long reports can be of two types: technical reports or management reports. The type of report selected depends on the audience and objectives of the research. There are many projects that require both types of research reports.

The technical report includes full details and documents about the research. It contains the original data files and thus becomes the major source document. Other researchers may have guidance on what was done and how it was done. It is suggested not to include unnecessary material. A good technical report includes sufficient information on data sources, research design, sampling design, data collection procedure, data analysis tools used etc., to enable other researchers to replicate the study. At the end conclusions and recommendations should be clearly mentioned followed by references.

The management report is for the nontechnical person/non-researcher (layman) who has the least interest in the technicality of the research methodology and findings. So the format of the management report

includes introductory sections, and conclusions with recommendations. Individual findings may be included next, so if the reader wants clarity on the conclusions/recommendations made, may refer to the same.

The report should be written with simplicity and attractiveness with clear writing, minimal use of technical words/jargon, the least mathematical details and liberal usage of visuals like charts and graphs. The management reports are emphasized practical aspects and insights and policy implications.

8.4 COMPONENTS OF RESEARCH REPORT

Any research report writing can be divided into two: preliminary pages of the report and chaptering of the report.

Contents of the Research Report
Title page
Letter of transmittal
Letter of authorization
Table of contents (including list of figures, tables, appendices, abbreviations)
Executive summary
Body Introduction Research Objectives Review of Literature ch Methodology Research Design Sampling Design Data Collection Data Analysis Limitations Findings Conclusions and Recommendations
Appendices Bibliography

8.4.1 *Title Page*

The title page of the report should be attractive enough to make a good impression on the reader.

Effect of Celebrity Endorsement on Consumer Buying Behaviour towards fashion apparels

Prepared for (Name of the organization)
(Address of the organization)

Prepared by (Name of the researcher)
(Name and address of the organization)

8.4.2 *Letter of transmittal*

A letter of transmittal is a type of short cover letter accompanied by a document that explains its purpose and importance so that the recipients understand what they received and why they received it.

Your Name Your Job Title

Your Company Name Your Company Address

The Date

Recipient's Name Recipient's Job Title

Recipient's Company Name Recipient's Company Address

Dear [Recipient's Name],

Explain why you're writing, and what the attached documents are about. Emphasize on the key points for the reader to understand the content of the documents and why is it important. Mention the instructions or requests (if any) for the recipient in clear words.

Thank the recipient, offer to provide additional information upon request. Mention your contact information.

Sincerely,

[signature]

Your Name

8.4.3 Letter of authorization

It is issued to the research conducting agency by the research-sponsoring agency before the actual beginning of the research work. It serves as a formal authority to the research conducting firm to conduct the research. The letter includes the name(s) of the person(s) who authorizes the researcher to conduct the research. It may also include a general explanation of the research project, terms of payment, special conditions (if any) requested by the client, and the project completion date.

8.4.4 Table of contents (including the list of figures and tables)

It includes the list of topics included in the research report with the page numbers. It offers the reader to have a quick overview of the chapters included in the research report along with major sections and sub-sections. The page numbers mentioned provide an opportunity to the reader to focus on the required information and skip certain sections.

A list of Figures, Tables, Appendices and a list of Abbreviations are also to be included (if any).

8.4.5 Executive summary

It covers all aspects of the report including major findings and conclusions in a summarized form. It is suggested to write an executive summary after the completion of the whole report writing. It should be written in such a way that the reader is compelled to read the whole report once the summary is referred. The summary should contain the objectives of the research, methodology, sampling, research design, findings and conclusions.

8.4.6 Body

It contains the main text of the report.

Introduction

This section introduces the report and research work to the reader and tells what the whole report is all about. It should include relevant background data on the topic of the research that is required by the reader to understand the report. The problem statement of the research can also be included here, where the need for conducting research is mentioned.

Research Objectives

The purpose of the research is revealed by the research objectives. The objectives may be the research questions and investigative questions. It is a clear, brief, indicative statement that provides direction to investigate the variables under the research study. Research objectives help obtain

answers to research questions and testing research hypotheses.

Well-defined research objectives provide direction to the researcher, offer guidelines for data collection (only required data should be collected in order to save resources and time), outline steps to be followed in order to achieve desired outcomes and help to stay focused. It is suggested to have specific, measurable, attainable, realistic and time-bound research objectives for the research study.

Review of Literature

Literature denotes a collection of published material and/or information on a specific research topic/area including books and journal articles of repute. A survey of scholarly published sources in order to collect more information or gain more knowledge on the specific area of research is called a literature review. It is a kind of looking back to what has been already studied by other researchers. It allows the researcher to identify and understand current trends/knowledge, relevant theories, methods and gaps in the existing research. It is not just a summary of the work done by others but it critically analyzes and evaluates the previous research works to have a clear picture of the state of the knowledge on the said topic. The steps to a literature review include: searching for the relevant literature, evaluating sources, identification of the gap, and writing the literature review.

Research Methodology

It refers to the description of specific methods selected and applied in the research conducted. These should be based on the literature review and thus shall provide an opportunity for the reader to critically evaluate the validity and reliability of the research conducted. The research methodology section of the report provides answers to 'how' i.e. how the researcher designed the study to ensure valid and reliable outcomes that are addressed by research questions and objectives. It contains details regarding research design, sampling design, data collection, data analysis and limitations of the study.

Research Design: The section should clearly mention the type of research design (Exploratory, Descriptive or Causal) the study is using and the major variables included in the study (based on the literature review).

Sampling Design: Details should be provided on the definition of the target population, sampling methods used, and sample size selected (with justification) for the study.

Data Collection: It should be specified that how data is collected for the current study (survey, questionnaire, interview, observation) along with the duration of data collection.

Data Analysis: The statistical methods/techniques (objective wise) used to analyze data are to be discussed over here.

Limitations: Limitations in research can appear due to constraints on the methodology or design of research. All the limitations of the research should be mentioned with an explanation of how these can affect the conclusions drawn. They also may provide an opportunity for future research.

It is suggested to clearly write the methodology so that the other researchers may understand and follow it in a similar type of research studies. Each and every stage of the research is to be explained and justified with a clear set of information and should be written in the past tense.

Findings

It is usually the longest section of the research report. It explains data. This explanation of quantitative data can be in the form of charts, graphs, and tables (depending upon the suitability of the data). Data reporting is more than just the presentation of the data. The data presented is to be analyzed in relation to the research questions/objectives. It is not compulsory (rather not possible) to include everything that has been collected. The findings are to be systematically presented in relation to the research objectives and should be included in a logical sequence. Organization of the data is a prerequisite to the presentation of the findings. It may follow subsections such as the general description of the study population, depending upon the research study design, more information on the problem can be provided, description on how each variable influence the research problem (by using statistical tests). It is important to provide titles and numbers to each table and chart. Again, it is not required to include all the tables, rather only those that present main findings and need elaborative discussion may be added in this section. Other data tables can be added to the annexures section of the report at the end. The section also should include discussion on the findings by objectives, which should logically lead the study to conclusions and recommendations. There should have a detailed discussion on findings from other studies that support or contradict the current findings.

Conclusions and Recommendations

Conclusions represent inferences drawn from the findings. Thus, the conclusions and recommendations should follow logically from the findings. There can be two separate sections for conclusions and recommendations, or both can be mentioned in a single section.

The conclusion should be brief and to the point. It is suggested to exclude

unnecessary details in the conclusion, as it is not the place for the details on the methodology or results. It also is advised to make conclusions drawn from the current data and research

i.e. generalized statements should not be a part of conclusions. The major emphasis of the conclusion should be on the evaluation, insights generated and implications which helps the reader to understand why this research should matter to them and it also may become the basis of continuing future research (by offering new approaches to the topic). The conclusions should be followed by recommendations/ suggestions. The findings and conclusions of the research conducted can lead to valid recommendations. It is important to note here that these should not be generalized suggestions, rather they should be specific to the current research conducted and must be feasible enough to be implemented (by the policymakers, organizations, stakeholders etc.).

8.4.7 Appendices

This section includes copies of data collection forms (questionnaire), statistical tests and output details, other tables that are not included in the body, instructions to the field workers (if any), and other required support material.

8.4.8 Bibliography

It is the list of all the sources including book(s) and published articles that were referred to and followed for the current study. Care should be taken not to miss any of the work which the researcher has consulted. Various formats used in the bibliographies are the American Psychological Association (APA), Chicago Manual of Style, Council of Biology Editors (CBE), Harvard, and Modern Language Association of America (MLA).

8.5 CONCLUSION

It is suggested to prepare an outline for the report. Before starting with writing of the report, it is required to review the work conducted and data analyzed by objectives. There can be a need to go back to raw data and refine the analysis, or need to search additional literature to answer questions that the current analysis has evoked.

CHECK YOUR PROGRESS:

Detail / Descriptive Answer

1. What is a Research Report? Explain the features/characteristics of a good report.
2. What are the types of Research Reports?
3. Explain the literature review component of the Research Report.
4. Explain in detail, the components of a Research Report.

5. Conclusions and recommendations are an essential part of Report writing, mentionsome tips to write conclusions and recommendations.

MCQ

1. The first page of the Research Report is ____
A. Appendix B. Title Page C. Methodology D. None of these
2. Bibliography means
A. Footnote B. List of Books referred C. Biography D. Quotations
3. Last stage of Research Process is _____
A. Analysis of Data B. Research Design
C. Report Writing D. None of these
4. Before starting to write a report, it is advisable to develop _____
A. An Outline B. Theme C. Model D. Chapter
5. The first chapter of the report should be entitled _____.
A. Methodology B. Conclusion C. Introduction D. Data Analysis

Answer

(1) B (2) B (3) C (4) A (5) C

Difference

1. Differentiate between Technical Report and Management Report.

Practical

1. Students should refer to 5 to 8 sample reports to understand various styles ofwriting research reports.
2. Students should conduct research on predefined topic and prepare a researchreport of the same at the end.

9.1 Introduction**9.2 Characteristics of a Good Research Paper****9.3 Elements of a Good Research Paper****9.4 Challenges With Writing a Good Research Paper****9.5 Conclusion****❖ Check Your Progress**

9.1 INTRODUCTION

After having detailed understanding about research process and the data collected through any research it is now the bank to understand the research paper. The ultimate objective of any research is to make the research results available public. A research paper is an excellent opportunity to demonstrate and disseminate the research findings. Also, it preserves the research results for future reference. There are three major documents to be published; Business articles, Magazine articles and 3 Academic articles.

Business articles are something which we read in form of newspaper articles or website articles majorly focusing on business and business-related activities carried out in the business world. The major focus of the business article is a free flow of information available to the public and letting the public decide upon the understanding of the business.

The magazine articles are those published with magazine periodicals published at a certain time intervals. The major focus of the magazine article is to provide information about upcoming or growing Trends of certain fields. In both the cases of business articles and magazine articles, the readers are expected to have their own interpretation. Also, both business articles nor magazine articles do not have any structured format it follows a structured methodology to collect the data.

Academic Publications on the contrary focus on detailed research methodology, data collection tools, data analysis and final interpretation of the topic. Therefore, a structure is considered as the unique characteristics of academic Publication.

In this unit, we focus on understanding the structure and several do's and don'ts of the research paper.

There are four basic academic publications:

1. **Research paper:** It is an article written with academy inside and studies scientific, business or social phenomenon, explaining details of research methodology, data collection tool, data analysis, scientific findings and conclusions with honest acceptance of limitations of the study.
2. **Case Studies:** It is a representation of specific scientific business or social situation presented and narrated inform of article. Case study may be either open ended or close ended. It means followed with several questions which the reader should answer assuming themselves as a part of the given situation.
3. **Literature review paper:** It is an article written with summarisation of several existing literature. It represents the work being carried out by the researcher to systematic collection, review, synthesization and interpretation of existing literature. It helps the reader understand the present status of a body of knowledge in that particular field.
4. **Academic articles:** It is free flow writing by subject for domain experts by stimulating the thoughts about the given situation. It may be a free flow analysis of a body of knowledge for an expert opinion about the subject matter. Normally academic articles are either theory builders or expert's opinions or editor-in-chief note.

The further unit focuses on a research paper in detail and a brief touch upon case study, literature review articles and academic articles.

Before we begin with detailing this type of article we must understand the role of the publication House. The history of Publication Houses are not so old but begins with the establishment of Elzevier in 17th century. Post that The Royal Society was established with the objective of certification, dissemination and preservation of scientific research. Gradually with the advancement in technology, research quality measurement matrices were developed and popularised. Journal impact factor, h index, g-index and i10 index are some of the examples of it.

The following figure reflects role of Publication House and Publication cycle.

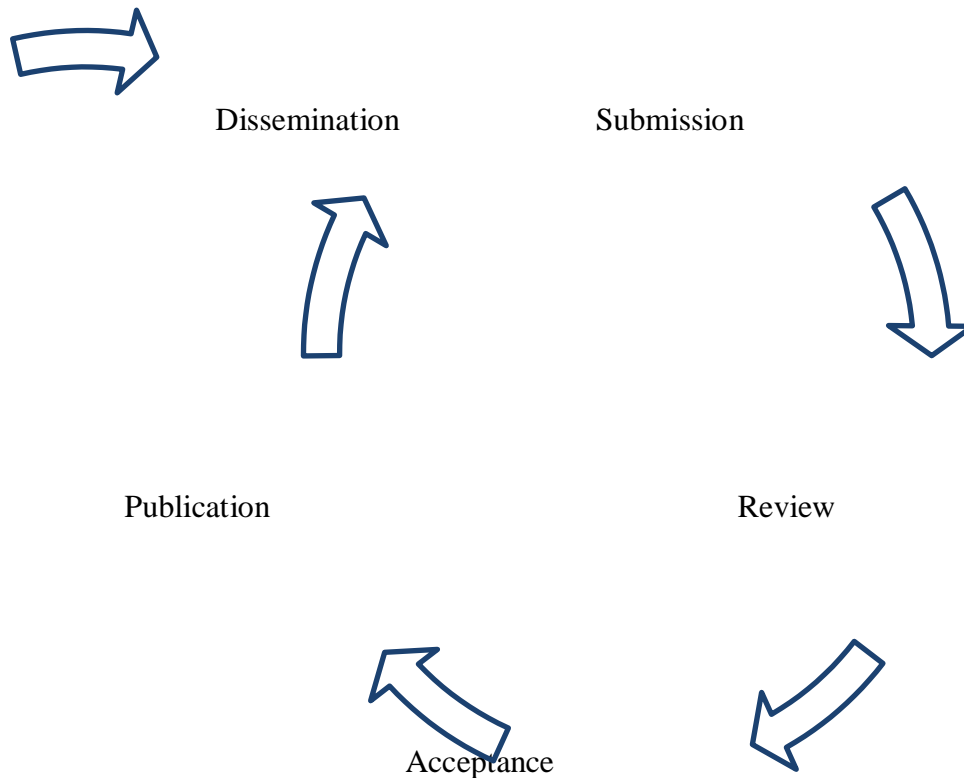


Figure 1 : Academic publication cycle

A research paper publication starts with the submission of a research paper to the publication house, which is later on forwarded for review. The opinion of the reviewer holds significant importance and the suggestions of the reviewer improve the quality of the research paper. Post-acceptance research paper is shared for final corrections, typesetting and copywriting. Upon completion of the above, the research paper has finally available for the public domain either in form of online or offline, available as a free or subscribe version.

9.2 CHARACTERISTICS OF A GOOD RESEARCH PAPER

There are mainly three characteristics of a good research paper; Originality, Significant contribution and Recency. Any journal assesses the paper for its original thought, concept, methodology or confusion. In the absence of originality, the research paper does not find a unique readership and loses its worth. A paper with incorrect or repetitive conclusion is unable to fetch the attention of the fellow researcher. An outdated phenomenon, concept or methodology leads to weaken your research paper.

Besides the above three major characteristics, a good research paper is written for focused readership and bounded scope of the study. A flavour of scientific methodology, data collection adds significant value to a research paper.

Flawless language and the ability to connect to the reader are considered essential characteristics of a good research paper. In the world of research, either nuance in terms of topic, idea or concept, or simplification of the existing body of knowledge makes a research paper, a good research paper.

9.3 ELEMENTS OF A GOOD RESEARCH PAPER

A good research paper consists of several elements such as a title, abstract, keywords, Introduction, literature review, research methodology, analysis, findings, conclusion, managerial/practical implications, limitations, references, tables and charts. It is not essential to have all of the above elements in a research paper. If the topic matter allows you to eliminate any of the above elements, you should do the same. The following part of the unit describes each of the elements in details:

A) Title of the paper:

It is an underlying understanding that the title of the research paper is the first impression of the work of the researcher on the mind of the reader. Generally, the researcher focuses reasonably less while designing the title of a paper. However, there are 5 step procedures for the scientific designing of the title of the paper.

1. Draft the first title (working title)
2. Decide the key aspects (key selling points)
3. Redraft the working title to include the key aspects (anchor title)
4. Refer to the anchor title to reduce its size without compromising on key selling points (orient Title)
5. Decide the final title only after completion of the entire research paper

1. Draft the first title (working title)

With a view to designing the first title, the researcher should collect several papers from the area of study and read the same to understand the current scenario in title framing. At the time of the first title, the researcher should mention all the terminologies and apply all possible options in order to make the title as long as possible. Let us take an example of the first title or working title.

For Ex. *This study will include a randomized selection of samples that will investigate whether working from home reduces professional efficacy among generation Z using 500 responses from top 6 cities, population-based, in India, to be conducted during the third lock-down period, using a structured questionnaire, to be floated in electronic form and relationship will be established in form of multiple regression model.*

2. Decide the key aspects (key selling points)

The researchers can identify the key aspects of the research by asking questions such as what, why, how much, and how to do the given study. What indicates the narrative tone of the research? Why indicates the purpose and how indicates the scope of the study. The method used for the study is indicated through how. Therefore, the father of the Title must include answers to the above 4 aspects.

3. Redraft the working title to include the key aspects (anchor title)

The anchor title considers only key selling points and removes unnecessary words from the working title.

For Ex. *To investigate whether working from home reduces professional efficacy among generation Z by applying a multiple regression model.*

4. Refer to the anchor title to reduce its size without compromising on key selling points (orient Title)

In most case, the researcher is unhappy with the anchor title and does not take its journey forward towards the orient title. However, four major aspects are to be considered to convert the anchor title into an orient title.

A) Avoid declarative statements - The title should not include any conclusion declaration as they are good in business articles or news headlines.

B) Avoid question marks - The existence of question marks in the title is not acceptable phenomenon in the field of Social Science Research. Questions marks seem good for the title of editorials, commentaries, and opinion pieces.

C) Avoid redundant phrase - Phrases such as "To study, to investigate, a study, an investigation" etc. are redundant and does not add value to the title of the research paper.

D) Capitalize each important words - Researchers are confused in taking the decision whether the word is important or not. In simple words, if any word of the title is a noun, pronoun, verb, adjective or adverb, they all are important words.

Applying above four suggestions, the orient title for our example looks

like the following:

For Ex. *Work From Home and Professional Efficacy among Generation Z in India*

5. Decide the final title only after completion of entire research paper

The final title should be decided after completion of the entire research paper. However, the researcher is expected to follow four suggestions in finalisation of title.

- A) Avoid the use of abbreviations unless they are very popular among the reader (you may use RBI or UNICEF but avoid using BMC)
- B) Rarely used quotes or exclamation mark.
- C) Limit the final title from 5 to 15 words
- D) Use subtitles to elaborate the title (subtitles are usually written after the title by putting :between them)

The final title for our study can look like the following:

For Ex. *Work From Home and Professional Efficacy among Generation Z : An Indian experience during third lock-down*

B) Abstract

An abstract is a summarisation of the research paper, generally, one paragraph of 300 words or less (Ideally consisting of 5 to 8 statements). It elaborates upon each major aspect of the research paper and helps the readers decide whether they want to read. In writing an abstract researcher should avoid the use of question marks, exclamation marks or quotes. The use of abbreviation, unless very popular and easily recognisable by readers, make abstract difficult to read. It is said that yes track must cover all the keywords and be free from grammatical or spelling errors. The researcher must not use any citations in the abstract. There are basically four types of abstracts:

1. Critical abstract

Describe the major findings along with the validity and reliability and completeness. It is an evaluation of the self-work and its comparison with the other relevant works with a length of around 500 words.

2. Descriptive abstract

Search tips tricks do not include any judgment it is else conclusions and limit themselves only to information. It is just the summarisation of work carried out with a length of around a hundred words.

3. Informative abstract

It explains the main arguments important reasons and evidence of research. It provides information about the purpose, methods and scope

of the study with a moderate length of around 300 words.

4. Highlight abstract

It is an incomplete and leading remark just to spark the readers' intention. However, highlighted abstracts never stand independent of the research paper and many a time it is popularly known as pseudo abstract.

Informative abstracts are most popular in academic research writing. Generally, the informative abstract is structured with 6 to 7 sentences. The opening sentence must reflect the purpose of the research. The following four to five statements should explain the research design, research methodology, sampling and approach to collect the sample. The researcher should write one sentence for each of the above aspects. The abstract was concluded with major findings and the conclusion was explained in a sentence or two.

C) Keywords

A good quality research paper includes 4 to 6 keywords. The majority of them are from title and subtitle and always focus on the novelty of the research paper. While writing keywords, the researcher should take care that each word is capitalised, and separated by a comma. Any verb, adjective or preverb cannot be used as keywords. Nouns and pronouns are the most popular keywords.

D) Introduction

The introduction of the research paper is considered as a journey from general to specific or an opportunity to establish the scope, context and significance of the study or outline the further structure of the research paper. The introduction can be divided into four sub-points or subsections; the general context of the paper, specific topical information, research problem identification, and organisation of the paper. The following unit briefs each one of these.

1. General context of the paper

The opening paragraph of the introduction section should discuss the general context in which the entire study is being conducted. Starting an Introduction section with a definition or terminology or phenomenon or description is considered a weak opening. A good research paper always starts by citing earlier research work. The quality of the general context of the paper is measured through the logic of the argument, the writing style, and overall quality.

The logic of the argument is reflected through a combination of premises and conclusion. During earlier units, it was described that premises lead to the conclusion. For example, if we have premise 1 as "Mahesh is a mathematician", other premise is "Mahesh is an artist". On the basis of the above two premises, the conclusion can be "Mahesh is multi-talented

personality". This is how the researcher can combine several premises and put up a logical conclusion/s.

The writing stylish is judged through the correct and specific use of nouns and verbs. Also use of professional language with simplicity adds value to the paper. The moral quality of writing is reflected in quality of the arguments. An introduction section must focus on all three aspects as readers at least would like to read through the opening paragraph of your introduction section.

2. Specific topical information

It is also known as the body structure of the introduction section. It should be divided into three paragraphs each consisting of the situation, the problem, and the solution.

With the view of establishing the situation, this paragraph should include the importance of studying the topic when describing several evidences that show the importance of the study. It also includes the generalisation of the present status of knowledge and the synthesization of prior research.

Under the problem, the research tries to establish a niche by putting up the counterclaims to existing theories for raising questions about existing theories or by identifying the research gap for continuing the existing theory. Any one or combination of the methods should apply to identify the problem.

Under the solution paragraph, the researcher outlines the purpose of the research and announces the present research by describing its purpose or summarising the findings of the earlier key research.

3. Research problem identification

This is going to be the second last paragraph of the introduction section and includes research on thought or opinion in line with our discussion and based upon existing literature review. This paragraph reflects the present research gap and the further actions to be taken to fulfil it.

4. Organisation of paper

This is the closing paragraph of the introduction section and reflects the article structure. It breathes about other components and their coverage.

E) Literature Review

A literature review is a survey of scholarly articles, books, databases, newspapers, magazines, conference proceedings, published thesis and dissertations, unpublished articles or any other material issued in a particular area of research. In nutshell, literature review is a description, summarization and Critical evaluation of existing literature.

There are five types of literature review: Argumentative, Integrative,

Narrative, Theoretical and Systematic.

An argumentative literature review results in arguments in favour of or against the existing study. An integrative literature review integrates several research findings. A narration of the present status of knowledge is explained through a narrative literature review. A theoretical literature review combines all existing theories of a particular field of research together and analyse them. Under systematic literature review, the reviewer not only reads but also critically analyses each and every aspect of the study.

There is five-step procedure literature review.

1. Organise the literature on a piece of paper (descriptive versus integrative writings)
2. Review the Literature and prepare a tabular format
3. Write the first draft
4. Read with precaution
5. Articulate (rewrite in a more meaningful way)

1. Organise the literature on a piece of paper (descriptive versus integrative writings)

With the view of organizing the literature review on a piece of paper, the reviewer can choose any one of the following method

A) Descriptive writing that focuses on methodology results findings and conclusion for each literature review. However, under this method, the reviewer needs not put up extra effort to analyse the given situation and therefore it is relatively poor method of analysis. For Ex. Methew et al. (2006) studied the effect of the union budget on the liquidity of grades taken at the National Stock Exchange. They have applied a longitudinal data Collection tool to study the impact over the next six months using multiple regression. They found that liquidity decrease used before the budget and increases sharply on the day of the budget. Gradually over a period of post-budget, it starts cooling down.

B) Integrative writing is an effort to acquire an idea concern are conclusions from the full of paper. In this method, the reviewer not only reviews but critically analyse and therefore it is considered as a superior method.

For Ex., the union budget increases liquidity on Indian stock exchange and gradually a period it cools down (Methew et al., 2006).

2. Review the Literature and prepare a tabular format
Review the existing literature and divide them into several categories and subcategories. Those categories and subcategories can be identified based on Copper's taxonomy. Copper has argued that any literature can be divided into several categories and subcategories based on six major parameters; focus, goal, perspective, coverage, organisation and audience.
3. Write the first draft
At the time of writing the first draft, the reviewer decides about the narrative in-text citation for parenthetical citation or a combination of them. In the text, citation reflects the name of the author in the texts of the sentence while in the case of parenthetical citations, author's name is in parentheses.
For Ex.
Narrative In-text citations - Methew et al. (2006) studied..... Parenthetical citation - Study concluded with X (Methew et al., 2006)
4. Read with precaution
Under the stage of literature review, there are researcher reads his or her own work to ensure spelling mistakes, proper use of tenses, grammar correction, completion of statements and meaningfulness of the statements. Each time one read his or her own work, the researcher identifies corrections and accommodates the same accordingly. The utmost care is taken for real communication between the author and the prospective reader.
5. Articulate (rewrite in a more meaningful way)
This is the last page of the literature review and at this stage, the researcher connects statements in the more meaningful way in order to complete the floor of the literature review section. The researcher can choose the flow of the statements by using any one or a combination of the following theme/s:
 - a) Chronology of Publication: Based on the year of Publication
 - b) Thematic: Based on the theme of the study
 - c) Chronology of events: Based on the year of the event
 - d) Methodological: Based on the method used for the existing study
 It is to take note that the researcher can take help from fellow colleagues or research guide to improvising the section of the literature review.

F) Research Methodology

Research methodology is considered as a very essential aspect of writing a research paper as it reflects the step-wise progression of the research.

There are 6 steps procedure to write the research methodology section

- 1) Decide the research approach
- 2) Design your research path
- 3) Mention the opening paragraph
- 4) Structuring the research process
- 5) Mention the closing paragraph
- 6) Review and revise the first draft

Now let us understand the above steps in detail.

1) Decide the research approach

Decide either of the research approach: Empirical-Analytical or interpretative

a) Empirical-Analytical is a research approach having a focus on objective knowledge with clear operational definitions using existing theories to build and test the hypothesis. It is also popularly known as theory explanation research.

b) Interpretative is a research approach having a focus on subjective knowledge with the unstructured definition of existing theories, designed with the objective of constructing a new theory or concept. It is popularly known as theory-building research.

2) Design your research path

Under the design of the path of research, the researcher has to differentiate between theories and methods. Theories are representations of different ways of characterizing the social world or phenomenon or event or subject matter whereas methods are the presentation of different ways of generating and analysing data for theories.

Do the concept of theories and methods are interconnected, they should be present separately to catch the eyes of The Reader and simplification of understanding.

3) Mention the opening paragraph

The opening paragraph should begin with restating the earlier research. The best way to open the paragraph is to praise the most cited research in the area. Also to take a note that the opening paragraph to include the summary of for the stages of Research Design.

The opening paragraph should not exceed 4 to 5 sentences.

4) Structuring the research process

Under the structuring of the research process the researcher can include 3 to 4 paragraphs. Each paragraph mainly discusses data decisions, tools and methods identified, methods of data collection and data processing.

5) Mention the closing paragraph

The frozen paragraph of the research methodology section is an essential aspect as it provides an idea about the data analysis section. The closing paragraph should include a comparison and contrast of several methods for data analysis. A good research paper always sites statistical or methodological literature review in the last paragraph of the research methodology with the objective of justifying the standoff the researcher to use several data analysis techniques.

6) Review and revise the first draft

The researcher should read and review about research methodology section in order to fix errors related to the use of tenses, grammar, spelling mistakes, logical Sequencing of the statements and most importantly absence of biasness.

It is to take note that you may take help from your fellow colleagues or research guide in this matter.

G) Data Analysis

Based on the research objectives and research design, the researcher can decide appropriate data analysis method and present the same in a research paper. Unit No. 6 and 7 have detailed several data analysis methods. However, in the real world, multivariate data analysis methods are emerging as recent methods.

The researcher needs to take care that he/she uses the appropriate method and presents it in a professional way.

There are steps of the data analysis process:

1. Identify the structure or step-wise process of data analysis
2. List down all the assumptions and assess each one of them
3. Construct the model
4. Assess the model fit (validity and reliability)

5. Applied in model corrections/ modifications/revisions, if any

1. Identify the structure or step-wise process of data analysis

The researcher should repair several standard books and journals from the field of statistics and mathematics in order to identify the flow diagram of the statistical process. The flow diagram provides an idea about the detailed steps to be taken care of for any data analysis process. The researcher should always try to cite the original statistician or mathematician who developed the process.

2. List down all the assumptions and assess each one of them

Assumptions are very crucial to be assessed to ensure the fitment of the data set to apply any statistical for mathematical analysis. The researcher should list and assess each assumption. It may happen that several assumptions do not hold true. However, reporting the statistical results of exemption is not only essential but also ethical.

3. Construct the model

The researcher should use appropriate statistical packages such as Microsoft Excel, statistical package for social science (SPSS), Minitab, Stata, R or any other. Such a software allows the researcher to construct and run the statistical model.

4. Assess the model fit (validity and reliability)

Unless validated, the statistical model does not provide authenticity to data analysis for future reference. There are four types of validity and a measure of Reliability, which were explained during earlier units.

5. Applied in model corrections/ modifications/revisions, if any

On the basis of step 4, Research may apply corrections or modifications for the revision of the statistical models and report the same in a research paper. The researcher should not feel that corrections or modifications are their mistakes. However, it should be considered as rectification carried out by the researcher in order to reach a true sense conclusion of the data analysis.

H) Findings and Conclusions

There is a difference between findings and conclusions. Findings indicates the numerical presentation of the data analysis where conclusion focuses more on managerial/practical implications of the same.

I) Practical/managerial implication

It is an essential part of the research paper as it conveniences the practical implications of the theory. The results derived from data analysis lead to its real-world implications and the reader is more interested to understand the same.

J) Limitations

After one of the Research reports, writing the limitation section is one of the toughest tasks in a research paper. Which should not consider limitation as a fault or wrongdoing. However, it is an honest acceptance of the researcher. The researcher should understand that it is the limitations of the study and not the limitation of the research. A good presentation of the limitations should not include resource limitations searches Time, Money, Responses etc. Should focus on limitations such as scope limitation, data Collection limitation, data analysis tool limitations etc. Limitations, at least, creates opportunities for future researchers to delimit the same.

K) References

The researcher should understand the difference between citations and reference. Citation is an individual or a group of sources to indicate to The Reader where the information came from whereas is referencing is a comprehensive list of all the resources used. Citations are part of the research paper whereas is references are comprehensive lists created at the end of the research paper. References are also known as a bibliography, which includes the name of the author, year of Publication, name of the journal, volume, issue no., page no.

The researcher should follow the standard style of referencing unless specified in journal submission guidelines. If nothing is specified refer to either American Psychological Association (APA) or Modern Language Association (MLA), as they are the most widely referred style of referencing. Cross-reference in this not much-appreciated method. However, the researcher should mention Complete Reference including every component of reference even for Cross reference. Mendeley, Endnote or Microsoft Word allows referencing features with several limitations. Besides the above, several free online sources such as BibMe, DocsCite, EasyBib, KnightCite etc.

L) Table and Charts

The researcher should not copy and paste table presented by statistical software. One should refer the formats of table in several reputed journals. Researcher should keep only those values from statistical software, which are used in the section of findings and conclusions.

At the time of putting the charts and graphs, the researcher should keep the format the same as per journal format.

9.4 CHALLENGES WITH WRITING A GOOD RESEARCH PAPER

It is always a challenging task to write a good research paper. Researcher faces the following problems at the time of writing a good research paper.

1. Time management

In many cases, the research work is a secondary or tertiary priority of the researcher. The researcher is not able to or in some cases avoids putting enough effort and devoting time to research. There are several hindrances to time management to research work such as professional duties, personal/family expectations, non-essentiality of research or output from research.

2. Patient to read and write daily

Reading the literature review really tests the patient level of the researcher. A good quality paper review takes over 10 to 12 hours. In most cases, the researcher lose the patient after crossing 1 to 2 hours on the same researchpaper reading or 30 to 60 Mins after writing.

3. Lack of command over the professional language

Specially, for non-English speakers, use of professional language is one of the major barriers to write a good research paper. In this case, reading good quality research paper is highly helpful. The researcher can improvise his/her language professionally, as it refers a good quality paper. Use of proper grammar, verbs, nouns and pronouns are major challenge. The researcher may use several free online software such as Grammarly to improvise the professional language and reduce errors.

4. Issues with understanding different statistical methods and its interpretation

Forth major challenge for author of good research paper is to deal with statistical methods and its' interpretation. The researcher is not expected to be master of all the statistical method but they are expected to understand at least the findings and conclusions are drawn from it.

9.5 CONCLUSION

As a final words, the researcher must have a good guide or colleague who act as co-author for research paper. It is always advisable to refer quality journal to get idea about quality publication.

CHECK YOUR PROGRESS:

Detail / Descriptive Answer

1. What are the characteristics of a Good research paper?
2. Explain the Literature review as component of the research paper
3. What precautions should be taken at the time of deciding the title of the paper?
4. Explain the components of a good research paper.
5. How should a research design Introduction section of the research paper?.

MCQ

1. Which of the following is not classification scheme according to Cooper's Taxonomy?
A. Focus B. Audience C. Methodology D. Relationship
2. Which of the following can be treated a literature review?
A. New Paper B. Thesis C. Research Paper D. All of the above
3. _____ section of the research paper explain the data collection method
A. Keywords B. Data analysis
C. Research Methodology D. References
4. The comprehensive list of all citations in a research paper is known as _____
A. Keywords B. Data analysis
C. Research Methodology D. References
5. The crux of the entire research paper is mentioned in _____
A. Research Methodology B. Data Analysis
C. Abstract D. References
6. The literature review that carries out study of several theories and presented it, is known as _____
A. Integrative LR B. Theoretical LR
C. Systematic LR D. All of the above

Answer

(1) D (2) D (3) C (4) D (5) C (6) B

Difference

1. Differentiate between Empirical-Analytical Research and Interpretative Research
2. Differentiate between Citations and References
3. Differentiate between Abstract and Introduction

Practical

1. Students should read 5 to 10 research papers and try to summarise them as Literature Review
2. Students should refer 5 to 10 research paper and summarise the research methodology used in those papers
3. Students should refer 5 to 10 research papers and summarise the data analysis methods used in those papers
4. Students should refer 5 to 10 research papers and summarise the data collection tools used in those papers

10.1 Introduction**10.2 Importance of Ethics in Research****10.3 Components of Research Ethics****10.4 Types of research misconduct****10.5 Ethical Consideration in Research: Participant-
Researcher****10.6 General Ethics****10.7 Committee on Research Ethics****10.8 Ethical Issues in internet-based research****10.9 A Template for Informed Consent****❖ Check Your Progress**

10.1 INTRODUCTION

The term "ethics" refers to the moral ideals that guide a person's behaviour. Research ethics can be defined as conducting research morally and legally. They are standards of behaviour that establish boundaries between right and wrong and acceptable and undesirable behaviour. The importance of ethics in the research process cannot be overstated. At various stages of the process, researchers must deal with various ethical dilemmas. The truth is that there can be issues with ethics at every step of the research process (Bickman & Rog, 2009). The research that deals with personal data are seen to be the most sensitive. Resnik (1998) claims that research ethics are common in researchers' interactions with respondents and peers.

Researchers are personally accountable for their research's ethical behaviour. At every level of the research process, they must address all ethical concerns.

Researchers must bear complete accountability for their own research's ethical behaviour. In simple words, ethics is the obligation of the researcher. A researcher's first and most important job is to ensure the participants' safety, dignity, rights, and well-being. Researchers must deal with various other challenges at various stages of the study process. The researcher, as well as the participants, each has a vital role to play. The rights of one are the obligations of the other. Researchers must respect the rights of participants and think about their research from their point of view.

Some people say that business schools do not teach students the skills or sensitivity to deal with ethical issues (Collins, 2000). They say that this is partly because there is not much ethical practice among university faculty members who rely on self-regulation and self-monitoring, which can be harmful (Cabral-Cardoso, 2004). In business, ethical issues are becoming more and more critical. With growing public concern about the limitations of inquiry and regulatory developments affecting human rights and data protection, ethical questions in social research have taken center stage. With the advancement of technology, additional ethical dilemmas in research have arisen.

10.2 IMPORTANCE OF ETHICS IN RESEARCH

There are various reasons why it is critical to follow ethical guidelines in research.

- Ethics prevent the researcher from engaging in unethical behaviour while pursuing knowledge and truth and honouring and respecting the respondents' rights.
- Prohibitions on creating, manipulating, or fabricating research data advance truth and prevent mistakes.
- Ethics are important because research often requires a lot of cooperation and coordination between people from different fields and institutions. This is why ethical standards emphasize the crucial values for collaborative work.
- Respondents who do not trust investigators or are suspicious of their motives will decline to participate in the study, making it impossible for researchers to undertake research and create a knowledge base that benefits the community.
- Research done ethically also has a better chance of being accepted by the public.

People are more likely to finance research projects if they are confident in their quality and integrity.

10.3 COMPONENTS OF RESEARCH ETHICS

Some of the components of research ethics are briefly discussed below.

Honesty: The researcher should be open and honest about his or her approach to data collection, findings, reporting, and publication.

Integrity : The researcher should be concerned about the agreements and commitments before the investigation.

Objectivity: Make every effort to eliminate bias in all stages of research. There are several components to this process: experimental design, data processing and interpretation, peer review, and others.

Respect for the privacy of individuals: Research participants' privacy is a concept in research ethics that asserts that a person participating in human subject research has a right to privacy. **Obtaining Consent:** One of the foundational concepts of research ethics is informed consent. Its goal is to ensure that human subjects can freely participate in research (voluntarily) complete understanding of what it means for them to do so and give their permission to do so before they start the investigation.

Citation: You must acknowledge the source in your bibliography or reference list when you quote or summarize another person's work, so that you may give proper credit to the author or creator and help the reader identify the source you referenced.

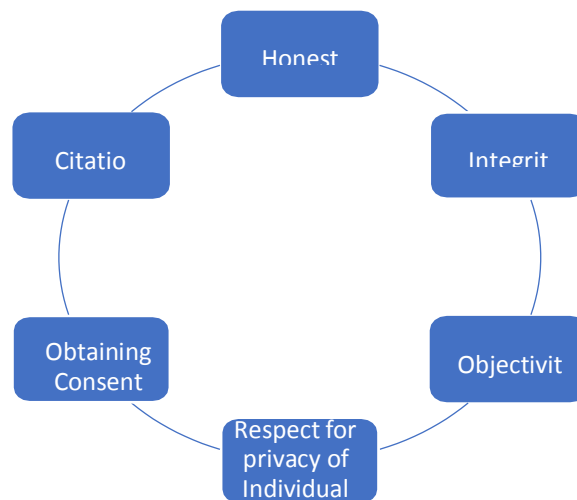


Figure 10.1 Components of Research Ethics

10.4 TYPES OF RESEARCH MISCONDUCT

There have been several types of research misconduct described. Fabrication, falsification, and plagiarism are three types of research misconduct defined by the National Science Foundation in the United States. Fabrication is the act of fabricating results and then recording or reporting them. Falsification is the deliberate manipulation of research materials, equipment, or procedures, or the alteration or omission of data or results, with the intent of creating an inaccurate record of the research. Plagiarism is the unauthorized use of other people's ideas, procedures, results, or language. It is when someone takes credit (or tries to take credit) for someone else's work. Plagiarism can be challenging to spot, particularly in journals with a limited audience. However, plagiarism detection software is now available.

Conferring authorship on persons who have not made a significant contribution to the research is also considered research misconduct. This is significantly more difficult to prove due to a lack of consistency in defining 'authorship' or substantial contribution.' Ghostwriting is when somebody other than the authorized researcher(s) makes a significant contribution. It contains plagiarism as well as a component of financial fraud. Misappropriation of data refers specifically to stealing the work and findings of others and publicizing them so that the author appears to have undertaken all of the labour necessary to obtain the data. Suppression is the unwillingness to publish critical findings because they are detrimental to the researcher's or sponsor's interests (s). To uphold ethical standards, it is vital that unfavourable results are likewise made publicly available and researchers.

10.5 ETHICAL CONSIDERATION IN RESEARCH: PARTICIPANT-RESEARCHER

Research is a public trust when done ethically. As a result, researchers must thoroughly understand the theories and procedures to ensure ethical research practices. As a researcher, one must understand what constitutes an honest study. With current knowledge, the researchers should devise a method that adheres to fundamental ethical principles while maintaining the overall security and safety of the study's participants.

Different research methods necessitate a distinct set of ethical standards. Let us separate research ethics into two categories to make it easier to understand: participant-researcher ethics and general ethics. We shall highlight numerous ethical difficulties that arise during the study process.

The researcher is primarily responsible for the participants and the other researchers involved in the study.

10.5.1 Informed Consent: The researcher's first obligation is to obtain informed consent.

One of the foundational concepts of research ethics is informed consent. Participants should be able to enter research freely (voluntarily) and be fully informed about the implications of participating, and they should provide their permission before doing so.

- Participant consent should be obtained before they are invited to participate in the research (prospectively), and participants should not be subjected to any undue pressure to give their consent. The participant must comprehend the study and consent to a minimal need for informed consent.
- In order to make sure that the person who is going to be a human subject understands the information, the enumerator should then ask the person to give their freely given, informed consent, preferably in writing. Non-written consent must be legally documented and witnessed if not stated in writing.
- The researcher's responsibility is to obtain the legally authorized representative's consent before researching an individual who is either a minor or incapable of giving informed consent.
- While obtaining the consent of the potential research subject, in addition to the consent of the legally authorized representative, the potential research subject is deemed incapable of giving informed consent. However, it is nonetheless competent to assent to research participation decisions. The potential participant's right to express his or her dissatisfaction should be recognized. An experiment should not harm a participant or their family members if they choose not to participate or choose to drop out. Participants or their families should not be denied any benefits or services because they did not participate in the research study or did not want to participate in the research study.
- All threats regarding the research should be disclosed to the participants by the researcher. During the consenting phase, the researcher should emphasize all of the research's adverse and positive aspects. The participants must be informed about the study's goal, aims, nature, duration, sponsors, and other pertinent information.
- **Informed consent from Minors:** The consumer's permission to participate should be sought. When participants are kids, or in scarce situations, they and their parents or guardians must permit them to be

in the study. Participants must be sufficiently informed of the study's objectives, methodology, financial sources, potential conflicts of interest and discomfort, as well as post-study provisions, before being allowed to participate.

10.5.2 Components of the Informed Consent Form that should Be Included:

1. The research is accompanied by explaining the study's methodology and objectives. Practical suggestion: The informed consent declaration might begin with the statement, "*We request you to participate in this research entitled.***.*"

2. Time duration: The respondents' participation is intended to last for a certain amount. The following information may be included in a heading in the document "Time Duration of the Procedures and Study":

Practical suggestion: If you accept to participate in it, you will be involved in this study for approximately 'n' weeks/months/years.

3. Participants should be aware of any discomforts or risks they might face due to their involvement in the research. For example, if participants are taking part in research of a new product trial, they may include the following information in the document.

Practical suggestion: Put a heading in the Informed consent document called "Risk and Discomfort" that says this:

"You are at risk for the following side effects while participating in the trial" (and the side effects to be enumerated). The majority of them are given here; however, they will differ from one person to the next."

4. Confidentiality of information: Respondents should be assured of the confidentiality of the information they are providing.

Practical tip: Insert a heading under "Statement of confidentiality" in the informed consent document that says something like this:

"You may be assured that the information you supply will be kept confidential, and it will be used for an academic purpose only."

5. Contact Information: Names and contact numbers of the principal investigator (PI) and any co-investigators. Add a header to "Contact Information for Questions or Concerns" in the informed consent document that states: "You have the right to ask any questions you may have about this research." Please contact the people listed below if you have any issues, recommendations, or questions. This is to be followed by the principal investigator (PI) and co-principal investigator (Co-PI) details.

6. **"Voluntary Participation":** All participation in the study is entirely optional, and participants have the option to withdraw at any time. Refusing to participate will not result in any penalties or loss of benefits to which they are otherwise entitled. *Practical tip::* In the informed consent document, a heading on "Voluntary Participation" might be included, with the following text:
"Active participation in this research study is completely voluntary. You have the option to avoid it at any moment if you want to participate. If you opt not to participate or later decide to stop participation in the research, you will not be penalized or lose any prizes."
7. **If the participant's information** (including images/photographs) is published as part of this research, he or she should be notified.

10.5.3 Other Important ethical considerations:

- The participants' and data's privacy, anonymity, and secrecy must all be respected (Jensen, 2002). In light of the ongoing discussions about professional standards and societal consensus, researchers conducting studies must take precautions to ensure subjects' anonymity, confidentiality, and "informed consent."
- A choice should be provided for participants to refuse the use of data-gathering technologies such as cameras, audio recorders, and other similar devices.
- The questionnaire should be written in the native language of the participants to be easy and simply understandable for them.
- The safety of the participants is the most critical consideration. Risks that are bigger than what they usually confront in their daily lives should not be presented.
- In case, it is the responsibility of the researcher to protect participants from the risks arising from their research.
- Researchers are responsible for safeguarding and promoting the interests and rights of participants during research studies.
- The researcher must deal with concerns relating to the participants' religious, cultural, economic, spiritual, psychological, physiological, and biological well-being, and political and social positions.
- Integrity, honesty, objectivity, and openness are qualities that researchers must accept and respect to sustain ethical standards throughout the study process.
- Researchers are obliged to think about the ethical consequences of their work before beginning a new research project.

10.6 GENERAL ETHICS

Apart from the criteria as mentioned above, a researcher must consider the following ethical considerations at various phases of the study process:

- The researcher's primary responsibility is to determine if the issue to be examined has inherent ethical repercussions because specific topics are more contentious than others. In order to avoid making a definitive decision on a topic before considering its ethical consequences, it is necessary to consider them first.
- When it comes to studies that involve direct human touch, ethics are of the utmost importance. Because of this, the impact of the research on individuals must be taken into consideration. Research that could be harmful should be avoided at all costs.
- Researchers who perform studies involving human subjects should include a detailed description and justification of the study procedure in the research design phase of the project.
- Each person who helped write the paper must be named in the paper. In the same way, all of the individuals identified as authors in the article should have made significant contributions to the piece's research and writing.
- The information must be gathered in a manner that does not cause harm or injury to anybody else.
- Data management must be done in a clear and ethically correct way to deal with and solve all of the problems that arise. The three most significant ethical challenges in data management are ethical and truthful data collecting, ownership and responsibility of obtained data, and keeping and sharing access to gathered data with colleagues and the public. It is necessary to avoid data manipulation.
- Plagiarism must be avoided by correctly citing the source. The researcher is responsible for acting appropriately and protecting copyrights, intellectual property, patents, and other types of intellectual property and other rights. At all costs, self-plagiarism - the act of copying one's work - must be avoided.
- Unlike duplicating, splitting up, segmenting, or slicing an extensive study into multiple papers is referred to as "salami publication" or "salami slicing." Due to the use of the identical hypothesis, methodologies, and subjects in all studies. Avoid publishing papers based on the same findings by not dividing the investigation into smaller subgroups.

- Avoid falsifying or misrepresenting data or results.
- Do not engage in a picture or video modification or any other sort of illustrative work.

The researcher must be truthful in his or her reporting of the data. Misconduct in research is a severe offence.

- The author should maintain the raw data if requested throughout the editorial review process. Additionally, the researcher must disclose her personal or financial interests and avoid prejudice.
- Individuals, cultures, religions, etc., should not be singled out for criticism by academics. They should follow the moral rules of their community.
- Act honestly and keep promises. Do not mistreat somebody because of their race, ethnicity, or other factors.
- Negligence and carelessness should be avoided at all costs. Be critical of work and document all you do. Be receptive to feedback.
- The researcher needs to keep records and other sensitive information private when used by him or her.
- The research must add to the knowledge that is already out there. Avoiding duplication is essential.
- As a researcher, you must adhere to all local laws and ordinances.
- As a researcher, you should report both positive and negative findings that you come across during your work.
- Ensure that all research activities are conducted openly and transparently.
- It is not just the researcher and editor who have ethical responsibilities to ensure that findings from a study are made public. Sponsors, publishers, and reviewers of the research also have to make sure that the findings are made public.
- An acknowledgement form should be completed for everybody who assisted the researcher in carrying out the study in any way.
- Researchers in their early stages often send the same piece of work to multiple reviewers or journals at once. It is morally wrong to do so. Stay away from this type of behaviour.
- International copyright rules, ethical conduct, and cost-effective resource utilization are all violated when previously published research papers or articles are resubmitted to journals with just slight changes.
- The sponsor of the study, the connections of the institutions involved, and any conflicts of interest must be fully stated in the final report.

10.7 COMMITTEE ON RESEARCH ETHICS

There are no research ethics committees in Indian universities. Researchers have little choice but to rely on their common sense to remove or reduce a wide range of critical ethical dilemmas that arise during their research. A unified strategy or framework, both at the domestic and national levels, to aid Indian researchers in tackling ethical challenges is, thus, necessary. The following recommendations may be beneficial:

- All Indian universities must have departmental or faculty-level research ethics committees because the challenges raised by diverse research methodologies differ.
- For this committee to function correctly, it needs to be open to the public, free of bias from the researcher, the sponsor, and anybody else with a vested interest.
- Before starting a study, researchers can submit their research protocols to these committees for advice, improvement, and approval.
- They may assist in raising knowledge of the do and don'ts of research by serving on committees such as the Research Ethics Committee. In contentious instances, the committees may serve as mediators and advisors.
- As a result of the rise in ethical difficulties brought on by technological advancements, these committees may provide advice on any of these issues.
- A research culture based on defensible norms of research procedures may be fostered by such ethical committees within an organization's research environment. India's research ethics committees must be dedicated to the highest quality, fair, and responsible research ethics.
- The panels may also keep track of the progress of ongoing research. Additionally, the researcher may provide committee members with updates on current events and topics and the current state of their research projects.
- The researchers must provide a final report to the committee to summarize the study's findings and conclusions.

10.8 ETHICAL ISSUES IN INTERNET-BASED RESEARCH

- In the general research landscape, the role of the internet has been growing (Gelinias et al., 2017). Researchers worldwide rely on internet-based approaches to data collection (Lafferty & Manca, 2015).

- Researchers nowadays prefer to collect data through online research. Online and web surveys aren't the only ways to get information these days.
- There are also new ways to get data, like looking at interactive spaces like blogs, websites, chat rooms, social media sites, etc. Accessing participants through social networking sites such as Facebook, Twitter, and LinkedIn have become increasingly frequent.
- Respect for autonomy, justice, and beneficence are among the general values that underlie ethical practice in online research, as they are in any research involving human beings (Kitchin, 2007).
- The option to participate in the study should be up to each participant, but those who cannot do so should be protected (Kitchin, 2007). Online research necessitates that researchers safeguard internet users' personal information and avoid sharing anything that could be construed as revealing that information (Gelinis et al., 2017). The involvement of survey participants must always be voluntary. Respondents should be informed about the nature of this study and the objectives for which their data will be utilized. Respondents should not be asked to provide personal information about themselves or others without permission. It's critical to protect their identities, and the investigator must ensure that the data isn't used for anything other than what it was acquired for.
- Data that can be used to identify an individual should be kept separate from other study data.
- It is essential that respondents are informed about the length of the survey and that they are provided with links to data protection documents such as privacy policies and cookie policies, as well as information about how to use a software package at the start of the survey, all of which should be in plain English.
- Without the respondent's consent, no survey software should be installed on their computer, and even with consent, respondents should be able to remove any such program.
- Respondents should have the right to request that their records be deleted, and the researcher should comply with such requests if possible.
- The researcher should make it clear where the email addresses came from and make sure that the people on the list have agreed to be contacted in the future for research purposes before they are used in a survey.

10.9 A TEMPLATE FOR INFORMED CONSENT INVESTIGATORS' NOTE:

Investigators are recommended to use as simple and unambiguous as feasible when writing informed consent letters. This template can also be

used to create informed consent letters by researchers. It is permissible to use different terminology or format. Except for the "Consent" part, the consent form should be written in the second person ("You are invited...").

The phrase "Informed Consent" should appear in the header, followed by the study's title. If your consent letter is longer than one page, include the participant's initials in the footer. Include any essential elements of informed consent that are relevant to your research. Components that are relevant to your study must be included.

RESEARCH TITLE

[Insert a title here]

PRINCIPAL INVESTIGATOR

[Insert Contact details of Principal Investigator]

RESEARCH OBJECTIVES

You have been requested to participate in a research project. Before you decide to take part in this study, you must understand why it is being conducted and what you'll be doing. Please take your time to read the following material. Please contact the researcher if you have any questions or require extra information.

The objectives of this study are to [accurately describe the study's objectives]

PROCEDURE OF THE STUDY

List all techniques used in the study, preferably in chronological order. Any procedures that are considered experimental should be noted. Using non-technical language, clearly explain technical terminology. All methods should be explained in language appropriate for the participants' assumed reading level.

If applicable, provide the time commitment expected of participants per appointment and the study's length. Provide information about the usage of audiotaping, videotaping, or filming techniques if they will be employed.

RISKS

It is essential to list any risks that could happen during the study and any steps that will be taken to reduce the risks.

You have the option of refusing to answer any or all questions. You can also end your participation at any moment.

BENEFITS

Make a list of the advantages you believe this research will bring. Include benefits for participants, other stakeholders, and scientific

knowledge. Make it clear unless there is no direct advantage to the participant. "There will be no direct benefit to you as a result of your participation in this study," for example. However, we believe that the findings of this study will help...

CONFIDENTIALITY

This [survey] is entirely anonymous. On your [survey], please do not include any personally identifiable information. Alternatively, you will not be able to remain anonymous in this study. Your data will be kept private by the researcher., including the following:

[Explain the steps taken to maintain confidentiality, such as those indicated below:

- Keeping notes, interview transcripts, and other identifiable participant information in a closed file cabinet.
- assigning individuals to code names/numbers that will be used throughout the research notes and documentation.]

VOLUNTARY PARTICIPATION

It is totally up to you whether you choose to participate in this study. Whether or not you engage in this study is entirely up to you. If you decide to participate in this study, you will sign the informed consent form. After obtaining informed consent, you have the option to withdraw your consent at any time and without providing a reason. If you withdraw from this study, it will not affect your relationship with the researcher. Your personal information will be returned to you or deleted if you cancel the survey before completing the data collection.

CONSENT

I have read, and I understand the information that has been given to me. I have also had the chance to ask questions. To be clear, I realize that my participation in this program is entirely optional and that I am free to leave at any moment without explanation. I understand that a copy of this consent form will be provided to me. I gladly agree to take part in this research.

Investigator's signature _____ Date _____

Participant's signature _____ Date _____

CHECK YOUR PROGRESS

- 1) Define the term “ Ethics” and “ Research Ethics”.
- 2) Briefly discuss the importance of research ethics.
- 3) Define honesty, integrity and objectivity with respect to components of researchethics.
- 4) What is fabrication, falsification, and plagiarism with respect to research ethics?
- 5) What is informed consent in research? Discuss informed consent in detail.
- 6) Discuss the Components of the Informed Consent Form.
- 7) List out ethical considerations in internet based research.
- 8) List out general ethical considerations in research.

Write Short notes on

- 1) Importance of research ethics.
- 2) Components of research ethics.
- 3) Types of research misconduct.
- 4) Committee on research ethics.

Multiple choice question

- 1) **Which of the following research steps is the least prone to ethical violations?**
 - a. Identifying the research variable
 - b. Data collection
 - c. Reporting research outcomes
 - d. Data analysis procedure
- 2) **Which of the following is an unethical practice?**
 - a) Avoiding duplication
 - b) Avoiding plagiarism
 - c) Avoiding manipulation
 - d) Avoiding reliable information
- 3) **Plagiarism in research is _____**
 - a) using previous data creatively
 - b) copying without due care and then using it
 - c) citing someone
 - d) referring to old data and revising it in light of new objectives
- 4) **A researcher publishes a new research using data from an earlier study, this is**
 - a) Unethical
 - b) Ethical
 - c) Permissible
 - d) Proper

- 5) **As a researcher, what is your ethical response if you discover sensitive information during the collecting of data from a sample?**
- Informing family members about the information.
 - Sharing the information with your college friends.
 - Disseminating the information to the wider public.
 - Maintaining the confidentiality of the information.
- 6) **The deliberate manipulation of research materials, equipment, or procedures, or the alteration or omission of data or results, with the intent of creating an inaccurate record of the research, is called**
- Plagiarism
 - Falsification
 - Informed consent
 - Fabrication
- 7) **The act of fabricating results and then recording or reporting them.**
- Fabrication
 - Plagiarism
 - Informed consent
 - Falsification
- 8) **concerned about the agreements and commitments before the investigation is called**
- Honesty
 - Informed consent
 - Integrity
 - Objectivity
- 9) **The following are the two most important aspects of research responsibility: sincerity in work and avoiding**
- Plagiarism
 - Research techniques
 - Writing the thesis
 - Confidentiality

Answer Keys :

1. a 2.d 3.b 4.a 5.d 6.b 7.a 8.c 9.a

True or False

- Plagiarism is unethical, but there is no legal action that can be done against the plagiarizer.
 - True
 - False
- Ethics in research lays the bounds of discipline for a researcher.
 - True

- b) False
- 3. The standard of research ethics varies from one person to the next.
 - a) True
 - b) False
- 4. The Institute is solely responsible for adhering to accepted research ethics.
 - a) True
 - b) False
- 5. It is not plagiarism when a researcher publishes previously published content on his own.
 - a) True
 - b) False

Answers

1. False 2. True 3. False 4. False 5. False

યુનિવર્સિટી ગીત

સ્વાધ્યાય: પરમં તપ:

સ્વાધ્યાય: પરમં તપ:

સ્વાધ્યાય: પરમં તપ:

શિક્ષણ, સંસ્કૃતિ, સદ્ભાવ, દિવ્યબોધનું ધામ
ડૉ. બાબાસાહેબ આંબેડકર ઓપન યુનિવર્સિટી નામ;
સૌને સૌની પાંખ મળે, ને સૌને સૌનું આત્મ,
દશે દિશામાં સ્મિત વહે હો દશે દિશે શુભ-લાભ.

અભણ રહી અજ્ઞાનના શાને, અંધકારને પીવો ?
કહે બુદ્ધ આંબેડકર કહે, તું થા તારો દીવો;
શારદીય અજવાળા પહોંચ્યાં ગુર્જર ગામે ગામ
ધ્રુવ તારકની જેમ ઝળહળે એકલવ્યની શાન.

સરસ્વતીના મયૂર તમારે ફળિયે આવી ગહેકે
અંધકારને હડસેલીને ઉજાસના ફૂલ મહેંકે;
બંધન નહીં કો સ્થાન સમયના જવું ન ઘરથી દૂર
ઘર આવી મા હરે શારદા દૈન્ય તિમિરના પૂર.

સંસ્કારોની સુગંધ મહેંકે, મન મંદિરને ધામે
સુખની ટપાલ પહોંચે સૌને પોતાને સરનામે;
સમાજ કેરે દરિયે હાંકી શિક્ષણ કેરું વહાણ,
આવો કરીયે આપણ સૌ
ભવ્ય રાષ્ટ્ર નિર્માણ...
દિવ્ય રાષ્ટ્ર નિર્માણ...
ભવ્ય રાષ્ટ્ર નિર્માણ