VELS
INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI

# DCMBA-26

# Research Methodology


**MBA**
ODL MODE
(Semester Pattern)

**School of Management Studies and Commerce**
Centre for Distance and Online Education
Vels Institute of Science, Technology and Advanced Studies (VISTAS)
Pallavaram, Chennai - 600117

# Vels Institute of Science, Technology and Advanced Studies

## Centre for Distance and Online Education

## Master of Business Administration (MBA)
## ODL Mode

(Semester Pattern)

# DCMBA-26: Research Methodology

**(4 Credits)**

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## FOREWORD

**Dr.Ishari K Ganesh**
**Chancellor**

Vels Institute of Science, Technology and Advanced Studies (VISTAS), Deemed-to-be University, was established in 2008 under section 3 of the Act of 1956 of the University Grants Commission(UGC), Government of India, New Delhi.

VISTAS has blossomed into a multi-disciplinary Institute offering more than 100 UG & PG Programmes, besides Doctoral Programmes, through 18 Schools and 46 Departments. All the Programmes have the approval of the relevant Statutory Regulating Authorities such as UGC, UGC-DEB, AICTE, PCI, BCI, NCTE and DGS.

Our University aims to provide innovative syllabi and industry-oriented courses, and hence, the revision of curricula is a continuous process. The revision is initiated based on the requirement and approved by the Board of Studies of the concerned Department/School. The courses are under Choice Based Credit Systems, which enables students to have adequate freedom to choose the subjects based on their interests.

I am pleased to inform you that VISTAS has been rendering its services to society to democratize the opportunities of higher education for those who are in need through Open and Distance Learning (ODL) mode.

VISTAS ODL Programmes offered have been approved by the University Grants Commission (UGC) – Distance Education Bureau (DEB), New Delhi.

The Curriculum and Syllabi have been approved by the Board of Studies, Academic Council, and the Executive Committee of the VISTAS, and they are designed to help provide employment opportunities to the students.

The MBA ODL Programme Study Materials have been prepared in the Self Instructional Mode (SIM) format as per the UGC-DEB (ODL & OL) Regulations 2020. It is highly helpful to the students, faculties and other professionals. It gives me immense pleasure to bring out the ODL programme with the noble aim of enriching learners' knowledge. I extend my congratulations and appreciation to the Programme Coordinator and the entire team for bringing up the ODL Programme in an elegant manner.

At this juncture, I am glad to announce that the syllabus of this ODL Programme has been made available on our website, **www.vistascdoe.in,** for the benefit of the student community and other knowledge seekers. I hope that this Self Learning Materials (SLM) will be a supplement to the academic community and everyone.

**CHANCELLOR**

## FOREWORD

**Dr.S.Sriman Narayanan**
**Vice-Chancellor**

My Dear Students!

Open and Distance Learning (ODL) of VISTAS gives you the flexibility to acquire a University degree without the need to visit the campus often. VISTAS-CDOE involves the creation of an educational experience of qualitative value for the learner that is best suited to the needs outside the classroom. My wholehearted congratulations and delightful greetings to all those who have availed themselves of the wonderful leveraged opportunity of pursuing higher education through this Open and Distance Learning Programme.

Across the World, pursuing higher education through Open and Distance Learning Systems is on the rise. In India, distance education constitutes a considerable portion of the total enrollment in higher education, and innovative approaches and programmes are needed to improve it further, comparable to Western countries where close to 50% of students are enrolled in higher education through ODL systems.

Recent advancements in information and communications technologies, as well as digital teaching and e-learning, provide an opportunity for non-traditional learners who are at a disadvantage in the Conventional System due to age, occupation, and social background to upgrade their skills.

VISTAS has a noble intent to take higher education closer to the oppressed, underprivileged women and the rural folk to whom higher education has remained a dream for a long time.

I assure you all that the Vels Institute of Science, Technology and Advanced Studies would extend all possible support to every registered student of this Deemed-to-be University to pursue her/his education without any constraints. We will facilitate an excellent ambience for your pleasant learning and satisfy your learning needs through our professionally designed curriculum, providing Open Educational Resources, continuous mentoring and assessments by faculty members through interactive counselling sessions.

VISTAS, Deemed- to- be University, brings to reality the dreams of the great poet of modern times, Mahakavi Bharathi, who envisioned that all our citizens be offered education so that the globe grows and advances forever.

I hope that you achieve all your dreams, aspirations, and goals by associating yourself with our ODL System for never-ending continuous learning.

With warm regards,

**VICE-CHANCELLOR**

## Course Introduction

The DCMBA-26 Course **"Research Methodology"** will provide you with an overview of the various research methods used when addressing a research question, including quantitative methods for analysing data, qualitative research, study design, literature review and how to write a scientific paper.

The Course Research Methodology has been divided in to five blocks and consisting of 16- Units.

**Block-1: Basics of Research** has been divided in to three Units. Unit-1 deals with Introduction to Management and provides an Introduction to Research, Unit- 2 explain about and 3 describe the Defining the Research Problem and Unit-3 presents about the Types of Research.

**Block-2**: **Design of Research** been divided in to two Units. Unit-4 explains about Research Design and the Unit-5 deals with the Basic Concepts Concerning Testing of Hypothesis.

**Block-3**: **Data Collection** has been split into four Units. Unit-6 discuss with the Collection of Data, Unit-7 deals with the Methods of Data Collection, Unit-8 focusing on Sources of Data Collection and Unit-9 focusing on Processing and Analysis of Data.

**Block-4: Sampling** has been split into five Units. Unit-10 discuss about the Sampling Fundamentals, Unit-11 explains about Measurement in Research, Unit-12 describes about the Scaling Techniques, Unit-13 deals with the Testing of Significance and Unit-14 discuss about the Parametric and Non- Parametric tests.

**Block-5: Interpretations and Report Writing** has been split into two Units. Unit-15 works with Interpretation techniques and the Unit-16 deals with Report Writing concepts.

# DCMBA-26: Research Methodology

## Block-1: Introduction

**Block-1: Basics of Research** has been divided in to three Units.

**Unit-1: Introduction to Research** explains about the Introduction and Meaning of Research, Purpose of Research, Characteristics of Research, Research Methods versus Methodology and Research Approaches.

**Unit-2: Defining the Research Problem** deals with Research Problem, Selecting the Problem and various Importance of Defining the Research Problem.

**Unit-3: Types of Research** presents about various Types of Research, Qualities of a Researcher, Importance of Research, Research Process and the Criteria of Good Research.

In all the Units of Block -1 **Basics of Research**, the Check your progress, Glossary, Answers to Check your progress and Suggested Reading has been provided and the Learners are expected to attempt all the Check your progress as part of study.

# Unit-1
# Introduction to Research

**STRUCTURE**



## Overview

Research methods are the strategies, processes or techniques utilized in the collection of data or evidence for analysis in order to uncover new information or create better understanding of a topic.

In this unit, the Meaning of Research, the Purpose of Research, the various Characteristics of Research, the Research Methods versus Methodology and the Research Approaches has been clearly explained.

## Objectives

After completion of this Unit, you will be able to understand:

- Some of the reasons for doing research
- How research can be used to gather evidence to inform your practice
- The applications of research

## 1.1. Introduction

Research is an essential and powerful tool in leading man towards progress. Without systematic research there would have been very little progress.

John W. Best has rightly said, “The secret of our cultural development has been research, pushing back the areas of ignorance by discovering new truths, which, in turn, lead to better ways of doing things and better products.”

Scientific research leads to progress in some field of life. New products, new facts, new concepts and new ways of doing things are being found due to ever-increasing significant research in the physical, the biological, the social and the psychological fields. Research today is no longer confined to the science laboratory.

## 1.2. Meaning of Research

Word ‘Research’ is comprising of two words = Re+Search. It means to search again. So, research means a systematic investigation or activity to gain new knowledge of the already existing facts. Research is an intellectual activity. It is responsible for bringing to light new knowledge. It is also responsible for correcting the present mistakes, removing existing misconceptions and adding new learning to the existing fund of knowledge. Research is considered as a combination of those activities which are removed from day-to-day life.

**Definitions of Research:**

The following are the important definitions of research:

“Research is an honest, exhaustive, intelligent searching for facts and their meanings or implications with reference to a given problem. The product or findings of a given piece of research should be an authentic, verifiable contribution to knowledge in the field studied.”

**- P.M. Cook**

“Research may be defined as a method of studying problems whose solutions are to be derived partly or wholly from facts.”

**- W.S. Monroes**

“Research is considered to be the more formal, systematic intensive process of carrying on the scientific method of analysis. It involves a more systematic STRUCTURE of investigation, usually resulting in some sort of formal record of procedures and a report of results or conclusion.”

**- John W. Best**

“Research comprises defining and redefining problems, formulating hypothesis or suggested solutions, collecting, organizing and evaluating data, making deductions and reaching conclusions and at last careful

testing the conclusions to determine whether they fit the formulated hypothesis."

- **Clifford Woody**

"Research is a systematic effort to gain new knowledge."

- **Redman & Mori**

## 1.3. Purpose of Research

The purpose of research is to discover answers to questions through the application of scientific procedure. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, some general objectives of research below:

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

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

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

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

## 1.4. Characteristics of Research

Following are the characteristics of research;

(i) Research is directed toward the solution of a problem.

(ii) Research requires expertise.

(iii) Research emphasizes the development of generalizations, principles, or theories that will be helpful in predicting future occurrences.

(iv) Research is based upon observable experience or empirical evidences.

(v) Research demands accurate observation and description.

(vi) Research involves gathering new data from primary or first-hand sources or using existing data for a new purpose.

(vii) Research is characterized by carefully designed procedures that apply rigorous analysis.

(viii) Research involves the quest for answers to un-solved problems.

(ix) Research strives to be objective and logical, applying every possible test to validate the procedures employed the data collected and the conclusions reached.

(x) Research is characterized by patient and unhurried activity.

(xi) Research is carefully recorded and collected.

(xii) Research sometimes requires courage.

## 1.5. Research Methods versus Methodology:

Research methods include all those techniques/methods that are adopted for conducting research. Thus, research techniques or methods are the methods that the researchers adopt for conducting the research studies. On the other hand, research methodology is the way in which research problems are solved systematically. It is a science of studying how research is conducted scientifically. Under it, the researcher acquaints himself/herself with the various steps generally adopted to study a research problem, along with the underlying logic behind them. Hence, it is not only important for the researcher to know the research techniques/methods, but also the scientific approach called methodology.

## 1.6. Research Approaches

There are two main approaches to research, namely

1. **Quantitative Approach** - The quantitative approach involves the collection of quantitative data, which are put to rigorous quantitative analysis in a formal and rigid manner. This approach further includes experimental, inferential, and simulation approaches to research.
2. **Qualitative Approach** - The qualitative approach uses the method of subjective assessment of opinions, behaviour and attitudes. Research in such a situation is a function of the researcher's impressions and insights.

The results generated by this type of research are either in non-quantitative form or in the form which cannot be put to rigorous quantitative analysis. Usually, this approach uses techniques like in depth interviews, focus group interviews, and projective techniques.

## Let us Sum up

In this unit, you have learned the following:

- The purpose of research is to find solutions through the application of systematic and scientific methods.
- The most important and difficult task of a researcher is to be as objective and neutral as possible. Good and effective research is identified by its nature, which signifies its focus on the research topic, a systematic way of implementation, and control over the variables and so on.
- Business managers in each field—whether human resources or production, marketing or finance—are constantly being confronted by problem situations that require effective and actionable decision making. Most of these decisions require additional information or information evaluation, which can be best addressed by research.

## Check your Progress

1. Who defined “Research” as “systematized effort to gain new knowledge”
   a. Tom & Zerry
   b. Redman and Mory
   c. F.W Taylor
   d. Ross Taylor
2. The main purpose of research in education is to_____
   a. help in individual’s personal growth
   b. increase the social prestige of an individual
   c. increase individual’s market value of jobs
3. Which of the following does not correspond to characteristics of research?
   a. Research is not passive
   b. Research is systematic
   c. Research is not a problem-oriented
   d. Research is not a process

## Glossary

| | |
|---|---|
| **Fundamental Research:** | It focuses on finding generalizations and formulating theories. |
| **Applied Research:** | It aims at finding a solution for an immediate problem facing a society or a business/industrial organization. |
| **Empirical Research:** | It relies only on real experiences and observations. |
| **Social Research:** | This refers to research conducted by social scientists in order to analyse a vast breadth of social phenomena. |
| **Quantifiable:** | It means something that is able to be expressed or measured as a quantity. |

### Answer to Check your Progress

1. Redman and Mory
2. help in individual's personal growth
3. Research is not a process

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-2
# Defining the Research Problem

**STRUCTURE**



## Overview

A research problem is a specific issue or gap in existing knowledge that you aim to address in your research. You may choose to look for practical problems aimed at contributing to change, or theoretical problems aimed at expanding knowledge.

In this Unit, the concept of Research Problem, Selecting the Problem and the Importance of Defining the Problem has been clearly explained.

## Objectives

After completion of this unit, you will be able to understand:

- The Characteristics and requirements of the research process
- Formulating a research problem
- Identify the selection of the problem
- Report the understanding of problem
- State about necessity of defined problem

## 2.1 Research Problem

A research problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same. Usually, we say that a research problem does exist if the following conditions are met with:

(i) There must be an individual (or a group or an organisation), let us call it '*I*,' to whom the problem can be attributed. The individual or the organisation, as the case may be, occupies an environment, say '*N*', which is defined by values of the uncontrolled variables, *Yj*.

(ii) There must be at least two courses of action, say *C*1 and *C*2, to be pursued. A course of action is defined by one or more values of the controlled variables. For example, the number of items purchased at a specified time is said to be one course of action.

(iii) There must be at least two possible outcomes, say *O*1 and *O*2, of the course of action, of which one should be preferable to the other. In other words, this means that there must be at least one outcome that the researcher wants, i.e., an objective.

(iv) The courses of action available must provide some chance of obtaining the objective, but they cannot provide the same chance, otherwise the choice would not matter. In simple words, we can say that the choices must have unequal efficiencies for the desired outcomes.

**The components of a research problem as under:**

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

(ii) There must be some objective(s) to be attained at. If one wants nothing, one cannot have a problem.

(iii) There must be alternative means (or the courses of action) for obtaining the objective(s) one wishes to attain. This means that there must be *at least two means* available to a researcher for if he has no choice of means, he cannot have a problem.

(iv) There must remain some doubt in the mind of a researcher with regard to the selection of alternatives. This means that research must answer the question concerning the relative efficiency of the possible alternatives.

(v) There must be some environment(s) to which the difficulty pertains.

Thus, a research problem is one which requires a researcher to find out the best solution for the given problem, i.e., to find out by which course of action the objective can be attained optimally in the context of a given environment. There are several factors which may result in making the problem complicated.

## 2.2. Selecting the Problem

The research problem undertaken for study must be carefully selected. The task is a difficult one, although it may not appear to be so. Every researcher must find out his own salvation for research problems cannot be borrowed. A problem must spring from the researcher's mind like a plant springing from its own seed. The following points may be observed by a researcher in selecting a research problem or a subject for research:

1. Subject which is overdone should not be normally chosen, for it will be a difficult task to throw any new light in such a case.
2. Controversial subject should not become the choice of an average researcher.
3. Too narrow or too vague problems should be avoided.
4. The subject selected for research should be familiar and feasible so that the related research material or sources of research are within one's reach. Even then it is quite difficult to supply definitive ideas concerning how a researcher should obtain ideas for his research. For this purpose, a researcher should contact an expert or a professor in the University who is already engaged in research.
5. The importance of the subject, the qualifications and the training of a researcher, the costs involved, and the time factor are few other criteria that must also be considered in selecting a problem. In other words, before the final selection of a problem is done, a researcher must ask himself the following questions:

   a. Whether he is well equipped in terms of his background to carry out the research?
   b. Whether the study falls within the budget he can afford?
   c. Whether the necessary cooperation can be obtained from those who must participate in research as subjects?

   If the answers to all these questions are in the affirmative, one may become sure so far as the practicability of the study is concerned.

6. The selection of a problem must be preceded by a preliminary study. This may not be necessary when the problem requires the conduct of a research closely similar to one that has already

been done. But when the field of inquiry is relatively new and does not have available a set of well developed techniques, a brief feasibility study must always be undertaken.

## 2.3. Importance of Defining the Problem

This statement signifies the need for defining a research problem. The problem to be investigated must be defined unambiguously for that will help to discriminate relevant data from the irrelevant ones. A proper definition of research problem will enable the researcher to be on the track whereas an ill-defined problem may create hurdles. And similar other questions crop up in the mind of the researcher who can well plan his strategy and find answers to all such questions only when the research problem has been well defined.

Thus, defining a research problem properly is a prerequisite for any study and is a step of the highest importance. In fact, formulation of a problem is often more essential than its solution. It is only on careful detailing the research problem that we can work out the research design and can smoothly carry on all the consequential steps involved while doing research.

## Let us Sum up

In this unit, you have learned the following:

- Problem discovery puts the research process into action and identification of the problem is the first step towards its solution.
- The significance of a clear and well-defined research problem cannot be overemphasized, as an ambiguous and general issue does not lend itself to scientific enquiry.
- A problem definition indicates a specific managerial decision area to be clarified or a particular problem to be solved. It specifies research questions to be answered and the objectives of the research.
- Another significant source for deriving the research problem is the industry and organizational data.
- Sometimes the expert interview, secondary data and organizational information might not be enough to define the problem. In such a case, an exploratory qualitative survey might be required to get an insight into the behavioural or perceptual aspects of the problem.

- Once the audit process of secondary review and interviews and survey is over, the researcher is ready to focus and define the issues of concern, that need to be investigated further, in the form of an unambiguous and clearly-defined research problem.

## Check your Progress

1. A research problem can be defined as _____ in the decision makers' existing body of knowledge which inhibits efficient decision making.
2. The management research problem has to be converted into a _____ before it can be tested.
3. The management decision problem can be tested, that is, subjected to research inquiry. (True/false)

## Glossary

**Research Problem:** It 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.

**Research Objectives:** They refer to the description of what is to be achieved by the study.

**Audit:** It means an official inspection of an organization's accounts, typically by an independent body.

**Hypothesis:** It refers to a supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation.

**Thesis:** It is a statement or theory that is put forward as a premise to be maintained or proved.

## Answer to Check your Progress

1. A gap
2. Research problem
3. False

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-3
# Types of Research

**STRUCTURE**



## Overview

Understanding and having a deep knowledge about the types of research can help the researchers to better plan the project by utilizing the most appropriate methodologies and techniques. It plays a vital role for the researchers to prove the hypothesis based on clearly defined parameters, environments and assumptions.

In this unit, the Types of Research, Qualities of a Researcher, Importance of Research, the Research Process and the Criteria of Good Research has been explained.

## Objectives

After completion of this unit, you will be able to explain:

- The Types of research from the perspective of applications, objectives and enquiry modes and
- Research paradigms.

## 3.1. Types of Research

There are varieties of ways through which we may classify it into different categories.

**(A) On the basis of nature of information:**

On the basis of nature of information, we can classify the research into two types;

Qualitative Research: Qualitative research is concerned with positive events, or more specifically, with things that affect or affect the good or the good. For example, an important aspect of qualitative research is "motivational research," which explores the causes of certain human behaviors. It refers to things that have the ability to quantify or say a lot. It involves measuring the quantity or quantity. Such studies are analyzed using various statistical and economic methods.

These include correlation, regression and time series analysis, among others.

**(B) On the basis of utility of content or nature of subject matter of research:**

On the basis of these criteria we can categorize the research into two categories.

i. Descriptive: Descriptive research consists of surveys and fact-finding enquiries of different types. The main objective of descriptive research is describing the state of affairs as it prevails at the time of study. The term ‘ex post facto research’ is quite often used for descriptive research studies in social sciences and business research.

ii. Analytical: The Analytical research, the researcher has to use the already available facts or information, and analyse them to make a critical evaluation of the subject.

iii. Basic/Fundamental/pure or Theoretical Research.

Basic research often involves the development and refinement of theories. In other words, "togather information is called 'pure' or ' basic' research". Pure mathematics or the study of certinnatural p henomena are examples of basic science.

iv. Experimental or Applied Research:

An attempt to find a solution to a pressing problem facing a company, business, business organization or society is called research. Researchers who do this type of research to draw some conclusions about a social or economic problem.

**(C) On the basis of approach of research:**

We may classify research into two different categories.

i. Longitudinal Research: Examples of this category are historical, Case study and Genetic research.

ii. Cross-Sectional Research: Examples of this category are Experimental and Survey Research.

**(D) On the basis of method of research:**

On the basis of research method we may classify a research into five different categories.

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

i. Philosophical Research: It is purely qualitative in nature and we are focusing on the vision of others on the content of research.

ii. Historical Research: It is both qualitative as well as quantitative in nature and deals with past events.

iii. Survey Research: It deals with present events and is quantitative in nature. It may further be sub-divided into; discretional, correlation and exploratory type of research.

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

v. Case-Study Research: It deals with unusual events. It may be qualitative as well as quantitative in nature depending upon the content.

## 3.2. Qualities of a Researcher

It is important for a researcher to possess certain qualities to conduct research. First and foremost, he being a scientist should be firmly committed to the ‘articles of faith’ of the scientific methods of research.

This implies that a researcher should be a social science person in the truest sense. Sir Michael Foster identified a few distinct qualities of a scientist. According to him, a true research scientist should possess the following qualities:

1. The nature of a researcher must be of the temperament that vibrates in unison with the theme which he is searching. Hence, the seeker of knowledge must be truthful with truthfulness of nature, which is much more important, much more exacting than what is sometimes known as truthfulness. The truthfulness relates to the desire for accuracy of observation and precision of statement.
2. A researcher must possess an alert mind. Nature is constantly changing and revealing itself through various ways. A scientific researcher must be keen and watchful to notice such changes, no matter how small or insignificant they may appear. Such receptivity has to be cultivated slowly and patiently over time by the researcher through practice. Research demands a systematic immersion into the subject matter by the researcher grasp even the slightest hint that may culminate into significant research problems.
3. Scientific enquiry is pre-eminently an intellectual effort. It requires the moral quality of courage, which reflects the courage of a steadfast endurance. The process of conducting research is not an easy task. There are occasions when a research scientist might feel defeated or completely lost. This is the stage when a researcher would need immense courage and the sense of conviction. The researcher must learn the art of enduring intellectual hardships.

## 3.3. Importance of Research

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

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

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

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

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

## 3.4. Research Process

Research process consists of series of actions or steps necessary to effectively carry out research. These actions or steps are; (i) Formulating the Research Problem (ii) Extensive Literature Survey (iii) Developing the Research Hypothesis (iv) Preparing the Research Design (v) Determining the Research Design (vi) Collecting the Research Data (vii) Execution of Project (viii) Analysis of the Data (ix) Hypothesis Testing (x) Generalization and Interpretations (xi) Preparing of Report or Presentation of the Result.

**(i) Formulation of Research Problem:** At the very outset, the researcher must decide the general area of interest or aspect of a subject matter that he would like to inquire into and then research problem should be formulated.

**(ii) Extensive Literature Survey:** Once the problem is formulated the researcher should undertake extensive literature survey connected with the problem. For this purpose, the abstracting and indexing journals and published or unpublished bibliographies are the first place to go to academic journals, conference proceedings, government reports, books etc. must be tapped depending on the nature of the problem.

**(iii) Development of Working Hypothesis:** After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses. Working hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. It's very important or it provides the focal point for research.

**(iv) Preparing the Research Design:** After framing hypothesis we have to prepare a research design i.e. we have to state the conceptual STRUCTURE within which research would be conducted. The preparation of such a design facilitates research to be as efficient as possible yielding maximal information. In other words, the function of research design is to provide for the collection of relevant evidence with optimum effort, time and

expenditure. But how all these can be achieved depends mainly on the research purpose.

**(v) Determining Sample Design:** A sample design is a definite plan determined before any data is actually collected for obtaining a sample from a given population. In census inquiry we involve a great deal of time, money and energy so it not possible in practice under many circumstances. Sample designs can be either probability or non-probability. With probability samples each element has a known probability of being included in the sample but the non-probability samples do not allow the researchers to determine this probability.

**(vi) Collecting the Data:** There are several ways of collecting the appropriate data which differ considerably in context of cost, time and other resources at the disposal of the researcher. Primary data can be collected either through experiment or through survey. In case of survey, data can be collected by any one or more of the following ways;

- By observation,
- Through personal interview,
- Through telephonic interviews,
- By mailing of questionnaires or
- Through schedules.

**(vii) Execution of the Project:** Execution of project is a very important step in the research process. If the execution of the project proceeds on correct lines, the data to be collected would be adequate and dependable .A careful watch should be kept for unanticipated factors in order to keep the survey realistic as much as possible.

**(viii) Analysis of Data:** The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding, tabulation and then drawing statistical inference. Analysis work after tabulation is generally based on the computation of various percentages; coefficients etc., by applying various well defined statistical formulae. In the process of analysis, relationships of differences supporting or conflicting with original or new hypothesis should be subjected to tests of significance to determine with what validity data can be said to indicate any conclusions

**(ix) Hypothesis Testing:** After analyzing the data, the researcher is in a position to test the hypothesis, if any, he had formulated earlier. Do the facts support the hypothesis or they happen to be contrary? This is the usual question which is to be answered by applying various tests like 't' test, 'F' test etc. F test have been developed by statisticians for the purpose .Hypothesis testing will result in either accepting the hypothesis or in rejecting it. If the researcher had no hypothesis to start with, generalizations established on the basis of data may be stated.

**(x) Generalizations and Interpretation:** If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalization i.e. to build a theory. As a matter of fact, the real value of research lies in its ability to arrive at certain generalizations. If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as interpretation.

**(xi) Preparation of the Report or the Thesis:** Finally, the researcher has to prepare the report of what has been done by him. The layout of the report should be as follows; the preliminary pages, the main text and end matter. The preliminary pages carry title, acknowledgements and forward and then index. The main text of the report should have introduction, review of literature and methodology.

## 3.5. Criteria of Good Research

One expects scientific research to satisfy the following criteria:

a. The purpose of the research should be clearly defined and common concepts be used.

b. The research procedure used should be described in sufficient detail to permit another researcher to repeat the researcher for further advancement, keeping the continuity of what has already been attained.

c. The procedural design of the research should be carefully planned to yield results that are as objective as possible.

d. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.

e. The analysis of data should be sufficiently adequate to reveal its significance and the methods of analysis used should be

appropriate. The validity and reliability of the data should be checked carefully.

f. Conclusions should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis.

g. Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

## Let Us Sum Up

In this unit, you have learned about the followings:

- The types of research depend on the field in which the specific research study is performed.
- The researchers in quantitative research classify features of the research and then build the statistical models to explain what he observes.
- The process of research is implemented as a series of actions or steps that are essentially performed in a specific order. These actions or activities usually overlap each other rather than pursuing a specific sequence.
- A hypothesis is an uncertain statement that involves the proposed answer to the problem. The hypothesis statement provides high priority to accountability and responsibility of research procedure.
- Having identified and defined the variables under study; the next step requires operational the stated relationship in the form of a theoretical framework. This is an outcome of the problem audit conducted prior to defining the research problem.
- The theoretical framework, once formulated, is a powerful driving force behind the research process and ought to be comprehensively developed.

## Check your Progress

1. The research that is especially carried out to test and validate the study hypotheses is termed

   a. Fundamental research

   b. Applied research

c. Conclusive research

d. Exploratory research

2. The research studies that explore the effect of one thing on another and more specifically, the effect of one variable on another are known as

   a. Causal research

   b. Applied research

   c. Conclusive research

   d. Exploratory research

3. In basic research, the context is vast and the time period is flexible. (True/false)

## Glossary

**Questionnaire:** It refers to a set of printed or written questions with a choice of answers, devised for the purposes of a survey or statistical study.

**Case Studies:** It refers to process or records of research into the development of a particular person, group, or situation over a period of time.

**Ethnography:** It refers to the scientific description of peoples and cultures with their customs, habits, and mutual differences.

**Focus Group:** It refers to a group of people assembled to participate in a discussion about a product before it is launched, or to provide feedback on a political campaign, television series, etc.

## Answer to Check your Progress

1. c. Conclusive research

2. a. Causal research

3. True

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.

2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.

**3.** Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

## Block-2: Introduction

**Block-2: Design of Research –** has been divided in to two Units.

**Unit-4: Research Design deals the Research Design concepts of** Introduction, Features of Research Design, Types of Research Design, and the Characteristics of a Good Research Design.

**Unit-5: Hypothesis Testing explain about the concept of** Hypothesis and its Meaning, the Characteristics of Hypothesis, the Basic Concepts Concerning Testing of Hypothesis and the various Limitations of Tests of Hypothesis.

In all the units of Block -2 **Design of Research**, the Check your progress, Glossary, Answers to Check your progress and Suggested Reading has been provided and the Learners are expected to attempt all the Check your progress as part of study.

# Unit-4
# Research Design

**STRUCTURE**



## Overview

Research design is the framework of research methods and techniques chosen by a researcher to conduct a study. The design allows researchers to sharpen the research methods suitable for the subject matter and set up their studies for success.

In this unit, the Features of Research Design, various Types of Research Design and the Characteristics of a Good Research Design has been clearly explained.

## Objectives

After studying this unit, you will be able to:

- Define research design
- Describe the need of research design
- Explain the different types of research design
- Identify the Secondary data and qualitative research
- Recognize the Descriptive research design
- Label the causal research design

## 4.1. Introduction

A research design helps to decide upon issues like what, when, where, how much, by what means etc. A research design is the arrangement of

conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. In fact, research design is the conceptual STRUCTURE within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data (Selltiz et al, 1962). Thus, research design provides an outline of what the researcher is going to do in terms of framing the hypothesis, its operational implications and the final data analysis. Specifically, the research design highlights decisions which include:

1. The nature of the study
2. The purpose of the study
3. The location where the study would be conducted
4. The nature of data required
5. Where the required data can be collected
6. What time period the study would cover
7. The type of sample design that would be used
8. The techniques of data collection that would be used
9. The methods of data analysis that would be adopted
10. The manner in which the report would be prepared

In view of the stated research design decisions, the overall research design may be divided into the following (Kothari 1988):

a. The sampling design that deals with the method of selecting items to be observed for the selected study;

b. The observational design that relates to the conditions under which the observations are to be made;

c. The statistical design that concerns with the question of how many items are to be observed, and how the information and data gathered are to be analysed;

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

## 4.2. Features of Research Design

The important features of Research Design may be outlined as follows:

i. It constitutes a plan that identifies the types and sources of

information required for the research problem;

ii. It constitutes a strategy that specifies the methods of data collection and analysis which would be adopted; and

iii. It also specifies the time period of research and monetary budget involved in conducting the study, which comprise the two major constraints of undertaking any research.

## 4.3. Types of Research Design

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

1. Exploratory Research Design;
2. Descriptive and Diagnostic Research Design; and
3. Hypothesis-Testing Research Design.

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

2. **Descriptive and Diagnostic Research Design:** A Descriptive Research Design is concerned with describing the characteristics of a particular individual or a group. Meanwhile, a diagnostic research design determines the frequency with which a variable occurs or its relationship with another variable. In other words, the study analyzing whether a certain variable is associated with another comprises a diagnostic research study. On the other hand, a study that is concerned with specific predictions or with the narration of facts and characteristics related to an individual,

group or situation, are instances of descriptive research studies. Most of the social research design falls under this category. As a research design, both the descriptive and diagnostic studies share common requirements, hence they are grouped together. The procedure to be used and the research design need to plan carefully. The research design must also make appropriate provision for protection against bias and thus maximize reliability, with due regard to the completion of the research study in an economical manner. The research design in such studies should be rigid and not flexible. Besides, it must also focus attention on the following:

a. Formulation of the objectives of the study,

b. Proper designing of the methods of data collection,

c. Sample selection,

d. Data collection,

e. Processing and analysis of the collected data, and

f. Reporting the findings.

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

## 4.4. Characteristics of a Good Research Design

A good research design often possesses the qualities of being flexible, suitable, efficient, and economical and so on. Generally, a research design which minimizes bias and maximizes the reliability of the data collected and analysed is considered a good design (Kothari 1988). A research design which does not allow even the smallest experimental error is said to be the best design for investigation. Further, a research design that yields maximum information and provides an opportunity of viewing the various dimensions of a research problem is considered to be the most appropriate and efficient design. Thus, the question of a good design relates to the purpose or objective and nature of the research problem studied. While a research design may be good, it may not be equally suitable to all studies. In other words, it may be lacking in

one aspect or the other in the case of some other research problems. Therefore, no single research design can be applied to all types of research problems.

A research design suitable for a specific research problem would usually involve the following considerations:

- The methods of gathering the information;
- The skills and availability of the researcher and his/her staff, if any;
- The objectives of the research problem being studied;
- The nature of the research problem being studied; and
- The available monetary support and duration of time for the research work.

## Let us Sum up

In this unit, you have learned about the following:

- Research design is a STRUCTURE that gives an outline of the overall research work. It is the result of better planning and implementation of a good strategy.
- A good research design is characterized by flexibility, efficiency and low cost, but it has many other features too.
- Several research designs are classified on the basis of the study performed in the research. These research designs can be listed as follows:
- Research design in exploratory research studies, descriptive studies, quantitative studies, qualitative studies and experimental research studies.

## Check your Progress

1. A formal document that presents the research objectives, design of achieving these objectives, and the expected outcomes/deliverables of the study is called
   a. Research design
   b. Research proposal
   c. Research hypothesis
   d. Research report

2. The execution details of the research question to be investigated are referred to as the _____.
3. Research designs come _____ the problem formulation stage.

## Glossary

**Research Gap:** It is a research question or problem which has not been answered appropriately or at all in a given field of study.

**Random Selection:** It refers to how sample members (study participants) are selected from the population for inclusion in the study.

**Sample Distribution:** It is a probability distribution of a statistic obtained through a large number of samples drawn from a specific population.

**Research Design:** It is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the research problem research.

## Answer to Check your Progress

1. (b) Research proposal
2. Research design
3. After

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-5
# Hypothesis Testing

**STRUCTURE**



## Overview

A hypothesis test assesses your sample statistic and factors in an estimate of the sample error to determine which hypothesis the data support.

## Objectives

After studying this unit, you will be able to:

- Identify the Steps involved in Hypothesis Testing
- Resolve the errors in Hypothesis Testing

## 5.1. Hypothesis - Meaning

“Hypothesis may be defined as a proposition or a set of propositions set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation in the light of established facts” (Kothari, 1988). A research hypothesis is quite often a predictive statement, which is capable of being tested using scientific methods that involve an independent and some dependent variables. For instance, the following statements may be considered:

i. “Students who take tuitions perform better than the others who do not receive tuitions” or,

ii. “The female students perform as well as the male students”.

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

## 5.2. Characteristics of Hypothesis

A hypothesis should have the following characteristic features:-

i. A hypothesis must be precise and clear. If it is not precise and clear, then the inferences drawn on its basis would not be reliable.

ii. A hypothesis must be capable of being put to test. Quite often, the research programmes fail owing to its incapability of being subject to testing for validity. Therefore, some prior study may be conducted by the researcher in order to make a hypothesis testable. A hypothesis "is tested if other deductions can be made from it, which in turn can be confirmed or disproved by observation" (Kothari, 1988).

iii. A hypothesis must state relationship between two variables, in the case of relational hypotheses.

iv. A hypothesis must be specific and limited in scope. This is because a simpler hypothesis generally would be easier to test for the researcher. And therefore, he/she must formulate such hypotheses.

v. As far as possible, a hypothesis must be stated in the simplest language, so as to make it understood by all concerned. However, it should be noted that simplicity of a hypothesis is not related to its significance.

vi. A hypothesis must be consistent and derived from the most known facts. In other words, it should be consistent with a substantial body of established facts. That is, it must be in the form of a statement which is most likely to occur.

vii. A hypothesis must be amenable to testing within a stipulated or reasonable period of time. No matter how excellent a hypothesis, a researcher should not use it if it cannot be tested within a given period of time, as no one can afford to spend a life-time on collecting data to test it.

viii. A hypothesis should state the facts that give rise to the necessity of looking for an explanation. This is to say that by using the

hypothesis, and other known and accepted generalizations, a researcher must be able to derive the original problem condition. Therefore, a hypothesis should explain what it actually wants to explain, and for this it should also have an empirical reference.

## 5.3. Basic Concepts Concerning Testing of Hypothesis

**(a) Null hypothesis and alternative hypothesis:**

The null hypothesis is generally symbolized as H0 and the alternative hypothesis as H1.

EX: If we are to compare method A with method B about its superiority and if we proceed on the assumption that both methods are equally good, then this assumption is termed as the null hypothesis. As against this, we may think that the method A is superior or the method B is inferior, we are then stating what is termed as alternative hypothesis.

**(b) The level of significance:**

It is always some percentage (usually 5%) which should be chosen with great care, thought and reason. In case we take the significance level at 5 per cent, then this implies that *Ho will be rejected.*

**(c) Type I and Type II errors:**

In the context of testing of hypotheses, there are basically two types of errors we can make. We may reject Ho when Ho is true and we may accept Ho when in fact Ho is not true. The former is known as Type I error and the latter as Type II error.

In other words, Type I error means rejection of hypothesis which should have been accepted and Type II error means accepting the hypothesis which should have been rejected. Type I error is denoted by α (alpha) known as α error, also called the level of significance of test; and Type II error is denoted by β (beta) known as β error.

## 5.4. Limitations of Tests of Hypothesis

(i) The tests should not be used in a mechanical fashion. It should be kept in view that testing is not decision-making itself; the tests are only useful aids for decision- making. Hence “proper interpretation of statistical evidence is important to intelligent decisions.”

(ii) Test does not explain the reasons as to why do the difference exist, say between the means of the two samples. They simply indicate whether the difference is due to fluctuations of

sampling or because of other reasons but the tests do not tell us as to which is/are the other reason(s) causing the difference.

(iii) Results of significance tests are based on probabilities and as such cannot be expressed with full certainty. When a test shows that a difference is statistically significant, then it simply suggests that the difference is probably not due to chance.

(iv) Statistical inferences based on the significance tests cannot be said to be entirely correct evidences concerning the truth of the hypotheses. This is specially so in case of small samples where the probability of drawing erring inferences happens to be generally higher. For greater reliability, the size of samples is sufficiently enlarged.

## Let Us Sum Up

In this unit, you have learned the following:

- When a researcher is working on original research, he would like to identify a need for his research somewhere close to the beginning of his paper.
- The researcher identifies the broad problem and states its importance. He also states what is significant in what has already been written. He describes the gap he proposes to fill in the existing research literature.
- A hypothesis should be open to testing so that other deductions can be made from it and can be confirmed or disproved by observation. The researcher should do some prior study to make the hypothesis testable.
- A hypothesis refers to a provisional idea whose merit needs evaluation, but has no specific meaning.
- The rejection of a hypothesis leads us to conclude that it is false. This way of putting the problem is convenient because of the uncertainty inherent in the problem.

## Check your Progress

1. Every research study always begins with a hypothesis. (True/ false)
2. The assumption about the expected result of the research is called the ___.
3. If one is making a proposition about the magnitude or behavior of a particular population, we call it a ___ hypothesis.

## Glossary

| | |
|---|---|
| **Objective:** | It refers to something not influenced by personal feelings or opinions in considering and representing facts. |
| **Deductive Reasoning:** | Something that is characterized by or based on the inference of particular instances from a general law. |
| **Inductive Reasoning:** | It is a method of reasoning in which the premises are viewed as supplying some evidence for the truth of the conclusion.<br><br>The truth of the conclusion of an inductive argument may be probable, based upon the evidence given. |
| **Proposition:** | It is a statement or assertion that expresses a judgement or opinion. |

## Answer to Check your Progress

1. True
2. Hypothesis
3. Descriptive

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

## Block-3: Introduction

**Block-3: Data Collection –** has been divided in to four Units.

**Unit-6: Classification of Data** deals with the Classification of Data, Types of Classification and Basic Principles in Classification of Data.

**Unit-7: Methods of Classification of Data** explains about the Methods of Classifying Data, Difference in the methods of Qualitative and Quantitative research.

**Unit-8: Sources of Data** discuss with the Sources of Data, Primary Data, Methods of Primary Data Collection, Secondary Data and Methods of Secondary Data Collection.

**Unit-9: Processing and Analysis of Data** presents about the Processing of Data, Editing of data, Coding of data, Tabulation of Data, Classification of data, Analysis of Data

In all the units of Block -3 **Data Collection**, the Check your progress, Glossary, Answers to Check your progress and Suggested Reading has been provided and the Learners are expected to attempt all the Check your progress as part of study.

# Unit-6
# Classification of Data

**STRUCTURE**



## Overview

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.

In this unit, Classification of Data, the Types of Classification and the Basic Principles in Classification of Data has been clearly explained.

## Objectives

After studying this unit, you will be able to:

- Recognize the methodology of collecting primary data
- Identify to design survey research

### 6.1. Classification of Data

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

## 6.2. Types of Classification

Classification can be one of the following two types, depending upon the nature of the phenomenon involved:

1. **Classification According to Attributes:** Data are classified on the basis of common characteristics which can either be descriptive or numerical. Descriptive characteristics refer to qualitative phenomenon which cannot be measured quantitatively; only their presence or absence in an individual item can be noticed.
2. **Classification According to Class-intervals:** Unlike descriptive characteristics, the numerical characteristics refer to quantitative phenomenon, which can be measured through some statistical units. Data relating to income, production, age, weight, etc. come under this category. Such data are known as statistics of variables and are classified on the basis of class intervals.

## 6.3. Basic Principles in Classification of Data

- **Classification should not be Ambiguous:** They very purpose of classification is to remove ambiguity. For this, homogeneity should be made the basis of classification. Various categories / groups should be clearly defined in classification. This avoids confusion in classification and facilitates analysis of concrete nature.
- **Classification should be on the basis of a single classification Principle:** The consideration for classification should be only one at a time. For example, buyers may be classified on the basis of economic or social status or frequency of purchases or the amount spent.
- **Classification should be Mutually Exclusive:** This means the answer given by a respondent should be suitable for placement under one classification only. There should be no overlapping of the categories after classification.
- **Classification should be Mutually Exhaustive:** Classification should cover all data under one category or the other. For this, all possible categories should be prepared at the time of classification. Answer of the respondents should not be omitted in the process of classification.
- **Classification should be Action-Oriented:** Classification should be devised keeping in view the future action to be taken

on the basis of the analysis and interpretation of data. Classification is a means and not the end in itself.

- **Classification should be Distinct:** Various sub-divisions under each category of classification should be so distinct as to indicate difference substantial enough to lead to different decisions to suit each specific aspect of the problem.
- **Classification should be pertinent to Marketing Research Project:** The purpose of classification should be to study the marketing problem in the best possible manner. Classification without reference to the purpose will not be useful for analysis of data.

## Let us Sum up

In this unit, you have learned the following:

- Data analysis is the process of transforming data to extract useful information that helps in finding some conclusion.
- There are various methods of data collection which help the user to gather and compile information from various locations.
- Representing the data symbolically by using some predefined rules is termed as coding of data. Coding of data is very much essential for performing efficient analysis.
- Data can be classified into three categories according to attributes and into two as per class intervals.

## Check your Progress

1. Which one among the following is the most comprehensive source of population data?
   a. Census
   b. National Sample Surveys
   c. Demographic Health Surveys
   d. National Family Health Surveys
2. The researcher should keep a clear set of_____ formulated at the very start of the research which will lead to clearer actions and better data collection as well as analysis
3. Library is used for data collection in_____.

## Glossary

**Attributes:** Data are classified on the basis of common characteristics which can either be descriptive or numerical.

**Geographical Classification**: There are various methods of data collection which help the user to gather and compile information from various locations.

## Answer to Check Your Progress

1. a. Census
2. Hypothesis
3. Doctrinal method

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-7
# Methods of Classification of Data

**STRUCTURE**



## Overview

The data collected through these methods can then be analyzed and used to support or refute research hypotheses and draw conclusions about the study's subject matter.

In this unit, the Methods of Classifying Data and the Difference in the methods of Qualitative and Quantitative research has been clearly explained.

## Objectives

After completion of this unit, you will be able to understand:

- Differences in methods of data collection in quantitative and qualitative research
- Major approaches to information gathering

## 7.1. Methods of Classifying Data

Classification of data is possible on the following basis:

- **Geographical Classification:** In geographical classification, the available data are divided on geographical basis, i.e., area-wise or region-wise. Geographical classification is quite simple, convenient and used extensively.
- **Chronological / Periodical Classification:** In chronological classification, the data are arranged / classified as per the time or period. Here, year or month is used as a base for classification.

- **Qualitative Classification:** Here, the available data are classified on the basis of some quality, attributes or qualifications.
- **Quantitative Classification:** In quantitative classification, the available data are classified on actual quantitative measurement. This method is also known as “classification by variables”. Variable is a characteristic which changes / varies from observation to observation.

## 7.2. Differences in the methods of quantitative and qualitative

Most methods of data collection can be used in both qualitative and quantitative research. The distinction is mainly due to the restrictions imposed on flexibility, structure, sequential order, depth and freedom that a researcher has in their use during the research process. Quantitative methods favour these restrictions whereas qualitative ones advocate against them.

The classification of a method into the quantitative or qualitative category depends upon your answers to the following questions:

- What philosophical epistemology is underpinning your approach to research enquiry?
- How was the information collected?
- Was it through a structured or unstructured/flexible format of data collection?
- Were the questions or issues discussed during data collection predetermined or developed during data collection?
- How was the information you gathered recorded?
- Was it in a descriptive, narrative, categorical, quantitative form or on a scale?
- How was the information analysed?
- Was it a descriptive, categorical or numerical analysis?
- How do you propose to communicate the findings?
- Do you want to write in a descriptive or analytical manner?

For example, if an observation is recorded in a narrative or descriptive format, it becomes qualitative information, but if it is recorded in categorical form or on a scale, it will be classified as quantitative information. Similarly for data collected through interviews. An unstructured interview, recorded in a descriptive or narrative form,

becomes a qualitative method, but in a structured interview, if the information is recorded in response categories or if the categories are developed and quantified out of descriptive responses, it is a quantitative method. Descriptive responses obtained in reply to open-ended questions are all qualitative but if the responses are in numerals, they will be considered quantitative. If you develop categories and quantify the categorization as a part of the analysis of descriptive responses to an open-ended question, it becomes a quantitative analysis. Data generated by focus groups, oral histories, narratives, group interviews is always qualitative in nature.

## Let us Sum up

In this unit, you have learned the following:

- There are various methods of data collection which help the user to gather and compile information from various locations.
- Primary data as the name suggests is original, problem- or project specific and collected for the specific objectives and needs to be spelt out by the researcher.
- It is an observation method in which the observer is not a member of the group under observation.
- The observation that takes place in the natural setting is called the uncontrolled observation.

## Check Your Progress

1. A process of collecting quantity of facts in systematic and organized manner to report any social problem or status of facts in certain area of society. is known as_____
2. Any social behaviour and attributes of man is measurable by _____
3. A researcher may relate cause and effect relationship by:_____

## Glossary

**Schedule:** It is a questionnaire containing a set of questions that are required to be answered to collect the data about a particular item.

**Rating Schedule:** It is the schedule used to measure and rate the thoughts, preferences, self-consciousness, perceptions and other similar characteristics of the respondents.

**Questionnaire:** It is a set of printed or written questions with a choice of answers, devised for the purposes of a survey or statistical study.

**Institution Survey Schedule:** It is the schedule used for studying different problems of institutions.

## Answer to Check Your Progress

1. Survey
2. Scaling
3. Observation of facts

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-8

# Sources of Data Collection

**STRUCTURE**



## Overview

The data are name after the source. Primary data refers to the data collected for the first time, whereas secondary data refers to the data that have already been collected and used earlier by somebody or some agency.

In this unit, the concept of Sources of Data, Primary Data, Methods of Primary Data Collection, Secondary Data and Methods of Secondary Data Collection has been clearly explained.

## Objectives

After studying this unit, you will be able to:

- Recognize the methodology of collecting primary data
- Know Major approaches to information gathering
- Understand the Collecting data using primary sources
  - Observation
  - The interview
  - The questionnaire
- Explain Methods of data collection in qualitative research
- Know Collecting data using secondary sources

## 8.1. Sources of Data

There are two sources of data in Statistics. **Statistical sources** refer to data that are collected for some official purposes and include censuses and officially conducted surveys. **Non-statistical sources** refer to the data that are collected for other administrative purposes or for the private sector.

Collection of Data

- Census and Sample Surveys
- Sampling Errors and NSSO

**Statistical Survey:** A statistical Survey is normally conducted using a sample. It is also called Sample Survey. It is the method of collecting sample data and analyzing it using statistical methods. This is done to make estimations about population characteristics. The advantage is that it gives you full control over the data. You can ask questions suited to the study you are carrying out. But, the disadvantage is that there is a chance of sample error creeping up. This is because a sample is chosen and the entire population is not studied.

**Census:** Opposite to a sample survey, a census is based on all items of the population and then data are analyzed. Data collection happens for a specific *reference period*. For example, the Census of India is conducted every 10 years. Other censuses are conducted roughly every 5-10 years. Data is collected using questionnaires that may be mailed to the respondents.

Responses can also be collected over other modes of communication like the telephone. An advantage is that even the most remote of the units of the population get included in the census method. The major disadvantage lies in the high cost of data collection and that it is a time-consuming process.

**Register:** Registers are basically storehouses of statistical information from which data can be collected and analysis can be made. Registers tend to be detailed and extensive. It is beneficial to use data from here as it is reliable. Two or more registers can be linked together based on common information for even more relevant data collection.

From agriculture to business, all industries maintain registers for record-keeping. Some administrative registers also serve the purpose of acting as a repository of data for other statistical bodies in a country.

## 8.2. Primary Data

Primary data is the one, which is collected by the investigator himself for the purpose of a specific inquiry or study. Such data is original in character and is generated by survey conducted by individuals or research institution or any organization.

The objectives of primary data are formulated on the basis of research objectives. Objective set the guidelines and directions of research planning. Formulating the objective offers the best feasible means of solution. The research study should yield measurements related to the research objectives as the measurements will provide directions for a decision.

The findings of the research should be capable of being utilized for the better performance of the organization. The cost-benefits analysis should be made for determining the objectives of the primary data collection.

### 8.2.1. Methods of Primary Data Collection

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

**Several Methods of Collecting Primary Data:**

1. Observation Method.
2. Interview Method.
3. Questionnaire method and
4. Schedules.
5. Other Methods.
    - Warranty card
    - Distributor audits.
    - Pantry audits
    - Panels/consumer panels
    - Mechanical devices
    - Projective techniques

- Depth interviews, and
- Content analysis.

1. **Observation Method:** Observation is an activity of a person which senses and assimilates the knowledge of the phenomenon or the recording of data using instrument. It can also be referred as datum collected during this activity. The observation method is the most commonly used method especially in studies relating to behavioural sciences. In a way we all observe things around us, but this sort of observation is not scientific observation. Observation becomes a scientific tool and the method of data collection for the researchers, when it serves a formulated research purpose, is systematically planned and recorded and is subjected to checks and controls on validity and reliability.

**Observation can be:**

- **Participant Observation Method:** In this method the researcher joints in the daily life of informants or organizations and observes how they behave.

Non-Participant Observation Method: In this method the researcher will not join the informants or organizations but will watch from outside.

1. **Interview Method:** Interview is a conversation between two or more people where question are asked by the interviewer to obtain information from the interviewee. The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. This method can be used through personal interviews and, if possible, through telephone interviews.

   Interviewing is one of the prominent methods of data collection. It may be defined as a two-way systematic conversation between an investigator and an informant, initiated for obtaining information relevant to a specific study. It involves not only conversation, but also leaning from the respondent's gestures, facial expressions and pauses, and his environment.

**Types of Interviews:**

- ✓ **Personal Interview:** Personal or face to face interviewing is a core function of marketing research; much of the quality of the entire research process rests on its effectiveness. Despite the growth in popularity of telephone and mail surveys, personal interviewing retains its long held

dominance across a wide spectrum of surveys – market, social, political. A personal interview is face to face communication with the respondent. The interviewer gets in touch with the respondent, asks the questions, and records the answers obtained.

- ✓ **Telephonic Interview:** The telephone interview is used when the information to be collected is limited. The telephone interview is used in lieu of personal interviews. It is most frequently used when the information has to be collecting quickly and inexpensively. However, it is not as versatile as personal interview as it is difficult to handle over the telephone information needed probes.

2. **Questionnaire Method:** The questionnaire is a list of questions to be asked from the respondents. It also contains a suitable space where the answers can be recorded. The term questionnaire usually refers to a self-administered process whereby the respondent himself reads the question and records his answers without the assistance of an interviewer. This is a narrow definition of a questionnaire.

   A questionnaire is a method of obtaining specific information about a defined problem so that the data, after analysis and interpretation, results in a better appreciation of the problem. A questionnaire form, which has to be completed by an interviewer, is often referred as schedule.

   - ✓ **Decide Questions Sequence:** Once the wording of the individual questions has been determined, it is necessary to set them up in some order. The sequence can influence the results obtained. A questionnaire has three major sections:

   i) Basic Information.

   ii) Classification Information.

   iii) Identification Information.

3. **Schedule:** Schedule is a device in social research, which is most frequently used in collecting field data especially where the survey method is employed. It is used in indirect interview. It contains questions and blank tables, which are to be field in by the investigators themselves after getting information from the respondents. Outwardly schedule and questionnaire appear to be the same but there is some difference between the two.

Schedule is used in direct interview and direct observation and is filled in by the research work himself.

According to Goode and Hatt, “Schedule is that name usually applied to a set of questions which are asked and filled in by an interviewer in a face to face situation with another person”.

**4. Other Methods:**

There are a number of methods for collection of data which is described as below:

- ✓ **Warranty Cards:** Warranty cards are usually postal sized cards, which are used by dealers of consumer durables to collect information regarding their products. The information sought is printed in the form of questions on the ‘warranty cards’ which is placed inside the package along with the produce with a request to the consumer to fill in the card and post it back to the dealer.
- ✓ **Distributor or Store Audits:** Distributor or store audits are performed by distributors as well as manufacturers through their sales men at regular intervals. Distributors get the retail stores audited through salesmen and use such information to estimate market size, market share, and seasonal purchasing pattern and so on. The data are obtained in such audits not by questioning but by observation.
- ✓ **Pantry Audits:** Pantry audit technique is sued to estimate consumption of the basket of goods at the consumer level. In this type of audit, the investigator collects an inventory of types, quantities and prices of commodities consumer. Thus in pantry audit data are recorded from the examination of consumer’s pantry.
- ✓ **Panels / Consumer Panels:** This form of data collection method is nowadays increasingly used for syndicated research. A panel is a group of study units that exist over time and from which data is collect on a regular interval of time.
- ✓ **Use of Mechanical Devices:** The use of mechanical devices has been widely made to collect information by way of indirect means. Eye camera, Pupil metric camera, Psycho-galvanometer, Motion picture camera and Audiometer are the principal devices so far developed and commonly used by

modern big business houses, mostly in the developed world for the purpose of collecting the required information.

- ✓ **Projective Techniques:** Projective techniques for the collection of data have been developed by psychologist to use projections of respondents for inferring about underlying motives, urges, or intentions which are such that the respondent either resists revealing them or is unable to figure out himself.
- ✓ **Depth Interview:** When an interview is held without the aid of a structured questionnaire, the interviewer has freedom in conducting it in the manner he desires. Such interviews are not subject to a well-defined and rigid procedure and are known as informal interviews. They are more appropriate in case of 'sensitive' issues, which may require more probing.
- ✓ **Content Analysis:** Content analysis consists of analyzing the content of documentary materials such as books, magazines, newspapers and the contents of all other verbal materials, which can be either spoken or printed.

## 8.3. Secondary Data

Secondary data are those data which have been already collected and analyzed by some earlier agency for its own use; and later the same data are used by a different agency.

According to W.A. Neiwswanger, "A primary source is a publication in which the data are published by the same authority which gathered and analyzed them.

A secondary source is publication, reporting the data which have been gather by other authorities and for which others are responsible".

**Characteristics for Selecting Secondary Data:**

Secondary data means data that are already available i.e., they refer to the data, which have already been collected and analyzed by someone else. Secondary data may either be published data or unpublished data.

By way of caution, the researcher, before using secondary data, must see that they possess following characteristics:

- ✓ **Reliability of Data**: There reliability can be tested by finding out such things about the said data:
  a. Who collected the data?

b. What were the sources of data?

c. Were the data collected by using proper methods?

d. At what time were they collected?

e. Was there any bias of the compiler?

f. What level of accuracy was desired? Was it achieved?

- ✓ **Suitability of data:** The data that are suitable for one enquiry may not necessarily be found suitable in another enquiry. Hence, if the available data are found to be unsuitable, they should not be used by the researcher. In this context, the researchers must very carefully scrutinize the definition of various terms and units of collection used at the time of collecting the data from the primary source originally.
- ✓ **Adequacy of data:** If the level of accuracy achieved in data is found inadequate for the purpose of the present enquiry, they will be considered as inadequate and should not be used by the researcher. The data will also be considered inadequate, if they are related to an area, which may be either narrower or wider than the area of the present enquiry.

### 8.3.1 Methods of Secondary Data Collection

In most of the studies the investigator finds it impracticable to collect first-hand information on all related issues and as such he makes use of the data collected by others. There is a vast amount of published information from which statistical studies may be made and fresh statistics are constantly in a state of production.

**The source of secondary data can broadly be classified under two heads:**

a. Internal Secondary Data.

b. External Secondary Data.

a. **Internal Secondary Data:** Data that originate within the firm for which the research is being conducted are internal data. If they were collected for some other purposes, they are internal secondary data. They may be adapted for the marketing research purposes. They may be formal data and informal data. For example Sales analysis and invoicing are considered important source of internal secondary data.

   - ✓ **Sales Analysis:** Sales analysis is an important tool of marketing research. It is the first step in the marketing

research programme and acts as a basis for the development of further marketing research. It reveals the current operating problems in the marketing area where the scope for marketing research can be adequately explored in smaller organizations, sales analysis is an important source of marketing information. It provides a major share of the factors for marketing research.

**Step in Sale Analysis: In sales analysis, the following steps are observed.**

- **Territorial Analysis:** Sales data per territory or region are classified and are put in comparable form to have a bird's eye view of the total sale. Sales vary from region to region and time to time. The causes of such variations can be revealed by investigation a survey of retailers of the region.
- **Customer Analysis:** Sales data according to different nature of customers are classified and compared. They provide the useful purpose of understanding the nature of customers and their behaviours to the sale.
- **Product Analysis:** Sales data product wise can be significant source of marketing research. The sales may vary from product to product. Understanding of their behaviour will be useful for framing product policy.
- **Time Analysis:** Sales data classified as per different segments of time, viz., monthly, six monthly and yearly may be useful source of analysis of sales.

✓ **Invoice Analysis:** Company invoices have been provided a very useful source of information. A copy of an invoice is preserved and information from it may be punched, tabulated, processed and summarized to provide suitable information to the researcher.

✓ **Accounting Records:** The basis for accounting records concerned with sales is the sales invoice. The usual sales invoice has a sizable amount of information on it, which generally includes name of customer, location of customer, items ordered, quantities ordered, quantities shipped, dollar extensions, back orders, discounts allowed, and date.

**b. External Secondary Data:**

The second forms of secondary data are external source which are generally published and are available in different forms and form different sources. Although external secondary data may be obtained from different sources, some of the sources are given here.

- **Libraries:** Researchers first attend libraries to find out relevant data pertaining to research. They provide many sources where suitable data may be obtained. Public libraries and college and University libraries contain a large amount of business information, which provides sources of other data. Management books, theses, management journals and other publications can be consulted in these libraries.
- **Literature:** A great amount of secondary data is available from literature, particularly literature on marketing subjects. With the development of marketing researches in different countries, new and interesting facts are coming into picture, which are available in various publications. Consultations of this literature may provide proper guidance pertaining to publication, which can be used from time to time.
- **Periodicals:** Business periodicals published fortnightly, monthly, quarterly, semi annually and annually are often consulted by the marketing executive and researchers to plan and design their marketing research. Also to use the available data for research purposes and to verify the conclusions derived from the marketing research, especially of field research. Periodical economic abstracts on economics, finance, trade, transport, industry, labour and management are being prepared by the Government as well as by the non-government agencies.
- **Census and Registration Data**: Census and Registration data have become very comprehensive sources of marketing research. Previously, these concentrated only one population census, but it now extends too many areas.

  a. Census of Population.

  b. Census of Agriculture.

  c. Census of Cattle.

d. Census of Trade.

e. Census of Transport.

f. Census of Industry.

g. Census of Banking and Finance.

h. Registration Data.

- **Trade Association:** Trade Association may be an excellent source of data pertaining to an industry. The trade association of one industry may exchange data with the trade association of another industry, and within one industry a firm may exchange data with another firm with the help of trade association of the industry.
- **Government Departments:** Different Government departments have different data, which are not available in libraries. But these are very useful for understanding various aspects of the economy. The researchers can utilize them for the purposes of their researchers.
- **Private Source:** Private Sources include varied sources available in the form of books, monographs, bulletins, journals, commercial reports and so on. They are priced and publicly circulated. Some of the sources include extensive original research, and some summarize the research findings of other person. Many of them are statements of cats and opinions.
- **Commercial Data:** There are several institutions and companies, which purchase and sell marketing information and data. Some of the companies are solely engaged in marketing research. They collect information and data directly from field surveys. Some such companies collect and process secondary data and supply them to their subscribers.
- **Financial Data:** The financial data of reputed concerns are available in several magazines, newspapers, journals and in summary of statistics. The Directorate of Income Tax publishes information pertaining to taxes and income ranges. Such information and data are useful to forecast the market potential of a particular product.
- **International Organizations:** International Organizations such as the International Monetary Fund, the World Bank, the United Nations Organizations, the Asian Ban, the African

Bank, Foreign embassies etc. publish several useful statistics, which can be used by researchers.

- **References and Bibliography:** In every publication, the researcher can find references and a bibliography which can be very good sources of information of marketing research. The researcher can consult them for further information and data.
- **Volumes of Statistics:** There are several private and public organizations, which prepare a summary of statistics. In India, the Indian Statistical Institute publishes the Statistical Abstract. Commerce Pvt. Ltd. The Times of India Ltd. And the Financial Express compiles Directories of different subjects. The Government of Indian publishes the Economic Survey of India wherein statistics relating to every field of economic activities are compiled in a suitable form.
- **Advertising Agencies:** Advertising agencies have proved to be very useful sources of marketing research. Recently, a large number of agencies have come into the findings of the advertising researches for their clients. Advertising agencies sometimes, publish reviews, resumes and tests of marketing researches.
- **Other Sources:** There are several other sources of marketing researches. Individuals conduct their own researches, which may be purchased by other institutions. Marketing Associations, Management Associations and individual business houses have been conducting marketing researches for other researches.

## Let us Sum up

In this unit, you have learned the following:

As the name suggests, primary data is data that is raw, collected for a p roblem or for a specific purpose and must be specified by the researche

- There are several ways to collect important data, such as:
  (a) interview method
  (b) survey method
  (c) research method
  (d) survey method

(e) timeline

(f) scaling technique

(g) Other methods include warranty cards, dealership inspections, ellar inspections, consumer panels, use of technological tools, projection techniques, in depth interviews and content analysis.

- Interview is a method of gathering information with the speech and presentation of the speech and the response of the speech and response. Interviews include personal interviews and phone calls**.**

## Check your Progress

1. An observation technique where the researcher himself actively remains associated with other members of the group and observes the behavior and activities of the group of study is known as_____.
2. A questionnaire consists of_____.
3. A Schedule may contain_____.

## Glossary

**Secondary Data:** It refers to data which is collected by someone who is someone other than the user.

**Interview:** It refers to a meeting of people face to face, especially for consultation.

**Observation:** It means the action or process of closely observing or monitoring something or someone.

## Answer to Check your Progress

1. Participant observation

2. Predetermined questions

3. Open ended questions

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.

2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.

**3.** Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit- 9
# Processing and Analysis of Data

**STRUCTURE**



## Overview

Data Analysis is a process of collecting, transforming, cleaning, and modeling data with the goal of discovering the required information. The results so obtained are communicated, suggesting conclusions, and supporting decision-making.

In this unit, the concept of Processing of Data and Analysis of Data has been clearly explained.

## Objectives

After studying this unit, you will be able to:

- Recognize the Meaning and Characteristics various measures of Central Tendency
- Define the Arithmetic Mean
- Describe the Median
- State the impression of Mode
- Explain the Measures of dispersion

## 9.1. Processing of Data

The process of inspecting, cleaning, transforming and modelling data with the specific purpose of highlighting useful information, suggesting conclusions and supporting decision making is termed as analysis of data. There are multiple facets and approaches to data analysis. The data that is acquired must be identified as a matter of utmost importance. This is followed by the processing and analysis of the same in order to infer proper and accurate results. This unit focuses on the meaning, importance and the process of data analysis.

Research is incomplete without proper analysis of the collected data. Processing of data involves analysis and manipulation of the collected data by performing various functions. The data has to be processed in accordance with the outline laid down at the time of developing the research plan. Processing of data is essential for ensuring that all relevant data has been collected to perform comparisons and analyses. The functions that can be performed on data are as follows:

- Editing
- Coding
- Tabulation
- Classification

Usually, experts are of the opinion that the exercise of processing and analyzing of data is inter-related. Therefore, the two should be thought as one and the same thing. It is argued that analysis of data generally involves a number of closely-related operations, which are carried out with the objective of summarizing the collected data and organizing it in such a way that they are able to answer the research questions associated with it.

However, in technical terms, processing of data involves data representation in a way that it is open to analysis. Similarly, analysis of data is defined as the computation of certain measures along with searching for the patterns of relationship that may exist among data groups.

### 9.1.1. Editing of data

Editing of data involves the testing of data collection instruments in order to ensure maximum accuracy. This includes checking the legibility, consistency and completeness of the data. The editing process aims at avoiding equivocation and ambiguity. The collected raw data is also

examined to detect errors and omissions, if any. A careful scrutiny is performed on the completed questionnaires and schedules to assure that the data has the following features:

- Accuracy
- Consistency
- Unity
- Uniformity
- Effective arrangement

The stages at which editing should be performed can be classified as follows:

**Field editing**: This involves reviewing the reporting forms, by the investigator, which is written in an abbreviated or illegible form by the informant at the time of recording the respondent's responses. Such type of editing must be done immediately after the interview. If performed after some time, such editing becomes complicated for the researcher, as it is difficult to decipher any particular individual's writing style. The investigator needs to be careful while field editing and restrain the researcher from correcting errors or omission by guesswork.

**Central editing**: This kind of editing involves a thorough editing of the entire data by a single editor or a team of editors. It takes place when all the schedules created according to the research plan have been completed and returned to the researcher. Editors correct the errors such as data recorded in the wrong place or the data recorded in months when it should be recorded in weeks. They can provide an appropriate answer to incorrect or missing replies by reviewing the other information in the schedule. At times, the respondent can be contacted for clarification. In some cases, if the answer is inappropriate or incomplete and an accurate answer cannot be determined on any basis, then the editor should delete or remove that answer from the collected data. She/he can put a note as 'no answer' in this case. The answers that can be easily deciphered as wrong should be dropped from the final results.

Besides using the above-stated methods according to the data source, the researcher should also keep in mind the following points while editing:

- Familiarity with the instructions given to interviewers and coders

- Know-how of editing instructions
- Single line striking for deleting of an original entry
- Standardized and distinctive editing of data
- Initialization of all answers that are changed

### 9.1.2. Coding of data

The coding of data can be defined as representing the data symbolically using some predefined rules. Once data is coded and summarized, the researcher can analyse it and relationships can be found among its various categories.

**Checklist for coding**

This enables the researcher to classify the responses of the individuals according to a limited number of categories or classes. Such classes should possess the following important characteristics:

- Classes should be appropriate and in accordance to the research problem under consideration.
- They must include a class for every data element.
- There should be a mutual exclusivity, which means that a specific answer can be placed in one and only one cell of a given category set.
- The classes should be one-dimensional. This means that every class is defined in terms of only one concept. As it is difficult to decipher any particular individual's writing style.
- The investigator needs to be careful while field editing and restrain the researcher from correcting errors or omission by guesswork.

**Significance of coding**

Data coding is required for quality analysis. Coding helps reduce Information from many classes to several classes. For this reason, only relevant and important data were kept for analysis in the study. Coding decisions are usually made during the design phase of the questi onnaire. This makespossible to precede selected questions, which can b e easily computerized into tabular form.

However, in case of hand coding, some procedures must be used. One such way is to customize the edges with colored pencils. Another way is to text the information from the survey. However,we should ensure that c oding errors are completely eliminated or minimized.

### 9.1.3. Tabulation of Data

In simple terms, tabulation means placing the results and data collected from research in a tabular form.

#### a) Methods of tabulation

Tabulation can be done either manually or mechanically using various electronic devices. Several factors like the size and type of study, cost considerations, time pressures and availability of tabulating machines decide the choice of tabulation. Relatively large data requires computer tabulation. Manual tabulation is preferred in case of small inquiries, when the number of questionnaires is small and they are of relatively short length. The different methods used in hand tabulation are as follows:

- **Direct tally method**: This method involves simple codes, which the researcher can use to directly tally data with the questionnaire. The codes are written on a sheet of paper called tally sheet and for each response, a stroke is marked against the code in which it falls. Usually, after every four strokes against a particular code, the fifth response is indicated by drawing a diagonal or horizontal line through the strokes. These groups are easy to count and the data is sorted against each code conveniently.
- **List and tally method**: In this method, code responses may be transcribed into a large worksheet, allowing a line for each questionnaire. This facilitates listing of a large number of questionnaires in one worksheet. Tallies are then made for each question.
- **Card sort method**: This is the most flexible hand tabulation method, where the data is recorded on special cards that are of convenient sizes and shapes and have a series of holes. Each hole in the card stands for a code. When the cards are stacked, a needle passes through a particular hole representing a particular code. These cards are then separated and counted. In this way, frequencies of various codes can be found out by the repetition of this technique.

#### b) Significance of tabulation

Tabulation enables the researcher to arrange data in a concise and logical order. It summarizes the raw data and displays the same in a compact form for further analysis. It helps in the orderly arrangement of

data in rows and columns. The various advantages of tabulation of data are as follows:

- A table saves space and reduces descriptive and explanatory statements to the minimum.
- It facilitates and eases the comparison process.
- Summation of elements and detection of omissions and errors becomes easy in a tabular description.
- A table provides a basis for various statistical computations.

### 9.1.4. Classification of data

Research studies involve extensive collection of raw data and usage of the data to implement the research plan.

To make the research plan easier, the data needs to be classified in different groups for understanding the relationship among the different phases of the research plan.

Classification of data involves arrangement of data in groups or classes on the basis of some common characteristics. The methods of classification can be divided under the following two headings:

- Classification according to attributes
- Classification according to class intervals

#### a) Classification of data according to attributes

Data is classified on the basis of similar features as follows:

- **Descriptive classification:** This classification is performed according to the qualitative features and attributes which cannot be measured quantitatively. These features can be either present or absent in an individual or an element. The features related to descriptive classification of attributes can be literacy, sex, honesty, solidarity, etc.
- **Simple classification:** In this classification the elements of data are categorized on the basis of those that possess the concerned attribute and those that do not.
- **Manifold classification:** In this classification two or more attributes are considered simultaneously and the data is categorized into a number of classes on the basis of those attributes. The total number of classes of final order is given by 2n, where *n* = number of attributes considered.

### b) Classification of data according to class intervals

Classifying data according to the class intervals is a quantitative phenomenon. Class intervals help categorize the data with similar numerical characteristics, such as income, production, age, weight, etc. Data can be measured through some statistical tools like mean, mode, median, etc. The different categories of data according to class intervals are as follows:

- **Statistics of variables:** This term refers to the measurable attributes, as these typically vary over time or between individuals. The variables can be discrete, i.e., taking values from a countable or finite set, continuous, i.e., having a continuous distribution function, or neither. This concept of variable is widely utilized in the social, natural and medical sciences.
- **Class intervals:** They refer to a range of values of a variable. This interval is used to break up the scale of the variable in order to tabulate the frequency distribution of a sample. A suitable example of such data classification can be given by means of categorizing the birth rate of a country. In this case, babies aged zero to one year will form a group; those aged two to five years will form another group, and so on. The entire data is thus categorized into several numbers of groups or classes or in other words, class intervals. Each class interval has an upper limit as well as a lower limit, which is defined as 'the class limit.' The difference between two class limits is known as class magnitude. Classes can have equal or unequal class magnitudes. The number of elements, which come under a given class, is called the frequency of the given class interval. All class intervals, with their respective frequencies, are taken together and described in a tabular form called the frequency distribution.

**Problems related to classification of data**

The problems related to classification of data on the basis of class intervals are divided into the following three categories:

(i) **Number of classes and their magnitude:** There are differences regarding the number of classes into which data can be classified. As such, there are no pre-defined rules for the classification of data. It all depends upon the skill and experience of the researcher. The researcher should display the data in such a way that it should be clear and meaningful to the analyst. As regards the magnitude of classes, it is usually held that class intervals should be of equal

magnitude, but in some cases unequal magnitudes may result in a better classification. It is the researcher's objective and judgement that plays a significant role in this regard. In general, multiples of two, five and ten are preferred while determining class magnitudes. H.A. Sturges suggested the following formula to determine the size of class interval: where,

i = size of class interval

*R* = Range (difference between the values of the largest element and smallest element among the given elements)

*N* = Number of items to be grouped

Sometimes, data may contain one or two or very few elements with very high or very low values. In such cases, the researcher can use an open-ended interval in the overall frequency distribution. Such intervals can be expressed below two years; or twelve years and above. However, such intervals are not desirable, yet cannot be avoided.

(ii) **Choice of class limits:** While choosing class limits, the researcher must determine the mid-point of a class interval. A mid-point is, generally, derived by taking the sum of the upper and lower limit of a class and then dividing it by two. The actual average of elements of that class interval should remain as close to each other as possible. In accordance with this principle, the class limits should be located at multiples of two, five, ten, twenty and hundred and such other figures. The class limits can generally be stated in any of the following forms:

**a.Exclusive type class intervals**: These intervals are usually stated as follows:

- 10–20
- 20–30
- 30–40
- 40–50

These intervals should be read in the following way:

- 10 and under 20
- 20 and under 30
- 30 and under 40
- 40 and under 50

In the exclusive type of class intervals, the elements whose values are equal to the upper limit of a class are grouped in the next higher class. For example, an item whose value is exactly thirty would be put in 30–40-class interval and not in 20–30-class interval. In other words, an exclusive type of class interval is that in which the upper limit of a class interval is excluded and items with values less than the upper limit, but not less than the lower limit, are put in the given class interval.

**b.Inclusive type class intervals**: These intervals are normally stated as follows:

- 11–20
- 21–30
- 31–40
- 41–50

This should be read as follows:

- 11 and under 21
- 21 and under 31
- 31 and under 41
- 41 and under 51

In this method, the upper limit of a class interval is also included in the concerning class interval. Thus, an element whose value is twenty will be put in 11–20-class interval. The stated upper limit of the class interval 11–20 is twenty but the real upper limit is 20.999999 and as such 11–20 class interval really means eleven and under twenty one. When data to be classified happens to be a discrete one, then the inclusive type of classification should be applied. But when data happens to be a continuous one, the exclusive type of class intervals can be used.

(iii) **Determining the frequency of each class**: The frequency of each class can be determined using tally sheets or mechanical aids. In tally sheets, the class groups are written on a sheet of paper and for each item a stroke (a small vertical line) is marked against the class group in which it falls. The general practice is that after every four small vertical lines in a class group, the fifth line for the element falling in the same group is indicated as a diagonal line through the above said four lines. This enables the researcher to perform the counting of elements in each one of the class groups.

## 9.2. Analysis of Data

**a) Descriptive analysis**: It is largely the study of distributions of one variable. This study provides us with profiles of companies, work groups, persons and other subjects on any of a multiple of characteristics such as size, Composition, efficiency, preferences, etc. This sort of analysis may be in respect of one variable described as uni-dimensional analysis, or in respect of two variables described as bi-variate analysis) or in respect of more than two variables described as multivariate analysis.

(i) **Univariate analysis**: In this analysis, only a single variable is taken into consideration. It is usually the first activity pursued while analysing the data. It is performed with the purpose of describing each variable in terms of mean, median or mode, and variability. Examples of such analysis are averages or a set of cases that may come under a specific category amidst a whole sample.

(ii) **Bivariate analysis**: This type of examines the relationship between two variables. It tries to find the extent of association that exists among these variables. Thus, a bivariate analysis may help you; for example, to find whether the variables of irregular meals and migraine headaches are associate; and up to what extent. Here, two variables are thus statistically measured simultaneously.

(iii) **Multivariate analysis**: This type of analysis involves observation and analysis of three or more than three statistical variables at a time. Such an analysis is performed using statistical tests or even in a tabular format. Thus, for example, you can study the variables of age, educational qualification and annual income of a given set of population at the same time using the multivariate analysis method.

**b) Correlation analysis studies:** The joint variation of two or more variables for determining the amount of correlation between two or more variables.

c) **Causal analysis:** It is concerned with the study of how one or more variables affect changes in another variable. It is thus a study of functional relationships existing between two or more variables. This analysis can be termed as regression analysis.

d) **Multivariate analysis:** This may be defined as all statistical methods which simultaneously analyse more than two variables on a sample of observations. Usually the following analyses are involved when we make a reference of multivariate analysis:

(i) Multiple regression analysis: This analysis is adopted when the researcher has one dependent variable which is presumed to be a function of two or more independent variables. The objective of this analysis is to make a prediction about the dependent variable based on its covariance with all the concerned independent variables.

(ii) Multiple discriminate analyses: This analysis is appropriate when the researcher has a single dependent variable that cannot be measured, but can be classified into two or more groups on the basis of some attribute. The object of this analysis happens to be to predict an entity's possibility of belonging to a particular group based on several predictor variables.

(iii) Multivariate analysis of variance (or multi-ANOVA): This analysis is an extension of two-way ANOVA, wherein the ratio of among group variance to within group variance is worked out on a set of variables.

(iv) Canonical analysis: This analysis can be used in case of both measurable and non-measurable variables for the purpose of simultaneously predicting a set of dependent variables from their joint covariance with a set of independent variables.

**e) Multiple regression analysis**

**Multiple regression analysis** is a statistical tool that helps the researchers to evaluate the effect of different factors on the consequences occurring at the same time. It analyzes the relationship between several independent or predictor variables and a dependent variable. In research technology, regression analysis is used to investigate a particular set of predictors and to show differences in the consequences that occur. Generally, regression is used to determine the effect of the specific factors along with the other factors that influence these consequences. The researchers use algebraic methods to analyze the result by making a group of factors associated with a particular phenomenon as a constant. According to the dictionary meaning, the multiple regressions are a statistical technique that predicts values of one variable on the basis of two or more other variables.

**Multiple regression and statistics:** The term 'multiple regressions' was first given by Pearson. The regression is of two types, simple and multiple and both the regression techniques are related to the Analysis Of Variance (ANOVA). Of these, multiple regressions is the

simplest method in comparison to other multivariate statistical techniques.

**Multiple regression and mathematics:** The multiple regression technique is used in mathematics to formulate simple regression equations, and to evaluate the best fitting curve for a straight line along the dots on an *x-y* plot or a scatter gram.

*Inferential analysis* is concerned with the various tests of significance for testing hypotheses in order to determine with what validity data can be said to indicate some conclusion or conclusions. It is also concerned with the estimation of population values. It is mainly on the basis of inferential analysis that the task of interpretation (i.e., the task of drawing inferences and conclusions) is performed.

## Let Us Sum Up

In this unit, you have learned about the following:

- Tabulation means placing the results and data collected from research in a tabular form. Tabulation can be done either mechanically or manually using various electronic devices.
- The process of tabulation enables the researcher to arrange data in a concise and logical order. It summarizes raw data and displays the same in a compact form for further analysis.
- There are three criteria for good collection of data: reliability, validity and sensitivity.
- Reliability is concerned with consistency, accuracy and predictability of the scale. It refers to the extent to which a measurement process is free from random errors.
- The sensitivity of a scale is an important measurement concept, particularly when changes in attitudes are under investigation.

## Check your Progress

1. Information may be obtained by_____in participation technique.

   a. face to face

   b. video conferencing

   c. means of mass media

   d. All the above

2. A Schedule may contain_____

3. Interview includes _____.

## Glossary

**Focus Groups:** It refers to a group of people assembled to participate in a discussion about a product before it is launched, or to provide feedback on a political campaign, television series, etc.

**Sensitivity:** It refers to an instrument's ability to accurately measure the variability in a concept.

**Behaviour Coding:** It refers to a systematic coding of the interaction between interviewers and respondents from live or taped interviews.

## Answer to Check your Progress

1. d. All the above

2. Open ended questions

3. Face to face conversation & Study of body language

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

## Block-4: Introduction

**Block-4: Sampling** has been divided in to five Units.

**Unit-10: Sampling Fundamentals** deals with Meaning of Sampling Design, Need for Sampling, Advantages of Sampling, Characteristics of Sampling, Essentials of Good Sampling, Sampling Concepts and Sampling Frame, Sample Size and Its Determination, Types of Sampling, Non Probability Sampling and Probability Sampling

**Unit-11: Measurement Scales** discuss about the Introduction and Classification of Scales.

**Unit -12: Scaling Techniques** explains about the Introduction, Meaning of Scaling and Scale Classification Bases.

**Unit-13: Testing of Significance** presents about Hypothesis and Procedure for Hypothesis Testing.

**Unit-14: Parametric and Non Parametric Test** describes about the Parametric tests or standard tests of hypothesis, Non-parametric tests or distribution-free tests of hypothesis and Multivariate Analysis

In all the units of Block -4 **Sampling**, the Check your progress, Glossary, Answers to Check your progress and Suggested Reading has been provided and the Learners are expected to attempt all the Check your progress as part of study.

# Unit-10
# Sampling Fundamentals

**STRUCTURE**



## Overview

Sampling is a technique where a small proportion of data is selected at random out of a population and is used to estimate the characteristics of the whole population. The outcome from the sampling can be close or similar to that of the result of using the population data set.

In this Unit the Meaning of Sampling Design, Need for Sampling, Advantages of Sampling, Characteristics of Sampling, Essentials of Good Sampling, Sampling Concepts and Sampling Frame, Sample Size and Its Determination, Types of Sampling, Non Probability Sampling and Probability Sampling has been explained.

## Objectives

After studying this unit, you will be able to:

- Describe the conception of sampling

- Steps involved in the sampling design
- Identify the characteristics of good sampling design
- State the different types of sampling design
- Report about the probability and non-probability sampling
- Explain the various types of errors in sampling
- Tell about determining of sampling size

## 10.1. Meaning of Sampling Design

Sampling design refers to a definite plan for obtaining a sample from the sampling frame. It refers to the technique or procedure, which a researcher adopts in selecting some sampling units from where inferences about population are drawn. Sampling data is obtained before collecting the final data.

## 10.2. Need for Sampling

We can define sampling as the process of obtaining information about an entire population by examining only a part of it. Sampling is required for the following reasons:

- It saves time and money. A sample study is usually less expensive than a census study.
- It produces results at a faster speed.
- It enables more accurate measurement for a sample study as it is conducted by experienced investigators.
- It is the only method for an infinitely large population.
- It usually enables you to estimate sampling errors and thus assists you in obtaining information concerning some characteristics of the population such as age group or gender.

## 10.3. Advantages of Sampling

- The solution to know the true or actual values of the various parameters of the population would be to take into account the entire population. This is not feasible due to the cost and time involved. Therefore, sampling seems more economical.
- As the magnitude of operation involved in a sample survey is small, the execution of the fieldwork and the analysis of results can be carried out at a faster rate and in a lesser time.
- Only a small staff is required for gathering and analysing

information and preparing reports. Therefore, sampling is a very cheap process.

- A researcher can collect detailed information in a lesser time than is possible in a census survey.
- As the scale of operation involved in a sample survey is small, the quality of interviews supervision and other related activities is better than the census survey.
- Sampling provides adequate information needed for the purpose and is sufficiently reliable for surveys.

## 10.4. Characteristics of Sampling

Usually, sampling involves determining a property or attribute to adhere to for the purpose of differentiating between items of a given population. These attributes, which are the objects of study, are called characteristics. The process of distinguishing the items is usually of two types, quantitative or qualitative. In quantitative sampling, characteristics pertaining to variables are dealt with. On the other hand, qualitative sampling is concerned with the characteristics related to attributes.

The basic idea behind sampling is to use the common characteristics of average items as samples for a larger entity. Thus, it involves choosing a subset of population elements for study. Thus, for example, if the population to be dealt with is, say that of roads, then the characteristics could be length, duration, roughness, carriage capacity, etc. Sampling proves to be a much cheaper and quicker mode of estimation where the population is absolutely huge.

## 10.5. Essentials of Good Sampling

After understanding various concepts related to sampling and sampling design, let us now look at the principles and essentials of sampling:

- **Unbiased**: One of the primary principles of sampling is that it should not be biased.
- **Adequate sampling size:** For accurate sampling, it is important that the size of sample is adequate.
- **Standardized samples:** Samples should be standardized so that they can be checked for relevance and accuracy.
- **Statistical Regularity:** According to this principle, the units of the sample must be selected at random.

## 10.6. Sampling Concepts and Sampling Frame

1. ***Universe/Population****:* The term 'Universe' refers to the total of the items or units in any field of inquiry, whereas the term 'population' refers to the total of items about which information is desired. The attributes that are the object of study are referred to as characteristics and the units possessing them are called as elementary units. The aggregate of such units is generally described as population. Thus, all units in any field of inquiry constitute universe and all elementary units (on the basis of one characteristic or more) constitute population. The population or universe can be *finite* or *infinite*. The population is said to be finite if it consists of a fixed number of elements so that it is possible to enumerate it in its totality.

2. ***Sampling frame****:* The elementary units or the group or cluster of such units may form the basis of sampling process in which case they are called as sampling units. A list containing all such sampling units is known as sampling frame. Thus sampling frame consists of a list of items from which the sample is to be drawn. If the population is finite and the time frame is in the present or past, then it is possible for the frame to be identical with the population. In most cases they are not identical because it is often impossible to draw a sample directly from population.

3. ***Sampling design****:* A sample design is a definite plan for obtaining a sample from the sampling frame. It refers to the technique or the procedure the researcher would adopt in selecting some sampling units from which inferences about the population is drawn. Sampling design is determined before any data are collected.

4. ***Statistic (s) and parameter(s):*** A statistic is a characteristic of a sample, whereas a parameter is a characteristic of a population. Thus, when we work out certain measures such as mean, median, mode or the like ones from samples, then they are called statistic(s) for they describe the characteristics of a sample. But when such measures describe the characteristics of a population, they are known as parameter(s).

5. ***Sampling error****:* Sample surveys do imply the study of a small portion of the population and as such there would naturally be a certain amount of inaccuracy in the information collected. This inaccuracy may be termed as sampling error or error variance. In other words, sampling errors are those errors which arise on account

of sampling and they generally happen to be random variations in case of random sampling in the sample estimates around the true population values. Within which the population average (or other parameter) will lie in accordance with the reliability specified in the confidence level as a percentage of the estimate □□or as a numerical quantity. For instance, if the estimate is Rs 4000 and the precision desired is □□4%, then the true value will be no less than Rs 3840 and no more than Rs 4160. This is the range (Rs 3840 to Rs 4160) within which the true answer should lie. But if we desire that the estimate should not deviate from the actual value by more than Rs 200 in either direction, in that case the range would be Rs 3800 to Rs 4200.

6. ***Confidence level and significance level:*** The confidence level or reliability is the expected percentage of times that the actual value will fall within the stated precision limits. Thus, if we take a confidence level of 95%, then we mean that there are 95 chances in 100 (or .95 in 1) that the sample results represent the true condition of the population within a specified precision range against 5 chances in 100 (or .05 in 1) that it does not. Precision is the range within which the answer may vary and still be acceptable; confidence level indicates the likelihood that the answer will fall within that range, and the significance level indicates the likelihood that the answer will fall outside that range. We can always remember that if the confidence level is 95%, then the significance level will be (100 – 95) i.e., 5%; if the confidence level is 99%, the significance level is (100 – 99) i.e., 1%, and so on. We should also remember that the area of normal curve within precision limits for the specified confidence level constitutes the acceptance region and the area of the curve outside these limits in either direction constitutes the rejection regions.

7. ***Sampling distribution****:* We are often concerned with sampling distribution in sampling analysis. If we take certain number of samples and for each sample compute various statistical measures such as mean, standard deviation, etc., then we can find that each sample may give its own value for the statistic under consideration. All such values of a particular statistic, say mean, together with their relative frequencies will constitute the sampling distribution of the particular statistic, say mean. Accordingly, we can have sampling distribution of mean, or the sampling distribution of standard deviation or the sampling distribution of any other statistical measure. It may be noted that each item in a sampling distribution is

a particular statistic of a sample. The sampling distribution tends quite closer to the normal distribution if the number of samples is large. The significance of sampling distribution follows from the fact that the mean of a sampling distribution is the same as the mean of the universe. Thus, the mean of the sampling distribution can be taken as the mean of the universe.

## 10.7. Sample Size and its Determination

Size of the sample should be determined by a researcher keeping in view the following points:

1. ***Nature of universe:*** Universe may be either homogenous or heterogeneous in nature. If the items of the universe are homogenous, a small sample can serve the purpose. But if the items are heterogeneous, a large sample would be required. Technically, this can be termed as the dispersion factor.
2. ***Number of classes proposed****:* If many class-groups (groups and sub-groups) are to be formed, a large sample would be required because a small sample might not be able to give a reasonable number of items in each class-group.
3. ***Nature of study****:* If items are to be intensively and continuously studied, the sample should be small. For a general survey the size of the sample should be large, but a small sample is considered appropriate in technical surveys.
4. ***Type of sampling****:* Sampling technique plays an important part in determining the size of the sample. A small random sample is apt to be much superior to a larger but badly selected sample.
5. ***Standard of accuracy and acceptable confidence level****:* If the standard of accuracy or the level of precision is to be kept high, we shall require relatively larger sample. For doubling the accuracy for a fixed significance level, the sample size has to be increased fourfold.
6. ***Availability of finance****:* In practice, size of the sample depends upon the amount of money available for the study purposes. This factor should be kept in view while determining the size of sample for large samples result in increasing the cost of sampling estimates.
7. ***Other considerations****:* Nature of units, size of the population, size of questionnaire, availability of trained investigators, the conditions under which the sample is being conducted, the time

available for completion of the study are a few other considerations to which a researcher must pay attention while selecting the size of the sample.

## 10.8. Types of Sampling

The various types of Sampling are as follows:

### 10.8.1 Probability Sampling

- A **probability sampling** scheme is one in which every unit in the population has a chance (greater than zero) of being selected in the sample, and this probability can be accurately determined.
- When every element in the population *does* have the same probability of selection, this is known as an 'Equal Probability of Selection' (EPS) design. Such designs are also referred to as 'self-weighting' because all sampled units are given the same weight.

**Probability sampling includes:**

- Simple Random Sampling
- Systematic Sampling
- Stratified Random Sampling
- Cluster Sampling
- Multistage Sampling
- Multiphase sampling

**a) Simple Random Sampling**

- Applicable when population is small, homogeneous & readily available
- All subsets of the frame are given an equal probability. Each element of the frame thus has an equal probability of selection.
- It provides for greatest number of possible samples. This is done by assigning a number to each unit in the sampling frame.
- A table of random number or lottery system is used to determine which units are to be selected.
- Estimates are easy to calculate.

**Disadvantages**

- If sampling frame large, this method impracticable.

- Minority subgroups of interest in population may not be present in sample in sufficient numbers for study.

**b) Systematic Sampling**

- Systematic sampling relies on arranging the target population according to some ordering scheme and then selecting elements at regular intervals through that ordered list.
- Systematic sampling involves a random start and then proceeds with the selection of every *k* th element from then onwards. In this case, *k*= (population size/sample size).
- It is important that the starting point is not automatically the first in the list, but is instead randomly chosen from within the first to the *k*th element in the list.
- A simple example would be to select every 10th name from the telephone directory (an 'every 10th' sample, also referred to as 'sampling with a skip of 10').

**Advantages:**

- Sample easy to select
- Suitable sampling frame can be identified easily
- Sample evenly spread over entire reference population

**Disadvantages:**

- Sample may be biased if hidden periodicity in population coincides with that of selection.
- Difficult to assess precision of estimate from one survey.

**c) Stratified Sampling**

Where population embraces a number of distinct categories, the frame can be organized into separate "strata." Each stratum is then sampled as an independent sub-population, out of which individual elements can be randomly selected.

- Every unit in a stratum has same chance of being selected.
- Using same sampling fraction for all strata ensures proportionate representation in the sample.
- Adequate representation of minority subgroups of interest can be ensured by stratification & varying sampling fraction between strata as required.

- Finally, since each stratum is treated as an independent population, different sampling approaches can be applied to different strata.

**Drawbacks**

- First, sampling frame of entire population has to be prepared separately for each stratum
- Second, when examining multiple criteria, stratifying variables may be related to some, but not to others, further complicating the design, and potentially reducing the utility of the strata.
- Finally, in some cases (such as designs with a large number of strata, or those with a specified minimum sample size per group), stratified sampling can potentially require a larger sample than would other methods.

**Post stratification**

- Stratification is sometimes introduced after the sampling phase in a process called "post stratification“.
- This approach is typically implemented due to a lack of prior knowledge of an appropriate stratifying variable or when the experimenter lacks the necessary information to create a stratifying variable during the sampling phase. Although the method is susceptible to the pitfalls of post hoc approaches, it can provide several benefits in the right situation. Implementation usually follows a simple random sample. In addition to allowing for stratification on an ancillary variable, post stratification can be used to implement weighting, which can improve the precision of a sample's estimates.

**d) Cluster Sampling**

- Cluster sampling is an example of 'two-stage sampling’.
- First stage a sample of areas is chosen;
- Second stage a sample of respondents *within* those areas is selected.
- Population divided into clusters of homogeneous units, usually based on geographical contiguity.
- Sampling units are groups rather than individuals.
- A sample of such clusters is then selected.
- All units from the selected clusters are studied.

**Advantages:**

- Cuts down on the cost of preparing a sampling frame.
- This can reduce travel and other administrative costs.

**Disadvantages:**

- Sampling error is higher for a simple random sample of same size.

**Identification of clusters**

- List all cities, towns, villages & wards of cities with their population falling in target area under study.
- Calculate cumulative population & divide by 30, this gives sampling interval.
- Select a random no. less than or equal to sampling interval having same no. of digits. This forms $1^{st}$ cluster.
- Random number + sampling interval = population of $2^{nd}$ cluster.
- Second cluster + sampling interval = $4^{th}$ cluster.
- Last or $30^{th}$ cluster = $29^{th}$ cluster + sampling interval

**Two type of cluster sampling method.**

- **One-stage sampling**. All of the elements within selected clusters are included in the sample.
- **Two-stage sampling**. A subset of elements within selected clusters is randomly selected for inclusion in the sample.

**Difference between Strata and Clusters**

- Although strata and clusters are both non-overlapping subsets of the population, they differ in several ways.
- All strata are represented in the sample; but only a subset of clusters is in the sample. With stratified sampling, the best survey results occur when elements within strata are internally homogeneous. However, with cluster sampling, the best results occur when elements within clusters are internally heterogeneous.

**e) Multistage Sampling**

- Complex form of cluster sampling in which two or more levels of units are embedded one in the other.
- First stage, random number of districts chosen in all states.

- Followed by random number of talukas, villages.
- Then third stage units will be houses.
- All ultimate units (houses, for instance) selected at last step are surveyed.
- This technique is essentially the process of taking random samples of preceding random samples.
- Not as effective as true random sampling, but probably solves more of the problems inherent to random sampling.
- An effective strategy because it banks on multiple randomizations. As such, extremely useful.
- Multistage sampling used frequently when a complete list of all members of the population not exists and is inappropriate.
- Moreover, by avoiding the use of all sample units in all selected clusters, multistage sampling avoids the large, and perhaps unnecessary, costs associated with traditional cluster sampling.

### 10.8.2. Non Probability Sampling

Non probability Sampling includes:

- Convenience Sampling,
- Quota Sampling
- Purposive Sampling
- Snowball Sampling

**a) Convenience sampling**

Convenience sampling is used to obtain information quickly and cheaply. In this model the only criterion in model selection is convenience for the scientist or researcher. Often the easiest models to use are neighbors, friends, family, colleagues and passersby. This design is often used in the preliminary stages of research, such as pretesting questionnaires. Some simple examples of sampling are:

- People are interviewed for their political views on television in stores.
- Follow the prices in the markets in order to reflect the inflation to the economy.
- Ask people to test the product.
- Testing with students or staff in the organization.

- A TV channel is interviewing people who come out of the cinema to get their opinions on a movie.

The researcher visited many stores near the residence and observed the brand of a particular product that people would make a rough guess about the brand. In all the above cases, the unit of measurement will be chosen spontaneously or appropriately. No effort was made to select a representative sample. Therefore, in this design, the size and direction of the difference between population value (parameter) and sample value (statistic) is unknown.

Therefore, it is not possible to estimate the sampling error and researchers cannot make clear statements about the results of these samples.

Therefore, empirical research (both descriptive and causal) should not use simple models. Simple models are often used in research. This is because the purpose of research is to understand the problem and to create a set of theories that can be tested with the help of research. If little is known about a subject, small sample sizes can be used in exploratory work to help understand regional differences in response.

**b) Decision making**

As a sampling decision, experts in a particular field choose what they believe are the best examples for the relevant research. Order sampling requires a special effort to find and reach individuals with the desired information. Here, expert judgment is used to identify representative samples.

For example, people shopping in the bazaar can be used to represent people living in that city, or some cities can be chosen to represent the country.

Decision making models are used when few/groups of people have the necessary information. This approach will not have a good effect on the results and therefore will not be helpful in the findings because we usually use an expert (responder) sample that is easy to eight to three.

Also, there is no purpose to measure the accuracy of the results. Companies looking to develop new products can use decision making models to select "experts" with experience or knowledge of similar products. Focus groups of these experts can be developed for better understanding. Thought leaders are included in the

organization's environment. Enlightened ideas (thinking and knowledge) are a rich source of information. Finding and reaching people who need information takes a special time. The most common use of decision making is business-to-business (B to B) business.

Here is an example of a small client, key client or proven technology company or person who is regularly used to evaluate new ideas, design goods, devise processes.

**c) Quota sampling**

In quota sampling, the sample contains the least number of each group of the population. The sample is selected according to certain cultural characteristics such as age, gender, occupation, education, income. Researchers are asked to select samples that meet these criteria. Samples meeting these characteristics were randomly assigned to field workers. A researcher wants to measure the job satisfaction of employees of a large organization and argues that job satisfaction varies among different types of employees.

10%, 15%, 35% and 40% of the employees of the organization are group I, II, III and IV, respectively. If a sample of 200 employees is to be taken from an organization, I, II, III and IV respectively from the population. 20, 30, 70 and 80 employees will be recruited from the group.

It is now possible to draw a sample of 200 workers from different classes at the rate specified in the population, from the quota given to the inspectors differently in each class. For example, a quota of 10 Tier I employees, 15 Tier II employees, 20 Tier III employees and 30 Tier IV employees can be assigned to the first employee. Likewise, the second surveyor may assign a different quota so that a total of 200 samples are selected at the same rate as the population distribution. Note that inspectors can select workers from any class as they wish. Therefore, the sample may not be representative of the population and therefore, the findings cannot be generalized. However, this design model was chosen because of the simplicity it offers in terms of effort, cost and time.

Quota sampling designs are similar to tiered random sampling designs. However, there is a difference between the two.

## Let Us Sum Up

In this unit, you have learned about the following

- A plan to derive a model from a model is called a model. It refers to the process or process used by researchers in selecting a sample from which inferences can be drawn about the population.
- Sampling is required to obtain information because it saves time and money. It is cheaper and gives faster results.
- Sampling involves identifying the trait or behavior that should be distinguished from a particular population.
- The main idea behind sampling is to use the characteristics of the environment as a sample of the larger area.
- A group is a group of people or things that have been created through specific analysis and are similar in one or more respects.
- An item contains a member of the population, while the sample constitutes a group of the population. It has only a fraction of the population.
- Sampling is the process of selecting a sufficient number of populations; thus, working on a sample helps us both to understand the characteristics of the population and to generalize the phenomenon.
- A census is a survey of all segments of the population, called a census or general survey. A census is required where the population is small (e.g. public banks in the country).
- The process of selecting samples from a population is termed as sampling design. Two types of sampling designs are probability sampling design and non-probability sampling design.
- In the proportionate allocation scheme, the size of the sample in each stratum is proportional to the size of the population of the strata.
- In cluster sampling, the entire population is divided into various clusters in such a way that the elements within the clusters are heterogeneous.

- Convenience sampling is used to obtain information quickly and inexpensively. The only criterion for selecting sampling units in this scheme is the convenience of the researcher or the investigator.
- Snowball sampling is generally used when it is difficult to identify the members of the desired population, e.g., deep-sea divers, families with triplets, people using walking sticks, doctors specializing in a particular ailment, etc.

## Check Your Progress

1. _____ Technique is generally followed when the population is finite.
2. _____ one is called non-probability sampling.
3. Sampling frame of the respondent population is an example of secondary data.

   (True/False)

## Glossary

**Quota sampling:** It is a sample which includes a minimum number from each specified subgroup in the population.

**Sampling Design:** It refers to a definite plan for obtaining a sample from the sampling frame.

**Stratified Random Sampling:** It is a method of sampling that involves the division of a population into smaller groups known as strata. In stratified random sampling, or stratification, the strata are formed based on members' shared attributes or characteristics.

**Sampling Frame:** It comprises all the elements of a population with proper identification that is available to us for selection at any stage of sampling.

## Answer to Check Your Progress

1. Systematic Sampling Technique

2. Quota sampling

3. True

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-11
# Measurement Scales

**STRUCTURE**



## Overview

Scales of measurement refer to ways in which variables/numbers are defined and categorized. Each scale of measurement has certain properties which in turn determines the appropriateness for use of certain statistical analyses.

In this unit the Introduction about Measurement of Scales and the Classification of Scales has been clearly explained.

## Objectives

After studying this unit, you will be able to:

- Recognize the tools of sound measurement
- Explain the techniques of developing measurement tools
- Describe the meaning and techniques of scaling
- Differentiate among Comparative and non-comparative scales
- Describe the Multi-dimensional scaling techniques

## 11.1. Introduction

Measurement is assigning numbers or other symbols to characteristics of objects being measured, according to predetermined rules. Concept (or Construct) is a generalized idea about a class of objects, attributes, occurrences, or processes. Relatively concrete constructs comprise of aspects such as Age, gender, number of children, education, income. Relatively abstract constructs take into accounts the aspects such as Brand loyalty, personality, channel power, satisfaction.

Scaling is the generation of a continuum upon which measured objects are located. Scale is a quantifying measure – a combination of items that is progressively arranged according to value or magnitude. The purpose is to quantitatively represent an item's, person's, or event's place in the scaling continuum.

## 11.2. Classification of Scales

From what has been stated above, we can write that scales of measurement can be considered in terms of their mathematical properties. The most widely used classification of measurement scales are: (a) nominal scale; (b) ordinal scale; (c) interval scale; and (d) ratio scale.

**(a) Nominal scale:** Nominal scale is simply a system of assigning number symbols to events in order to label them. The usual example of this is the assignment of numbers of basketball players in order to identify them. Such numbers cannot be considered to be associated with an ordered scale for their order is of no consequence; the numbers are just convenient labels for the particular class of events and as such have no quantitative value. Nominal scales provide convenient ways of keeping track of people, objects and events.

**(b) Ordinal scale:** The lowest level of the ordered scale that is commonly used is the ordinal scale. The ordinal scale places events in order, but there is no attempt to make the intervals of the scale equal in terms of some rule. Rank orders represent ordinal scales and are frequently used in research relating to qualitative phenomena. A student's rank in his graduation class involves the use of an ordinal scale. One has to be very careful in making statement about scores based on ordinal scales.

For instance, if Ram's position in his class is 10 and Mohan's position is 40, it cannot be said that Ram's position is four times as good as that of Mohan. The statement would make no sense at all.

Ordinal scales only permit the ranking of items from highest to lowest. Ordinal measures have no absolute values, and the real differences between adjacent ranks may not be equal. All that can be said is that one person is higher or lower on the scale than another, but more precise comparisons cannot be made.

**(c) Interval scale:** In the case of interval scale, the intervals are adjusted in terms of some rule that has been established as a basis for making the units equal. The units are equal only in so far as one accepts the assumptions on which the rule is based. Interval scales

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

**(d) Ratio scale:** Ratio scales have an absolute or true zero of measurement. The term 'absolute zero' is not as precise as it was once believed to be. We can conceive of an absolute zero of length and similarly we can conceive of an absolute zero of time. For example, the zero point on a centimeter scale indicates the complete absence of length or height. But an absolute zero of temperature is theoretically unobtainable and it remains a concept existing only in the scientist's mind. The number of minor traffic-rule violations and the number of incorrect letters in a page of type script represent scores on ratio scales.

Ratio scale represents the actual amounts of variables. Measures of physical dimensions such as weight, height, distance, etc. are examples. Generally, all statistical techniques are usable with ratio scales and all manipulations that one can carry out with real numbers can also be carried out with ratio scale values. Multiplication and division can be used with this scale but not with other scales mentioned above. Geometric and harmonic means can be used as measures of central tendency and coefficients of variation may also be calculated.

## Let us Sum up

In this unit, you have learned about the following:

- In comparative scales it is assumed that respondents make use of a standard frame of reference before answering the question.

- Comparative scale data is interpreted generally in a relative kind. The comparative scale includes paired comparison, rank order, constant sum scale and Q-sort technique to mention a few.
- In the non-comparative scales, the respondents do not make use of any frame of reference before answering the questions. The resulting data is generally assumed to be interval or ratio scale.
- If an unbalanced scale is used, the nature and degree of the unbalance in the scale should be taken into account during the data analysis.
- The Stapel scale is used to measure the direction and intensity of an attitude. At times it may be difficult to use semantic differential scales because of the problem in creating bipolar adjectives.
- There are four types of measurement scales—nominal, ordinal, interval and ratio scales. We will discuss each one of them in detail.

**Check your Progress**

1. A researcher is interested in studying the prospects of a particular political party in an urban area. So, what tool should he prefer for the study?
2. Nominal scale is also known as_____
3. _____Scale are used for labelling variables into distinct classifications.

**Glossary**

**Non-Comparative Scales**: The non-comparative scales are divided into two categories, namely, the graphic rating scales and the itemized rating scales.

**Graphic Rating Scale**: In the graphic rating scale the respondent is asked to tick his preference on a graph.

**Itemized Rating Scale**: In the itemized rating scale, the respondents are provided with a scale that has a number of brief descriptions associated with each of the response categories.

## Answer to Check your Progress

1. Questionnaire
2. Categorical variable
3. Nominal

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-12
# Scaling Techniques

**STRUCTURE**



## Overview

Scaling technique is a method of placing respondents in continuation of gradual change in the pre-assigned values, symbols or numbers based on the features of a particular object as per the defined rules. All the scaling techniques are based on four pillars, i.e., order, description, distance and origin.

In this unit, the Meaning of Scaling and the Scale Classification Bases has been explained

## Objectives

After completion of this unit, you will be able to explain:

- Meaning of Scaling
- Scale Classification Bases

## 12.1. Introduction

In research we quite often face measurement problem (since we want a valid measurement but may not obtain it), especially when the concepts to be measured are complex and abstract and we do not possess the standardized measurement tools. Alternatively, we can say that while measuring attitudes and opinions, we face the problem of their valid measurement. Similar problem may be faced by a researcher, of course in a lesser degree, while measuring physical or institutional concepts. As such we should study some procedures which may enable us to

measure abstract concepts more accurately. This brings us to the study of scaling techniques.

## 12.2. Meaning of Scaling

Scaling describes the procedures of assigning numbers to various degrees of opinion, attitude and other concepts. This can be done in two ways viz.

Making a judgement about some characteristic of an individual and then placing him directly on a scale that has been defined in terms of that characteristic and

Constructing questionnaires in such a way that the score of individual's responses assigns him a place on a scale. It may be stated here that a scale is a continuum, consisting of the highest point (in terms of some characteristic e.g., preference, favorableness, etc.) and the lowest point along with several intermediate points between these two extreme points. These scale-point positions are so related to each other that when the first point happens to be the highest point, the second point indicates a higher degree in terms of a given characteristic as compared to the third point and the third point indicates a higher degree as compared to the fourth and so on. Numbers for measuring the distinctions of degree in the attitudes/opinions are, thus, assigned to individuals corresponding to their scale-positions.

## 12.3. Scale Classification Bases

The number assigning procedures or the scaling procedures may be broadly classified on one or more of the following bases: (a) subject orientation; (b) response form; (c) degree of subjectivity; (d) scale properties; (e) number of dimensions and (f) scale construction techniques.

**(a) Subject orientation:** Under it a scale may be designed to measure characteristics of the respondent who completes it or to judge the stimulus object which is presented to the respondent. In respect of the former, we presume that the stimuli presented are sufficiently homogeneous so that the between stimuli variation is small as compared to the variation among respondents. In the latter approach, we ask the respondent to judge some specific object in terms of one or more dimensions and we presume that the between-respondent variation will be small as compared to the variation among the different stimuli presented to respondents for judging.

**(b) Response form:** Under this we may classify the scales as

categorical and comparative. Categorical scales are also known as rating scales. These scales are used when a respondent scores some object without direct reference to other objects. Under comparative scales, which are also known as ranking scales, the respondent is asked to compare two or more objects. In this sense the respondent may state that one object is superior to the other or those three models of pen rank in order 1, 2 and 3. The essence of ranking is, in fact, a relative comparison of a certain property of two or more objects.

**(c) Degree of subjectivity:** With this basis the scale data may be based on whether we measure subjective personal preferences or simply make non-preference judgements. In the former case, the respondent is asked to choose which person he favours or which solution he would like to see employed, whereas in the latter case he is simply asked to judge which person is more effective in some aspect or which solution will take fewer resources without reflecting any personal preference.

**(d) Scale properties:** Considering scale properties, one may classify the scales as nominal, ordinal, interval and ratio scales. Nominal scales merely classify without indicating order, distance or unique origin. Ordinal scales indicate magnitude relationships of 'more than' or 'less than', but indicate no distance or unique origin. Interval scales have both order and distance values, but no unique origin. Ratio scales possess all these features.

**(e) Number of dimensions:** In respect of this basis, scales can be classified as 'uni - dimensional' and 'multidimensional' scales. Under the former we measure only one attribute of the respondent or object, whereas multidimensional scaling recognizes that an object might be described better by using the concept of an attribute space of 'n' dimensions, rather than a single-dimension continuum.

**(f) Scale construction techniques:** Following are the five main techniques by which scales can be developed.

(i) ***Arbitrary approach****:* It is an approach where scale is developed on *ad hoc* basis. This is the most widely used approach. It is presumed that such scales measure the concepts for which they have been designed, although there is little evidence to support such an assumption.

(ii) ***Consensus approach:*** Here a panel of judges evaluate the items chosen for inclusion in the instrument in terms of whether

they are relevant to the topic area and unambiguous in implication.

(iii) ***Item analysis approach:*** Under it a number of individual items are developed into a test which is given to a group of respondents. After administering the test, the total scores are calculated for everyone. Individual items are then analysed to determine which items discriminate between persons or objects with high total scores and those with low scores.

(iv) *Cumulative scales* are chosen on the basis of their conforming to some ranking of items with ascending and descending discriminating power. For instance, in such a scale the endorsement of an item representing an extreme position should also result in the endorsement of all items indicating a less extreme position.

(v) *Factor scales* may be constructed on the basis of inter correlations of items which indicate that a common factor accounts for the relationship between items. This relationship is typically measured through factor analysis method.

## Let us Sum up

In this unit, you have learned about the following:

- The choice of the measurement scale has implications for the statistical technique to be used for data analysis.
- Pre-test is a trial test of a specific aspect of the study, such as the common methods of data collection or common data collection tools-schedule (used as tool for interviewing), questionnaire or measurement scale.
- Pre-test is the administration of the data collection instrument with a small set of respondents from the population for the full scale survey.
- The pre-testing of interview schedule involves contact with respondents drawn from the same population as for the actual survey.
- There are three criteria for good collection of data: reliability, validity and sensitivity.
- Reliability is concerned with consistency, accuracy and predictability of the scale. It refers to the extent to which a measurement process is free from random errors.

- The sensitivity of a scale is an important measurement concept, particularly when changes in attitudes are under investigation.

## Check your Progress

1. Scale in which the respondent directly compares two or more objects and makes choices among them is _____.

2. The _____ scale measurement has a natural zero.

3. _____ is consider the sources of errors in measurement.

## Glossary

**Focus Groups:** It refers to a group of people assembled to participate in a discussion about a product before it is launched, or to provide feedback on a political campaign, television series, etc.

**Sensitivity:** It refers to an instrument's ability to accurately measure the variability in a concept.

**Behaviour Coding:** It refers to a systematic coding of the interaction between interviewers and respondents from live or taped interviews.

**Likert Scale:** It is a scale used to represent people's attitudes to a topic.

**Split-Panel Tests:** They are the controlled experimental testing among questionnaire variants or interviewing modes for determining which is 'better' or for measuring differences between them.

## Answer to Check Your Progress

1. Ranking Scale

2. Ratio

3. Respondent, situation, measurer, instrument

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.

2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.

3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-13
# Testing of Significance

**STRUCTURE**



## Overview

A hypothesis test assesses your sample statistic and factors in an estimate of the sample error to determine which hypothesis the data support. When you can reject the null hypothesis, the results are statistically significant, and your data support the theory that an effect exists at the population level.

In this unit the Hypothesis and the Procedure for Hypothesis Testing has been clearly explained.

## Objectives

After studying this unit, you will be able to:

- Identify the Steps involved in Hypothesis Testing
- Resolve the errors in Hypothesis Testing
- Describe the One Sample and Two Sample Parametric Tests

## 13.1. Hypothesis

Hypothesis is usually considered as the principal instrument in research. Its main function is to suggest new experiments and observations. In fact, many experiments are carried out with the deliberate object of testing hypotheses.

Decision-makers often face situations wherein they are interested in testing hypotheses on the basis of available information and then take decisions on the basis of such testing.

In social science, where direct knowledge of population parameter(s) is rare, hypothesis testing is the often used strategy for deciding whether a sample data offer such support for a hypothesis that generalisation can be made.

Thus hypothesis testing enables us to make probability statements about population parameter(s). The hypothesis may not be proved absolutely, but in practice it is accepted if it has withstood a critical testing. Before we explain how hypotheses are tested through different tests meant for the purpose, it will be appropriate to explain clearly the meaning of a hypothesis and the related concepts for better understanding of the hypothesis testing techniques

## 13.2. Procedure for Hypothesis Testing

To test a hypothesis means to tell (on the basis of the data the researcher has collected) whether or not the hypothesis seems to be valid. In hypothesis testing the main question is: whether to accept the null hypothesis or not to accept the null hypothesis? Procedure for hypothesis testing refers to all those steps that we undertake for making a choice between the two actions i.e., rejection and acceptance of a null hypothesis. The various steps involved in hypothesis testing are stated below:

(i) ***Making a formal statement:*** The step consists in making a formal statement of the null hypothesis ($H_0$) and also of the alternative hypothesis ($H_a$). This means that hypotheses should be clearly stated, considering the nature of the research problem.

(ii) ***Selecting a significance level:*** The hypotheses are tested on a pre-determined level of significance and as such the same should be specified. Generally, in practice, either 5% level or 1% level is adopted for the purpose. The factors that affect the level of significance are:

(a) The magnitude of the difference between sample means;

(b) The size of the samples;

(c) The variability of measurements within samples; and

(d) Whether the hypothesis is directional or non-directional (A directional hypothesis is one which predicts the direction of the difference between, say, means). In brief, the level of significance must be adequate in the context of the purpose and nature of enquiry.

(iii) ***Deciding the distribution to use:*** After deciding the level of significance, the next step in hypothesis testing is to determine the appropriate sampling distribution. The choice generally remains between normal distribution and the *t*-distribution. The rules for selecting the correct distribution are similar to those which we have stated earlier in the context of estimation.

(iv) ***Selecting a random sample and computing an appropriate value****:* Another step is to select a random sample(s) and compute an appropriate value from the sample data concerning the test statistic utilizing the relevant distribution. In other words, draw a sample to furnish empirical data.

(v) ***Calculation of the probability****:* One has then to calculate the probability that the sample result would diverge as widely as it has from expectations, if the null hypothesis were in fact true.

(vi) ***Comparing the probability****:* Yet another step consists in comparing the probability thus calculated with the specified value for a, the significance level. If the calculated probability is equal to or smaller than the value in case of one-tailed test (and a /2 in case of two-tailed test), then reject the null hypothesis (i.e., accept the alternative hypothesis), but if the calculated probability is greater, then accept the null hypothesis. In case we reject $H_0$, we run a risk of (at most the level of significance) committing an error of Type I, but if we accept $H_0$, then we run some risk (the size of which cannot be specified as long as the $H_0$ happens to be vague rather than specific) of committing an error of Type II.

## Let Us Sum Up

In this unit you have learned about the following:

- The first step of the testing procedure is to establish the hypothesis to be tested. As it is known, these statistical hypotheses are generally assumptions about the value of the population parameter; the hypothesis specifies a single value or a range of values for two different hypotheses rather than constructing a single hypothesis.
- The two hypotheses are generally referred to as the (1) null hypotheses denoted by H0 and (2) alternative hypothesis denoted by H1.

- The hypothesis may be rejected or accepted depending upon whether the value of the test statistic falls in the rejection or the acceptance region.

## Check Your Progress

1. The term “Regression” coined by_____
2. Least Square Method uses _____
3. In descriptive statistics, data from the entire population or a sample is summarized with ___.

## Glossary

**Alternative Hypothesis:** Statistical techniques of hypothesis testing involve proving a statement that acts as an alternative for the hypothesis.

**Observation:** From the observation (of data), different statistics are constructed to estimate the population parameters. In general (but not always) the sampling distribution of these statistics depends on the parameters and form of the parent population.

**Frequencies:** The theoretical frequencies in a contingency table are calculated by imposing the limitations that the row totals, column totals and the grand total remain constant.

## Answer to Check your Progress

1. Francis Galton
2. Linear regression
3. Numerical descriptor

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-14

# Parametric and Non Parametric Tests

**STRUCTURE**



## Overview

Parametric statistics are based on assumptions about the distribution of population from which the sample was taken. Nonparametric statistics are not based on assumptions, that is, the data can be collected from a sample that does not follow a specific distribution.

In this unit, the parametric tests or standard tests of hypothesis, Non-parametric tests or distribution-free tests of hypothesis and Multivariate Analysis has been explained.

## Objectives

After studying this unit, you will be able to:

- Describe the One Sample and Two Sample Parametric Tests
- Explain the Chi-square Test
- Recognize the conception of ANOVA
- Explain the concept of multivariate analysis
- Classify the multivariate analysis
- Define the Discriminant Analysis and Conjoint Analysis
- Discuss the Factor Analysis and Cluster Analysis
- State the Multidimensional Scaling (MDS)

## 14.1. Parametric tests or standard tests of hypothesis

Parametric tests assume certain properties of the population sample such as observations from a normal population, large sample size, population parameters like mean and variance. The various parametric tests of hypothesis are based on the assumption of normality. In other words, the source of data for them is normally distributed. They can be listed as follows:

- **Z-test:** This is based on the normal probability distribution and is used for judging the significance of several statistical measures, particularly the mean.
- **t-test:** This is based on t-distribution and is considered an appropriate test for judging the significance of a sample mean or for judging the significance of difference between the means of two samples in case of small sample(s) when population variance is not known (in which case we use variance of the sample as an estimate of the population variance)
- **Chi- square**: This test is based on a chi-square distribution and is used for comparing a sample variance to a theoretical population variance.
- **F-test**: This test is based on F-distribution and is also used to compare the variance of two independent samples. It is also used to compare the significance of multiple correlation coefficients.

## 14.2. Non-parametric tests or Distribution-free tests of Hypothesis

A non-parametric test is a test that does not assume anything about the underlying distribution. It is sometimes called a distribution free test. There are various types of non parametric tests. There are situations in testing where assumptions cannot be made. In such situations, non-parametric methods are employed. There are various types of non-parametric tests.

These include:

- Sign test: They include one-sample sign test and two-sample sign test.
- Fisher–Irwin test.
- McNamara test.
- Wilcoxon matched-pairs test.

**Sign test**: This is one of the easiest tests in practice based on the plus/ minus sign of an observation in a sample. The sign may be one of the following two types:

- **One-sample sign test**: This is a very simple distribution-free test and is applied in case of a sample from a continuous symmetrical population, wherein the probability of a sample to be either less or more than mean is half. Here, to test a null hypothesis, all those items, which are greater than the alternate hypothesis, are replaced by a plus sign and those, which are less than the alternate hypothesis, are replaced by a minus sign.
- **Two-sample sign test**: In case of all the problems consisting of paired data, two-sample sign test is used. Here, each pair of values can be replaced with a plus sign in the first value of the first sample with the first value of the second sample. If the first value is less, minus sign is assigned.

**Mann-Whitney Test**

This test was developed by H B Mann and R Whitney in the 1940s. The test is used to examine whether two samples have been drawn from populations with same locations (mean). The application of a t test involves the assumption that the samples are drawn from the normal population. If the normality assumption is violated, this test can be used as an alternative to a t test. This is a very powerful non-parametric test as this can be used both for qualitative and quantitative data. A two tailed hypothesis for a Mann-Whitney test could be written as:

H0 : Two samples come from identical populations or Two populations have identical probability distribution.

H1 : Two samples come from different populations or Two populations differ in locations.

The procedure involved in the use of Mann-Whitney U test is very simple and is described in the following steps:

(i) The two samples are combined (pooled) into one large sample and then we determine the rank of each observation in the pooled sample. If two or more sample values in the pooled samples are identical, i.e., if there are ties, the sample values are each assigned a rank equal to the mean of the ranks that would otherwise be assigned.

(ii) We determine the sum of the ranks of each sample. Let R1 and R2 represent the sum of the ranks of the first and the second sample

whereas n1 and n2 are the respective sample sizes of the first and the second sample. For convenience, choose n1 as a small size if they are unequal so that n1 □□n2. A significant difference between R1 and R2 implies a significant difference between the samples.

**Kruskal Wallis**

One of the assumptions used in the ANOVA technique is that all the involved populations from where the samples are taken are normally distributed. If this assumption does not hold true, the F-statistic used in ANOVA becomes invalid. The normality assumptions may not hold true when we are dealing with ordinal data or when the size of the sample is very small.

The Kruskal-Wallis test comes to our rescue during such situations. This is, in fact, a non-parametric counterpart to the one-way ANOVA. The test is an extension of the Mann-Whitney U test discussed earlier. Both methods require that the scale of the measurement of a sample value should be at least ordinal.

The hypothesis to be tested in-Kruskal-Wallis test is:

$H_0$ : The k populations have identical probability distribution.

$H_1$ : At least two of the populations differ in locations.

The procedure for the test is listed below:

(i) Obtain random samples of size $n_1$, ..., nk from each of the k populations.

Therefore, the total sample size is n = n1 + n2 + ... + nk

(ii) Pool all the samples and rank them, with the lowest score receiving a rank of 1. Ties are to be treated in the usual fashion by assigning an average rank to the tied positions.

(iii) Let r = the total of the ranks from the $i^{th}$ sample.

The Kruskal-Wallis test uses the $\chi^2$ to test the null hypothesis. The test statistic is given by:

$$H = \frac{12}{n(n+1)} \sum_{i=1}^{k} \frac{r_i^2}{n_i} - 3(n+1),$$

which follows a $\chi^2$ distribution with the k–1 degrees of freedom. Where,

k = Number of samples

n = Total number of elements in k samples.

The null hypothesis is rejected, if the computed $\chi^2$ is greater than the

critical value of $\chi^2$ at the level of significance.

- **Fisher–Irwin test**: This is applied where there is no difference between two sets of data. In other words, it is used where you can assume that two different treatments are supposedly different in terms of the results that they produce. It is applied in all those cases where result for each item in a sample can be divided into one of the two mutually exclusive categories.
- **McNamara test**: It is applied where the data is nominal in nature and is related to two interrelated samples. By using this test, you can judge the significance of any observed changes in the same subject.
- **Wilcox on matched-pairs test**: This test is applied in the case of a matched-pair such as output of two similar machines. Here, you can determine both the direction and the magnitude between the matched values. This test is also called Signed Rank Test.

The test procedure is outlined in the following steps:

(i) Let denote the difference in the score for the $i^{th}$ matched pair. Retain signs, but discard any pair for which d = 0.

(ii) Ignoring the signs of difference, rank all the di's from the lowest to highest. In case the differences have the same numerical values, assign to them the mean of the ranks involved in the tie.

(iii) To each rank, prefix the sign of the difference.

(iv) Compute the sum of the absolute value of the negative and the positive ranks to be denoted as T– and T+ respectively.

(v) Let T be the smaller of the two sums found in step iv.

When the number of the pairs of observation (n) for which the difference is not zero is greater than 15, the T statistic follows an approximate normal distribution under the null hypothesis, that the population differences are centered at 0. The mean □T and standard deviation □T of T are given by:

$$\mu_T = \frac{n(n+1)}{4} \quad \text{and} \quad \sigma_T = \sqrt{\frac{n(n+1)(2n+1)}{24}}$$

The test statistic is given by:

$$Z = \frac{T - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}}$$

For a given level of significance □, the absolute sample Z should be greater than the absolute Z□/2 to reject the null hypothesis. For a one-sided upper tail test, the null hypothesis is rejected if the sample Z is greater than Z□ and for a one-sided lower tail test, the null hypothesis is rejected if sample Z is less than – Z□.

## 14.3. Multivariate Analysis

### 14.3.1 Factor Analysis

Factor analysis is a multivariate statistical technique in which there is no distinction between dependent and independent variables. In factor analysis, all variables under investigation are analysed together to extract the underlined factors.

Factor analysis is a data reduction method. It is a very useful method to reduce a large number of variables resulting in data complexity to a few manageable factors. These factors explain most part of the variations of the original set of data. A market researcher might have collected data on say, more than 50 attributes (or items) of a product which may become very difficult to analyse. Factor analysis could help to reduce the data on 50 odd attributes to a few manageable factors. It helps in identifying the underlying STRUCTURE of the data.

A *factor* is a linear combination of variables. It is a construct that is not directly observable but that needs to be inferred from the input variables. The factors are regression analysis as the factor scores, when used as independent variables in regression analysis, help to solve the problem of multicollinearity. (The problem of multicollinearity in a regression model arises when the independent variables are so highly correlated that it becomes difficult to separate out the influence of each of the independent variables on the dependent variable.) The factor scores could also be used in other multivariate techniques.

**Uses of Factor Analysis**

The technique of factor analysis has multiple uses as discussed in the following situations:

**Scale construction:** Factor analysis could be used to develop concise multiple item scales for measuring various constructs. We have already discussed in the chapter Attitude Measurement and Scaling the process of developing a multiple item scale that typically starts generating a large

set of items (statements) relating to the attitude being measured. This is done as part of exploratory research. Factor analysis can reduce the set of statements to a concise instrument and at the same time, ensure that the retained statements adequately represent the critical aspects of the constructs being measured.

Suppose we want to prepare a multiple item scale for measuring the job satisfaction of skilled workers in an organization. As the first step, we would generate a large number of statements, numbering say 100 or so as part of exploratory research. These statements could be subjected to factor analysis and let us assume that we get three factors out of it. Now, if we want to construct a 15-item scale to measure job satisfaction, what could be done is to separate five items in each of the factors having the highest factor loading. The concept of factor loading will be discussed later in the book. This way, a 15-item scale to measure job satisfaction could be developed.

**Establish antecedents:** This method reduces multiple input variables into grouped factors. Thus, the independent variables can be grouped into broad factors. For example, all the variables that measure the safety clauses in a mutual fund could be reduced to a factor called safety clause. Thus, the company could know about the broad benefit that an investor seeks in a fund.

**Psychographic profiling:** Different independent variables are grouped to measure independent factors. These are then used for identifying personality types. One of the most well-known inventories based on this technique is called the 16 PF inventory.

**Segmentation analysis:** Factor analysis could also be used for segmentation. For example, there could be different sets of two-wheelers-customers owning two wheelers because of different importance they give to factors like prestige, economy consideration and functional features.

**Marketing studies:** The technique has extensive use in the field of marketing and can be successfully used for new product development; product statistically independent. We will show you their application in a acceptance research, developing of advertising copy, pricing studies and for branding studies. For example we can use it to:

- identify the attributes of brands that influence consumers' choice;
- get an insight into the media habits of various consumers;
- identify the characteristics of price-sensitive customers.

**Conditions for a Factor Analysis Exercise**

Factor analysis requires some specific conditions that must be ensured before executing the technique. These are mentioned in detail in this section.

- Factor analysis exercise requires metric data. This means the data should be either interval or ratio scale in nature. The variables for factor analysis are identified through exploratory research which may be conducted by reviewing the literature on the subject, researches carried out already in this area, by informal interviews of knowledgeable persons, qualitative analysis like focus group discussions held with a small sample of the respondent population, analysis of case studies and judgement of the researcher. Generally in a survey research, a five or seven-point Likert scale or any other interval scales may be used.
- As the responses to different statements are obtained through different scales, all the responses need to be standardized. The standardization helps in comparison of different responses from such scales. The standardization is carried out using the following formulae:

$$\text{Standardized score of respondent on a statement} = \frac{\text{Actual score of 1th respondent on statement} - \text{Mean of all respondents on the statement}}{\text{Standard deviation of all respondents on the statement}}$$

- The size of the sample respondents should be at least four to five times more than the number of variables (number of statements).
- The basic principle behind the application of factor analysis is that the initial set of variables should be highly correlated. If the correlation coefficients between all the variables are small, factor analysis may not be an appropriate technique. A correlation matrix of the variables could be computed and tested for its statistical significance. The hypothesis to be tested may be written as:

H0: Correlation matrix is insignificant, i.e., correlation matrix is an identity matrix where diagonal elements are one and off diagonal elements are zero.

H1: Correlation matrix is significant.

- The test is carried out by using a Bartlett test of sphericity, which takes the determinant of the correlation matrix into consideration.

The test converts it into a chi-square statistics with degrees of freedom equal to [(k(k-1))/2], where k is the number of variables on which factor analysis is applied. The significance of the correlation matrix ensures that a factor analysis exercise could be carried out.

- Another condition which needs to be fulfilled before a factor analysis could be carried out is the value of Kaiser-Meyer-Olkin (KMO) statistics which takes a value between 0 and 1. For the application of factor analysis, the value of KMO statistics should be greater than 0.5. The KMO statistics compares the magnitude of observed correlation coefficients with the magnitudes of partial correlation coefficients. A small value of KMO shows that correlation between variables cannot be explained by other variables.

**Steps in a Factor Analysis Exercise**

There are basically two steps that are required in a factor analysis exercise.

1. **Extraction of factors:** The first and the foremost step is to decide on how many factors are to be extracted from the given set of data. This could be accomplished by various methods like the centroid method, the principal component method and the maximum likelihood method. Here, only the principal component method will be discussed very briefly. As we know that factors are linear combinations of the variable which are supposed to be highly correlated, the mathematical form of the same could be written as:

   Fi = Wi1X1* + Wi2X2* + Wi3X3* + ... + WikXk*

   where,

   X * = i th standardized variable

   F = Estimate of i th factor

   W = Weight or factor score coefficient for i th standardized variable.

   k = Number of variables

   The principal component methodology involves searching for those values of Wi so that the first factor explains the largest portion of total variance. This is called the first principal factor. This explained variance is then subtracted from the original input matrix so as to yield a residual matrix. A second principal factor is extracted from the residual matrix in a way such that the second factor takes care of

most of the residual variance. One point that has to be kept in mind is that the second principal factor has to be statistically independent of the first principal factor. The same principle is then repeated until there is little variance to be explained. Theory may be used to specify how many factors should be extracted or it may be based on the criterion of the Kaiser Guttman method. This method states that the number of factors to be extracted should be equal to the number of factors having an eigenvalue of at least 1. Since each of the variables in the original data set has a variance of 1 (eigenvalue of 1), therefore, if there are 50 variables then the total variation in the data set will be 50.

2. **Rotation of factors:** The second step in the factor analysis exercise is the rotation of initial factor solutions. This is because the initial factors are very difficult to interpret. Therefore, the initial solution is rotated so as to yield a solution that can be interpreted easily. Most of the computer software would give options for *orthogonal rotation, varimax rotation* and *oblique rotation*. Generally, the varimax rotation is used as these results in independent factors.

   The varimax rotation method maximizes the variance of the loadings within each factor. The variance of the factor is largest when its smallest loading tends towards zero and its largest loading tends towards unity. The basic idea of rotation is to get some factors that have a few variables that correlate high with that factor and some that correlate poorly with that factor. Similarly, there are other factors that correlate high with those variables with which the other factors do not have significant correlation. Therefore, the rotation is carried out in such way so that the factor loadings as in the first step are close to unity or zero.

   This procedure avoids problems of having factors with all variables having midrange correlations. This is done for a better interpretation of the results and for the ease obtained in naming the factors. Once this is done, a cut-off point on the factor loading is selected. There is no hard and fast rule to decide on the cut-off point. However, generally it is taken to be greater than 0.5. All those variables attached to a factor, once the cut-off point is decided, are used for naming the factors. This is a very subjective procedure and different researchers may name same factors differently. Another point to be noted is that a variable which appears in one factor should not appear in any other factor. This means that a variable should have a high loading only on one factor and a low loading on other factors. If

that is not the case, it implies that the question has not been understood properly by the respondent or it may not have been phrased clearly. Another possible cause could be that the respondent may have more than one opinion about a given item (statement).

### 14.3.2. Cluster

Cluster analysis is a grouping technique. The basic assumption underlying the technique is the fact that similarity is based on multiple variables, and the technique attempts to measure the proximity in terms of the study variables. The emerging groups are homogenous in their composition and heterogeneous as compared to the other groups. The grouping can be done for objects, individuals, entities and products.

The researcher identifies a set of clustering variables which have been assumed as significant for the purpose of classifying the objects into groups. Thus, it is also referred to as a classification technique, numerical taxonomy and Q analysis.

This is basically because the technique is used in various branches of social science, like psychology, sociology, engineering and management. If one were to plot the groups geometrically, a robust cluster analysis is one where individual objects in one cluster are concentrated together and where the individual clusters are far apart from each other.

**Differentiating Cluster Analysis**

In terms of the nature of the technique vis-á-vis the other multivariate techniques, cluster analysis is similar in terms of analysing the function of multiple independent variables. However, there are essential differences between the other data reduction techniques and cluster analysis.

In factor analysis, the objective was to reduce the original correlated variables to a more manageable number of orthogonal or oblique factors. However, the data reduction was carried out on the columns of the data matrix. On the other hand, in cluster analysis the focus is on the rows, or the individuals or entities and the objective is to group the individuals on the variables.

The other data classification technique is the two group discriminant analyses. Here also, one might wish to group individuals or objects into groups, but the classification or identification of groups is *a priori*. Thus, in the technique one has an established classification rule and the

objective of the technique is to validate the information to attest whether the groups obtained by the identified function are correctly classified or not. In cluster analysis, the whole population/sample is undifferentiated and the attempts to assess similarity in response to variables and the grouping happens *post* the clustering.

### 14.3.3 Discriminant Analysis

Discriminant analysis is used to predict group membership. This technique is used to classify individuals/objects into one of the alternative groups on the basis of a set of predictor variables. The dependent variable in discriminant analysis is categorical and on a nominal scale, whereas the independent or predictor variables are either interval or ratio scale in nature.

When there are two groups (categories) of dependent variable, we have two-group discriminant analysis and when there are more than two groups, it is a case of multiple discriminant analysis. In case of two-group discriminant analysis, there is one discriminant function, whereas in case of multiple discriminant analysis, the number of functions is one less than the number of groups.

#### Objectives and Uses of Discriminant Analysis

The objectives of discriminant analysis are the following:

- To find a linear combination of variables that discriminate between categories of dependent variable in the best possible manner.
- To find out which independent variables are relatively better in discriminating between groups.
- To determine the statistical significance of the discriminant function and whether any statistical difference exists among groups in terms of predictor variables.
- To develop the procedure for assigning new objects, firms or individuals whose profile but not the group identity are known to one of the two groups.
- To evaluate the accuracy of classification, i.e., the percentage of customers that it is able to classify correctly. Discriminant analysis can be a very powerful technique of analysis in multiple situations. Some areas in which it is extensively used are as follows:
- **Scale construction:** Discriminant analysis is used to identify

then variables/statements that are discriminating and on which people with diverse views will respond differently. For example, in case one wants to assess people who believe that corporate governance is the responsibility of policy-makers against those who think it needs to be self driven or individual centric, one may generate a number of statements and then conduct a pilot study and select only those statements on which the two groups differ significantly.

- **Segment discrimination:** Most business managers recognize that the population under consideration can never be totally homogeneous in composition. Therefore, to understand what the key variables are on which two or more groups differ from each other, this technique is extremely useful. Questions to which one may seek answers are as follows:
- What are the demographic variables on which potentially successful
- Salesmen and potentially unsuccessful salesmen differ?
- What are the variables on which users/non-users of a product can be differentiated?
- What are the economic and psychographic variables on which price sensitive and non-price sensitive customers be differentiated?
- What are the variables on which the buyers of local/national brand of a product be differentiated?
- **Perceptual mapping:** The technique is also used extensively to create attribute-based spatial maps of the respondent's mental positioning of brands. The advantage of the technique is that it can present brands or objects and the attributes on the same map. Therefore, the business manager can determine what attribute is the Unique Selling Proposition (USP) of which brand and which are the attributes that are valued by the respondent but there is no brand that currently satisfies that need.

## Let Us Sum Up

In this unit, you have learned the following:

- There are situations where assumptions cannot be made. In such situations, different statistical methods are used, which are known as non-parametric tests.

- The Mann-Whitney test is used to examine whether two samples have been drawn from populations with same locations (mean).
- The Kruskal-Wallis test is an extension of the Mann-Whitney U test discussed earlier. Both methods require that the scale of the measurement of a sample value should be at least ordinal.
- Factor analysis is a multivariate statistical technique in which there is no distinction between dependent and independent variables. In factor analysis, all variables under investigation are analysed together to extract the underlined factors.
- Cluster analysis is a grouping technique. The basic assumption underlying the technique is the fact that similarity is based on multiple variables and the technique attempts to measure the proximity in terms of the study variables.
- Discriminant analysis is used to predict group membership. This technique is used to classify individuals/objects into one of the alternative groups on the basis of a set of predictor variables.
- The dependent variable in discriminant analysis is categorical and on a nominal scale, whereas the independent or predictor variables are either interval or ratio scale in nature.
- Validation starts with a framework that defines the scope and aspects (in the case of multi-dimensional scales) of the proposed interpretation. The framework also includes a rational justification that links the interpretation to the test.

## Check your Progress

1. Linear-regression models are relatively simple and provide an easy-to-interpret mathematical formula that can generate _____.
2. For each value of the _____ distribution of the dependent variable must be normal.
3. A Linear Regression model's main aim is to find the best fit linear line and the _____ of intercept and coefficients such that the error is minimized.

## Glossary

**Cluster Analysis:** Cluster Analysis is a technique used for classifying objects into groups.

**Conjoint Analysis**: Conjoint analysis is concerned with the measurement of the joint effect of two or

more attributes that are important from the customers' point of view.

**Discriminant Analysis:** In this analysis, two or more groups are compared. In the final analysis, we need to find out whether the groups differ one from another.

**Factor Analysis**: Factor Analysis is the analysis whose main purpose is to group large set of variable factors into fewer factors.

**Multivariate Analysis:** In multi variate analysis, the number of variables to be tackled are many.

## Answer to Check your Progress

1. Predictions
2. Intermediate variable
3. Optimal values

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

## Block-5: Introduction

**Block-5: Interpretations and Report Writing** has been divided in to two Units.

**Unit-15: Interpretations** describes about the Introduction, Meaning of Interpretations, Importance of Interpretation and Techniques of Interpretation.

**Unit-16: Report writing** deals with the Report Writing, Role of Research Reports, Types of Research Reports, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Mechanics of Writing a Research Report and Precautions for Writing Research Reports.

In all the units of Block -5 **Interpretations and Report Writing**, the Check your progress, Glossary, Answers to check your progress and Suggested Reading has been provided and the Learners are expected to attempt all the Check your progress as part of study.

# Unit-15
# Interpretations

**STRUCTURE**



## Overview

Interpretation of research data means drawing inference from the collected facts and computed statistics or test statistics. The task of interpretation has two major aspects; the effort to establish continuity in research through linking the results of given study with those of others.

In this unit, the Meaning of Interpretations, the Importance of Interpretation and the Techniques of Interpretation has been clearly explained.

## Objectives

After studying this unit, you will be able to:

- Explain the meaning and characteristics of research report
- Recognize the significance of report writing
- Describe the techniques and precaution of interpretation

## 15.1. Introduction

After collecting and analyzing the data, the researcher has to accomplish the task of drawing inferences followed by report writing. This has to be done very carefully, otherwise misleading conclusions may be drawn and the whole purpose of doing research may get vitiated. It is only through interpretation that the researcher can expose relations and processes that underlie his findings. In case of hypotheses testing

studies, if hypotheses are tested and upheld several times, the researcher may arrive at generalizations. But in case the researcher had no hypothesis to start with, he would try to explain his findings on the basis of some theory. This may at times result in new questions, leading to further researches. All this analytical information and consequential inference(s) may well be communicated, preferably through research report, to the consumers of research results who may be either an individual or a group of individuals or some public/private organisation.

## 15.2. Meaning of Interpretation

Interpretation refers to the task of drawing inferences from the collected facts after an analytical and/or experimental study. In fact, it is a search for broader meaning of research findings. The task of interpretation has two major aspects viz.,

(i) The effort to establish continuity in research through linking the results of a given study with those of another, and

(ii) The establishment of some explanatory concepts. “In one sense, interpretation is concerned with relationships within the collected data, partially overlapping analysis. Interpretation also extends beyond the data of the study to include the results of other research, theory and hypotheses.”

## 15.3. Importance of Interpretation

Interpretation is essential for the simple reason that the usefulness and utility of research findings lie in proper interpretation. It is being considered a basic component of research process because of the following reasons:

(i) It is through interpretation that the researcher can well understand the abstract principle that works beneath his findings. Through this he can link up his findings with those of other studies, having the same abstract principle, and thereby can predict about the concrete world of events. Fresh inquiries can test these predictions later on. This way the continuity in research can be maintained.

(ii) Interpretation leads to the establishment of explanatory concepts that can serve as a guide for future research studies; it opens new avenues of intellectual adventure and stimulates the quest for more knowledge.

(iii) Researcher can better appreciate only through interpretation why his findings are what they are and can make others to understand the real significance of his research findings.

(iv) The interpretation of the findings of exploratory research study often results into hypotheses for experimental research and as such interpretation is involved in the transition from exploratory to experimental research. Since an exploratory study does not have a hypothesis to start with, the findings of such a study have to be interpreted on a *post-factum* basis in which case the interpretation is technically described as '*post factum*' interpretation.

## 15.4. Techniques of Interpretation

The task of interpretation is not an easy job; rather it requires a great skill and dexterity on the part of researcher. Interpretation is an art that one learns through practice and experience. The researcher may, at times, seek the guidance from experts for accomplishing the task of interpretation.

The technique of interpretation often involves the following steps:

(i) Researcher must give reasonable explanations of the relations which he has found and he must interpret the lines of relationship in terms of the underlying processes and must try to find out the thread of uniformity that lies under the surface layer of his diversified research findings. In fact, this is the technique of how generalization should be done and concepts be formulated.

(ii) Extraneous information, if collected during the study, must be considered while interpreting the final results of research study, for it may prove to be a key factor in understanding the problem under consideration.

(iii) It is advisable, before embarking upon final interpretation, to consult someone having insight into the study and who is frank and honest and will not hesitate to point out omissions and errors in logical argumentation. Such a consultation will result in correct interpretation and, thus, will enhance the utility of research results.

## Let Us Sum Up

In this unit, you have learned about the following:

- The preliminary section typically includes the title page, the table of contents and the letter of authorization and the letter of transmittal. The most significant section of this part is a short but succinct executive summary, which summarizes the main report.
- The main report includes the background of the study, as well as the scope, framework and the methodology of the study,

including the data collection and sampling plan. The section culminates into the most important part of the report, the study findings and interpretation of these results.

- Researcher must accomplish the task of interpretation only after considering all relevant factors affecting the problem to avoid false generalization. He must be in no hurry while interpreting results, for quite often the conclusions, which appear to be all right at the beginning, may not at all be accurate.

## Check your Progress

1. The first page of the research report is_____.
2. A comprehensive full Report of the research process is called_____.
3. Which of the following is not one of the seven major parts to the research report?

   a. Results

   b. Abstract

   c. Method

   d. Footnotes

## Glossary

**Executive summary:** It is important in a research report as this presents the report in a shortened form. Sometimes, the decision maker would read only this portion of the report when constrained by time. This should describe the problem, approach, and research design that was adopted. A small portion of the summary section should be devoted to the major results, conclusions and recommendations.

**Approach to the problem**: It discusses the broad approach that was adopted in addressing the problem. This should contain a description of the theoretical foundations that guided the research, any analytical models formulated, research questions, hypothesis and the factors that influenced the research design.

## Answer to check your Progress

1. Title Page

2. Thesis

3. Footnotes

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.
2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.
3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Unit-16
# Report Writing

**STRUCTURE**



## Overview

In many ways, a research report can be considered as a summary of the research process that clearly highlights findings, recommendations, and other important details. Reading a well-written research report should provide you with all the information you need about the core areas of the research process.

In this unit, the Report Writing, Role of Research Reports, Types of Research Reports, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Mechanics of Writing a Research Report and Precautions for Writing Research Reports has been clearly explained.

## Objectives

After studying this unit, you will be able to:

- Discuss the layout of report
- Categorize different types of report

## 16.1. Report Writing

On completion of the research study and after obtaining the research results, the real skill of the researcher lies in analysing and interpreting the findings and linking them with the propositions formulated in the form of research hypotheses at the beginning of the study. The statistical or qualitative sum up of results would be little more than numbers or conclusions unless the researcher is able to present the documented version (research report) of the research endeavor.

Thus, one cannot overemphasize the significance of a well-documented and structured research report. Just like all the other steps in the research process, this requires careful and sequential treatment. In this unit, we will be discussing in detail the documentation of the research study. The format and the steps might be moderately adjusted and altered based on the reader's requirement. Thus, it might be for an academic and theoretical purpose or might need to be clearly spelt and linked with the business manager's decision dilemma.

## 16.2. Role of Research Reports

Research reports are designed in order to convey and record the information that will be of practical use to the reader. It is organized into distinct units of specific and highly visible information. The role of research reports may be summarized as follows:

- The research report fulfils the historical task of serving as a concrete proof of the study that was undertaken. This serves the purpose of providing a framework for any work that can be conducted in the same or related areas.
- It is the complete detailed report of the research study undertaken by the researcher; thus, it needs to be presented in a comprehensive and objective manner. This is a one-way communication of the researcher's study and analysis to the reader/manager, and thus needs to be all inclusive and yet neutral in its reporting.
- For academic purpose, the recorded document presents a knowledge base on the topic under study and for the business manager seeking help in taking more informed decisions; the report provides the necessary guidance for taking appropriate action.
- As the report documents all the steps followed and the analysis carried out, it also serves to authenticate the quality of the work

carried out and establishes the strength of the findings obtained. Thus, effective recording and communicating of the results of the study becomes an extremely critical step of the research process. Based on the nature of the research study and the researcher's orientation, the report can take different forms.

## 16.3 Types of Research Reports

Research reports can be categorized on the following bases:

1. On the basis of size
2. On the basis of information
3. On the basis of representation

### 1. Classification on the basis of size

Based on the size of the report, it is possible to divide the report into brief reports and detailed reports.

- **Brief reports:** These kinds of reports are not formally structured and are generally short, sometimes not running more than four to five pages. The information provided has limited scope and is a prelude to the formal structured report that would subsequently follow. These reports could be designed in several ways.
- **Working papers or basic reports** are written for the purpose of recording the process carried out in terms of scope and framework of the study, the methodology followed and instrument designed. The results and findings would also be recorded here. However, the interpretation of the findings and study background might be missing, as the focus is more on the present study rather than past literature.
- **Survey reports** might or might not have an academic orientation. The focus here is to present findings in easy-to-comprehend format that includes figures and tables. The advantage of these reports is that they are simple and easy to understand and present the findings in a clear and usable format.
- **Detailed reports:** These are more formal and could be academic, technical or business reports. Sometimes, the researcher may prepare both kinds— for an individual as well as for a business purpose.

### 2. Classification on the basis of information

The ways through which the results of the research report can be

presented on the basis of information contained as follows:

- **Technical report**: A technical report is not written by the researcher himself but is written on behalf of other researchers. In writing technical reports, importance is mainly given to the methods that have been used to collect the information and the data, the presumptions that were made and finally, the various presentation techniques that were used to present the findings and the data. Following are the main features of a technical report:
  - **Summary**: It covers a brief analysis of the findings of the research in a few pages.
  - **Nature**: It contains the reasons for which the research is undertaken, the analysis and the data that is required in order to prepare the report.
  - **Methods employed**: It contains a description of the methods that were employed in order to collect data.
  - **Data**: It covers a brief analysis of the various sources from which the data was collected with their features and drawbacks.
  - **Analysis of data and presentation of the findings**: It contains the various forms in which the data that has been analysed and can be presented.
  - **Conclusions**: It contains a brief explanation of the findings of the research.
  - **Bibliography**: It contains a detailed analysis of the various bibliographies that have been used in order to conduct the research.
  - **Technical appendices**: It contains the appendices for the technical matters and for questionnaires and mathematical derivations.
  - **Index**: The index of the technical report must be provided at the end of the report.
- **Popular report**: A popular report is formulated when there is a need to draw the conclusions of the findings of the research report. One of the main considerations while formulating a research report is that it must be simple and attractive. It must be written in a very simple manner that can be is understood all, and also be made attractive by using large prints, various sub-headings and by giving cartoons occasionally. The following are the main points that must be kept in

mind while preparing a popular report:

- **Findings and their implications**: While preparing a popular report, importance is given to the findings of the information and the conclusions that can be drawn out of these findings.
- **Recommendations for action**: If there are any deviations in the report then recommendations are made for taking corrective action in order to rectify the errors.
- **Objective of the study**: In a popular report, the specific objective for which the research has been undertaken is presented.
- **Methods employed**: The report must contain the various methods that have been employed in order to conduct a research.
- **Results**: The results of the research findings must be presented in a suitable and appropriate manner by taking the help of charts and diagrams.
- **Technical appendices**: The report must contain in-depth information used to collect the data in the form of appendices.

- **Technical reports:** These are major documents and would include all elements of the basic report, as well as the interpretations and conclusions, as related to the obtained results. This would have a complete problem background and any additional past data/records that are essential for understanding and interpreting the study results.

All sources of data, sampling plan, data collection instrument(s), data analysis outputs would be formally and sequentially documented.

- **Business reports:** These reports include conclusions as understood by the business manager. The tables, figures and numbers of the first report would now be pictorially shown as bar charts and graphs and the reporting tone would be more in business terms. Tabular data might be attached in the appendix.

**3. Classification on the basis of representation**

Following are the ways through which the results of the research report can be classified on the basis of representation:

- **Written report:** A written report plays a vital role in every business operation. The manner in which an organization writes business letters and business reports creates an impression about its

standard. Therefore, the organization should emphasize on the improvement of writing skills of the employees in order to maintain effective relations with their customers. Making an effective written report requires a lot of hard work. Therefore, before you begin writing, it is important to know the objective, i.e., the purpose of writing, collection and organization of required data.

- **Oral report:** At times, oral presentation of the results that is drawn out of research is considered effective, particularly in cases where policy recommendations are to be made. This approach proves beneficial because it provides a medium of interaction between the listeners and the speakers. This leads to a better understanding of the findings and their implications. However, the main drawback of oral presentation is lack of any permanent records related to the research. Oral presentation of a report is more effective when it is supported by various visual devices such as slides, wall charts and white boards that help in better understanding of the research reports.

## 16.4. Different Steps in Writing Report

Research reports are the product of slow, painstaking, accurate inductive work. The usual steps involved in writing report are: (a) logical analysis of the subject-matter; (b) preparation of the final outline; (c) preparation of the rough draft; (d) rewriting and polishing; (c) preparation of the final bibliography; and (f) writing the final draft.

Though all these steps are self explanatory, yet a brief mention of each one of these will be appropriate for better understanding.

- ***Logical analysis of the subject matter**:* It is the first step which is primarily concerned with the development of a subject. There are two ways in which to develop a subject (a) logically and (b) Chronologically. The logical development is made on the basis of mental connections and associations between the one thing and another by means of analysis. Logical treatment often consists developing the material from the simple possible to the most complex structures. Chronological development is based on a connection or sequence in time or occurrence. The directions for doing or making something usually follow the chronological order.
- ***Preparation of the final outline:*** It is the next step in writing the research report “Outlines are the framework upon which long written works are constructed. They are an aid to the logical

organisation of the material and a reminder of the points to be stressed in the report."

- ***Preparation of the rough draft:*** This follows the logical analysis of the subject and the preparation of the final outline. Such a step is of utmost importance for the researcher now sits to write down what he has done in the context of his research study. He will write down the procedure adopted by him in collecting the material for his study along with various limitations faced by him, the technique of analysis adopted by him, the broad findings and generalizations and the various suggestions he wants to offer regarding the problem concerned.
- ***Rewriting and polishing of the rough draft:*** This step happens to be most difficult part of all formal writing. Usually this step requires more time than the writing of the rough draft. The careful revision makes the difference between a mediocre and a good piece of writing. While rewriting and polishing, one should check the report for weaknesses in logical development or presentation. The researcher should also "see whether or not the material, as it is presented, has unity and cohesion; does the report stand upright and firm and exhibit a definite pattern, like a marble arch? Or does it resemble an old wall of mouldering cement and loose brick."4 In addition the researcher should give due attention to the fact that in his rough draft he has been consistent or not. He should check the mechanics of writing—grammar, spelling and usage.
- ***Preparation of the final bibliography****:* Next in order comes the task of the preparation of the final bibliography. The bibliography, which is generally appended to the research report, is a list of books in some way pertinent to the research which has been done. It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts; the first part may contain the names of books and pamphlets, and the second part may contain the names of magazine and newspaper articles. Generally, this pattern of bibliography is considered convenient and satisfactory from the point of view of reader, though it is not the only way of presenting bibliography. The entries in bibliography should be made adopting the following order:

***For books and pamphlets the order may be as under:***

1. Name of author, last name first.

2. Title, underlined to indicate italics.
3. Place, publisher, and date of publication.
4. Number of volumes.

***Example***

Kothari, C.R., *Quantitative Techniques,* New Delhi, Vikas Publishing House Pvt. Ltd., 1978.

*For magazines and newspapers the order may be as under:*

a. Name of the author, last name first.
b. Title of article, in quotation marks.
c. Name of periodical, underlined to indicate italics.
d. The volume or volume and number.
e. The date of the issue.
f. The pagination.

***Example***

Robert V. Roosa, "Coping with Short-term International Money Flows", *The Banker,* London, September, 1971, p. 995.

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

- ***Writing the final draft:*** This constitutes the last step. The final draft should be written in a concise and objective style and in simple language, avoiding vague expressions such as "it seems", "there may be", and the like ones. While writing the final draft, the researcher must avoid abstract terminology and technical jargon. Illustrations and examples based on common experiences must be incorporated in the final draft as they happen to be most effective in communicating the research findings to others. A research report should not be dull, but must enthuse people and maintain interest and must show originality. It must be remembered that every report should be an attempt to solve some intellectual problem and must contribute to the solution of a problem and must add to the knowledge of both the researcher and the reader.

## 16.5. Layout of the Research Report

The research report must necessarily be conveyed enough about the study so that he can place it in its general scientific context, judge the adequacy of its methods and thus form an opinion of how seriously the findings are to be taken. For this purpose there is the need of proper layout of the report. The layout of the report means as to what the research report should contain. A comprehensive layout of the research report should comprise (A) preliminary pages; (B) the main text; and (C) the end matter.

**(A) Preliminary Pages**

In its preliminary pages the report should carry a *title and date,* followed by acknowledgements in the form of 'Preface' or 'Foreword'. Then there should be a *table of contents* followed by *list of tables and illustrations* so that the decision-maker or anybody interested in reading the report can easily locate the required information in the report.

**(B) Main Text**

The main text provides the complete outline of the research report along with all details. Title of the research study is repeated at the top of the first page of the main text and then follows the other details on pages numbered consecutively, beginning with the second page. Each main section of the report should begin on a new page. The main text of the report should have the following sections:

(i) Introduction; (ii) Statement of findings and recommendations; (iii) The results; (iv) The implications drawn from the results; and (v) The summary.

(i) ***Introduction:*** The purpose of introduction is to introduce the research project to the readers. It should contain a clear statement of the objectives of research i.e., enough background should be given to make clear to the reader why the problem was considered worth investigating. A brief summary of other relevant research may also be stated so that the present study can be seen in that context. The hypotheses of study, if any, and the definitions of the major concepts employed in the study should be explicitly stated in the introduction of the report.

The methodology adopted in conducting the study must be fully explained. The scientific reader would like to know in detail about such thing: How was the study carried out? What was its basic design? If the study was an experimental one, then what were the

experimental manipulations? If the data were collected by means of questionnaires or interviews, then exactly what questions were asked (The questionnaire or interview schedule is usually given in an appendix)? If measurements were based on observation, then what instructions were given to the observers? Regarding the sample used in the study the reader should be told: Who were the subjects? How many were there?

How were they selected? All these questions are crucial for estimating the probable limits of generalizability of the findings. The statistical analysis adopted must also be clearly stated. In addition to all this, the scope of the study should be stated and the boundary lines be demarcated. The various limitations, under which the research project was completed, must also be narrated.

(ii) ***Statement of findings and recommendations****:* After introduction, the research report must contain a statement of findings and recommendations in non-technical language so that it can be easily understood by all concerned. If the findings happen to be extensive, at this point they should be put in the summarised form.

(iii**)** ***Results****:* A detailed presentation of the findings of the study, with supporting data in the form of tables and charts together with a validation of results, is the next step in writing the main text of the report. This generally comprises the main body of the report, extending over several chapters. The result section of the report should contain statistical summaries and reductions of the data rather than the raw data. All the results should be presented in logical sequence and splitted into readily identifiable sections. All relevant results must find a place in the report. But how one is to decide about what is relevant is the basic question. Quite often guidance comes primarily from the research problem and from the hypotheses, if any, with which the study was concerned. But ultimately the researcher must rely on his own judgement in deciding the outline of his report. “Nevertheless, it is still necessary that he states clearly the problem with which he was concerned, the procedure by which he worked on the problem, the conclusions at which he arrived, and the bases for his conclusions.”

(iv) ***Implications of the results****:* Toward the end of the main text, the researcher should again put down the results of his research clearly and precisely. He should, state the implications that flow from the results of the study, for the general reader is interested in the implications for understanding the human behaviour. Such

implications may have three aspects as stated below:

(a) A statement of the inferences drawn from the present study which may be expected to apply in similar circumstances.

(b) The conditions of the present study which may limit the extent of legitimate generalization of the inferences drawn from the study.

(c) The relevant questions that still remain unanswered or new questions raised by the study along with suggestions for the kind of research that would provide answers for them.

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

(v) ***Summary:*** It has become customary to conclude the research report with a very brief summary, resting in brief the research problem, the methodology, the major findings and the major conclusions drawn from the research results.

**(C) End Matter**

At the end of the report, appendices should be enlisted in respect of all technical data such as questionnaires, sample information, mathematical derivations and the like ones. Bibliography of sources consulted should also be given. Index (an alphabetical listing of names, places and topics along with the numbers of the pages in a book or report on which they are mentioned or discussed) should invariably be given at the end of the report. The value of index lies in the fact that it works as a guide to the reader for the contents in the report.

## 16.6. Types of Reports

Research reports vary greatly in length and type. In each individual case, both the length and the form are largely dictated by the problems at hand. For instance, business firms prefer reports in the letter form, just one or two pages in length. Banks, insurance organisations and financial institutions are generally fond of the short balance-sheet type of tabulation for their annual reports to their customers and shareholders. Mathematicians prefer to write the results of their investigations in the form of algebraic notations. Chemists report their results in symbols and

formulae. Students of literature usually write long reports presenting the critical analysis of some writer or period or the like with a liberal use of quotations from the works of the author under discussion.

In the field of education and psychology, the favourite form is the report on the results of experimentation accompanied by the detailed statistical tabulations. Clinical psychologists and social pathologists frequently find it necessary to make use of the case-history form. News items in the daily papers are also forms of report writing. They represent firsthand on-the scene accounts of the events described or compilations of interviews with persons who were on the scene.

In such reports the first paragraph usually contains the important information in detail and the succeeding paragraphs contain material which is progressively less and less important. Book-reviews which analyze the content of the book and report on the author's intentions, his success or failure in achieving his aims, his language, his style, scholarship, bias or his point of view.

Such reviews also happen to be a kind of short report. The reports prepared by governmental bureaus, special commissions, and similar other organisations are generally very comprehensive reports on the issues involved. Such reports are usually considered as important research products. Similarly,

Ph.D. theses and dissertations are also a form of report-writing, usually completed by students in academic institutions.

The above narration throws light on the fact that the results of a research investigation can be presented in a number of ways viz., a technical report, a popular report, an article, a monograph or at times even in the form of oral presentation. Which method(s) of presentation to be used in a particular study depends on the circumstances under which the study arose and the nature of the results.

A *technical report* is used whenever a full written report of the study is required whether for recordkeeping or for public dissemination. A *popular report* is used if the research results have policy implications. We give below a few details about the said two types of reports:

**(A). Technical Report**

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

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

1. **Summary of results:** A brief review of the main findings just in two or three pages.
2. **Nature of the study:** Description of the general objectives of study, formulation of the problem in operational terms, the working hypothesis, the type of analysis and data required, etc.
3. **Methods employed:** Specific methods used in the study and their limitations. For instance, in sampling studies we should give details of sample design viz., sample size, sample selection, etc.
4. **Data:** Discussion of data collected their sources, characteristics and limitations. If secondary data are used, their suitability to the problem at hand is fully assessed. In case of a survey, the manner in which data were collected should be fully described.
5. **Analysis of data and presentation of findings:** The analysis of data and presentation of the findings of the study with supporting data in the form of tables and charts be fully narrated. This, in fact, happens to be the main body of the report usually extending over several chapters.
6. **Conclusions:** A detailed summary of the findings and the policy implications drawn from the results be explained.
7. **Bibliography:** Bibliography of various sources consulted be prepared and attached.
8. **Technical appendices:** Appendices be given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular technique of analysis and the like ones.
9. **Index:** Index must be prepared and be given invariably in the report at the end.

The order presented above only gives a general idea of the nature of a technical report; the order of presentation may not necessarily be the same in all the technical reports. This, in other words, means that the presentation may vary in different reports; even the different sections outlined above will not always be the same, nor will all these sections appear in any particular report.

It should, however, be remembered that even in a technical report, simple presentation and ready availability of the findings remain an important consideration and as such the liberal use of charts and diagrams is considered desirable.

**(B). Popular Report**

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

Besides, in such a report emphasis is given on practical aspects and policy implications.

We give below a general outline of a popular report.

1. ***The findings and their implications:*** Emphasis in the report is given on the findings of most practical interest and on the implications of these findings.
2. ***Recommendations for action****:* Recommendations for action on the basis of the findings of the study is made in this section of the report.
3. ***Objective of the study****:* A general review of how the problem arises is presented along with the specific objectives of the project under study.
4. ***Methods employed****:* A brief and non-technical description of the methods and techniques used, including a short review of the data on which the study is based, is given in this part of the report.
5. ***Results:*** This section constitutes the main body of the report wherein the results of the study are presented in clear and non-technical terms with liberal use of all sorts of illustrations such as charts, diagrams and the like ones.
6. *Technical appendices:* More detailed information on methods used, forms, etc. is presented in the form of appendices. But the appendices are often not detailed if the report is entirely meant for general public.

**(C). Oral Presentation**

At times oral presentation of the results of the study is considered effective, particularly in cases where policy recommendations are indicated by project results. The merit of this approach lies in the fact that it provides an opportunity for give-and-take decisions which generally lead to a better understanding of the findings and their implications. But the main demerit of this sort of presentation is the lack of any permanent record concerning the research details and it may be

just possible that the findings may fade away from people's memory even before an action is taken. In order to overcome this difficulty, a written report may be circulated before the oral presentation and referred to frequently during the discussion.

Oral presentation is effective when supplemented by various visual devices. Use of slides, wall charts and blackboards is quite helpful in contributing to clarity and in reducing the boredom, if any. Distributing a board outline, with a few important tables and charts concerning the research results, makes the listeners attentive who have a ready outline on which to focus their thinking. This very often happens in academic institutions where the researcher discusses his research findings and policy implications with others either in a seminar or in a group discussion.

Thus, research results can be reported in more than one ways, but the usual practice adopted, in academic institutions particularly, is that of writing the Technical Report and then preparing several research papers to be discussed at various forums in one form or the other. But in practical field and with problems having policy implications, the technique followed is that of writing a popular report.

Researches done on governmental account or on behalf of some major public or private organisations are usually presented in the form of technical reports.

## 16.7. Mechanics of Writing a Research Report

There are very definite and set rules which should be followed in the actual preparation of the research report or paper. Once the techniques are finally decided, they should be scrupulously adhered to, and no deviation permitted. The criteria of format should be decided as soon as the materials for the research paper have been assembled. The following points deserve mention so far as the mechanics of writing a report are concerned:

1. ***Size and physical design****:* The manuscript should be written on unruled paper 8 1/2□□× 11□ size. If it is to be written by hand, then black or blue-black ink should be used. A margin of at least one and one-half inches should be allowed at the left hand and of at least half an inch at the right hand of the paper. There should also be one-inch margins, top and bottom. The paper should be neat and legible. If the manuscript is to be typed, then all typing should be double-spaced on one side of the page only except for the insertion of the long quotations.

2. ***Procedure:*** Various steps in writing the report should be strictly adhered (All such steps have already been explained earlier in this chapter).

3. ***Layout****:* Keeping in view the objective and nature of the problem, the layout of the report should be thought of and decided and accordingly adopted (The layout of the research report and various types of reports have been described in this chapter earlier which should be taken as a guide for report-writing in case of a particular problem).

4. ***Treatment of quotations****:* Quotations should be placed in quotation marks and double spaced, forming an immediate part of the text. But if a quotation is of a considerable length (more than four or five type written lines) then it should be single-spaced and indented at least half an inch to the right of the normal text margin.

5. ***The footnotes****:* Regarding footnotes one should keep in view the followings:

   (a) The footnotes serve two purposes viz., the identification of materials used in quotations in the report and the notice of materials not immediately necessary to the body of the research text but still of supplemental value. In other words, footnotes are meant for cross references, citation of authorities and sources, acknowledgement and elucidation or explanation of a point of view. It should always be kept in view that footnote is not an end or a means of the display of scholarship. The modern tendency is to make the minimum use of footnotes for scholarship does not need to be displayed.

   (b) Footnotes are placed at the bottom of the page on which the reference or quotation which they identify or supplement ends. Footnotes are customarily separated from the textual material by a space of half an inch and a line about one and a half inches long.

   (c) Footnotes should be numbered consecutively, usually beginning with 1 in each chapter separately. The number should be put slightly above the line, say at the end of a quotation.

   At the foot of the page, again, the footnote number should be indented and typed a little above the line. Thus, consecutive numbers must be used to correlate the reference in the text with its corresponding note at the bottom of the page, except in

case of statistical tables and other numerical material, where symbols such as the asterisk (*) or the like one may be used to prevent confusion.

(d) Footnotes are always typed in single space though they are divided from one another by double space.

6. ***Documentation style:*** Regarding documentation, the first footnote reference to any given work should be complete in its documentation, giving all the essential facts about the edition used. Such documentary footnotes follow a general sequence. The common order may be described as under:

(i) ***Regarding the single-volume reference***

1. Author's name in normal order (and not beginning with the last name as in a bibliography) followed by a comma;
2. Title of work, underlined to indicate italics;
3. Place and date of publication;
4. Pagination references (The page number).

*Example*

John Gassner*, Masters of the Drama,* New York: Dover Publications, Inc. 1954, p. 315.

(ii) ***Regarding multivolume reference***

1. Author's name in the normal order;
2. Title of work, underlined to indicate italics;
3. Place and date of publication;
4. Number of volume;
5. Pagination references (The page number).

(iii) ***Regarding works arranged alphabetically***

For works arranged alphabetically such as encyclopedias and dictionaries, no pagination reference is usually needed. In such cases the order is illustrated as under:

*Example 1*

"Salamanca," *Encyclopedia Britannica,* 14th Edition.

*Example 2*

"Mary Wollstonecraft Godwin," *Dictionary of national biography.*

But if there should be a detailed reference to a long encyclopedia article, volume and pagination reference may be found necessary.

(iv) ***Regarding periodicals reference***

1. Name of the author in normal order;
2. Title of article, in quotation marks;
3. Name of periodical, underlined to indicate italics;
4. Volume number;
5. Date of issuance;
6. Pagination.

(v) ***Regarding anthologies and collections reference***

Quotations from anthologies or collections of literary works must be acknowledged not only by author, but also by the name of the collector.

(vi) ***Regarding second-hand quotations reference***

In such cases the documentation should be handled as follows:

1. Original author and title;
2. “Quoted or cited in,”;
3. Second author and work.

*Example*

J.F. Jones, *Life in Ploynesia,* p. 16, quoted in *History of the Pacific Ocean area,* by R.B. Abel, p. 191.

(vii) ***Case of multiple authorship***

If there are more than two authors or editors, then in the documentation the name of only the first is given and the multiple authorship is indicated by “et al.” or “and others”.

Subsequent references to the same work need not be so detailed as stated above. If the work is cited again without any other work intervening, it may be indicated as *ibid,* followed by a comma and the page number. A single page should be referred to as p., but more than one page be referred to as pp. If there are several pages referred to at a stretch, the practice is to use often the page number, for example, pp. 190ff, which means page number 190 and the following pages; but only for page 190 and the following page ‘190f’. Roman numerical is generally used to indicate the number of the

volume of a book. Op. cit. (opera citato, in the work cited) or Loc. cit. (loco citato, in the place cited) is two of the very convenient abbreviations used in the footnotes. Op. cit. or Loc. cit. after the writer's name would suggest that the reference is to work by the writer which has been cited in detail in an earlier footnote but intervened by some other references.

7. ***Punctuation and abbreviations in footnotes:*** The first item after the number in the footnote is the author's name, given in the normal signature order. This is followed by a comma. After the comma, the title of the book is given: the article (such as "A", "An", "The" etc.) is omitted and only the first word and proper nouns and adjectives are capitalized. The title is followed by a comma.

   Information concerning the edition is given next. This entry is followed by a comma. The place of publication is then stated; it may be mentioned in an abbreviated form, if the place happens to be a famous one such as Lond for London, N.Y. for New York, N.D. for New Delhi and so on. This entry is followed by a comma. Then the name of the publisher is mentioned and this entry is closed by a comma. It is followed by the date of publication if the date is given on the title page. If the date appears in the copyright notice on the reverse side of the title page or elsewhere in the volume, the comma should be omitted and the date enclosed in square brackets [c 1978], [1978]. The entry is followed by a comma. Then follow the volume and page references and are separated by a comma if both are given. A period closes the complete documentary reference. But one should remember that the documentation regarding acknowledgements from magazine articles and periodical literature follow a different form as stated earlier while explaining the entries in the bibliography.

   Certain English and Latin abbreviations are quite often used in bibliographies and footnotes to eliminate tedious repetition. The following is a partial list of the most common abbreviations frequently used in report-writing (the researcher should learn to recognise them as well as he should learn to use them):

   anon., anonymous

   ante., before

   art., article

   aug., augmented

bk., book

bull., bulletin

cf., compare

ch., chapter

col., column

diss., dissertation

ed., editor, edition, edited.

ed. cit., edition cited

e.g., exempli gratia: for example

eng., enlarged

et.al. and others

et seq., et sequence: and the following

ex., example

f., ff., and the following

fig(s)., figure(s)

fn., footnote

ibid. ibidem: in the same place (when two or more successive footnotes refer to the same work, it is not necessary to repeat complete reference for the second footnote. Ibid. may be used. If different pages are referred to, pagination must be shown).

id., idem: the same

ill., illus., or

illust(s). Illustrated, illustration(s)

Intro., intro., introduction

*l*, or *ll*, line(s)

loc. cit., in the place cited; used as op.cit., (when new reference

loco citato: is made to the same pagination as cited in the previous note)

MS., MSS., Manuscript or Manuscripts

N.B., nota bene: note well

n.d., no date

n.p., no place

no pub., no publisher

no(s)., number(s)

o.p., out of print

op. cit: in the work cited (If reference has been made to a work opera citato and new reference is to be made, ibid., may be used, if intervening reference has been made to different works, op.cit. must be used. The name of the author must precede.

p. or pp., page(s)

passim: here and there

post: after

rev., revised

tr., trans., translator, translated, translation

vid or vide: see, refer to

viz., namely

vol. or vol(s)., volume(s)

vs., versus: against

8. ***Use of statistics, charts and graphs:*** A judicious use of statistics in research reports is often considered a virtue for it contributes a great deal towards the clarification and simplification of the material and research results. One may well remember that a good picture is often worth more than a thousand words. Statistics are usually presented in the form of tables, charts, bars and line-graphs and pictograms. Such presentation should be self explanatory and complete in itself. It should be suitable and appropriate looking to the problem at hand. Finally, statistical presentation should be neat and attractive.

9. ***The final draft:*** Revising and rewriting the rough draft of the report should be done with great care before writing the final draft. For the purpose, the researcher should put to himself questions like: Are the sentences written in the report clear? Are they grammatically correct? Do they say what is meant'? Do the various points incorporated in the report fit together logically? "Having at least one colleague read the report just before the final revision is extremely helpful. Sentences that seem crystal-clear to the writer may prove quite confusing to other people; a connection that had seemed self

evident may strike others as a *non-sequitur.* A friendly critic, by pointing out passages that seem unclear or illogical, and perhaps suggesting ways of remedying the difficulties, can be an invaluable aid in achieving the goal of adequate communication."

10. ***Bibliography:*** Bibliography should be prepared and appended to the research report as discussed earlier.
11. ***Preparation of the index:*** At the end of the report, an index should invariably be given, the value of which lies in the fact that it acts as a good guide, to the reader. Index may be prepared both as subject index and as author index. The former gives the names of the subject-topics or concepts along with the number of pages on which they have appeared or discussed in the report, whereas the latter gives the similar information regarding the names of authors. The index should always be arranged alphabetically. Some people prefer to prepare only one index common for names of authors, subject-topics, concepts and the like ones.

## 16.8. Precautions for Writing Research Reports

Research report is a channel of communicating the research findings to the readers of the report. A good research report is one which does this task efficiently and effectively. As such it must be prepared keeping the following precautions in view:

1. While determining the length of the report (since research reports vary greatly in length), one should keep in view the fact that it should be long enough to cover the subject but short enough to maintain interest. In fact, report-writing should not be a means to learning more and more about less and less.
2. A research report should not, if this can be avoided, be dull; it should be such as to sustain reader's interest.
3. Abstract terminology and technical jargon should be avoided in a research report. The report should be able to convey the matter as simply as possible. This, in other words, means that report should be written in an objective style in simple language, avoiding expressions such as "it seems," "there may be" and the like.
4. Readers are often interested in acquiring a quick knowledge of the main findings and as such the report must provide a ready availability of the findings. For this purpose, charts, graphs and the statistical tables may be used for the various results in the main report in addition to the summary of important findings.

5. The layout of the report should be well thought out and must be appropriate and in accordance with the objective of the research problem.
6. The reports should be free from grammatical mistakes and must be prepared strictly in accordance with the techniques of composition of report-writing such as the use of quotations, footnotes, documentation, proper punctuation and use of abbreviations in footnotes and the like.
7. The report must present the logical analysis of the subject matter. It must reflect a STRUCTURE wherein the different pieces of analysis relating to the research problem fit well.
8. A research report should show originality and should necessarily be an attempt to solve some intellectual problem. It must contribute to the solution of a problem and must add to the store of knowledge.
9. Towards the end, the report must also state the policy implications relating to the problem under consideration. It is usually considered desirable if the report makes a forecast of the probable future of the subject concerned and indicates the kinds of research still needs to be done in that particular field.
10. Appendices should be enlisted in respect of all the technical data in the report.
11. Bibliography of sources consulted is a must for a good report and must necessarily be given.
12. Index is also considered an essential part of a good report and as such must be prepared and appended at the end.
13. Report must be attractive in appearance, neat and clean, whether typed or printed.
14. Calculated confidence limits must be mentioned and the various constraints experienced in conducting the research study may also be stated in the report.
15. Objective of the study, the nature of the problem, the methods employed and the analysis techniques adopted must all be clearly stated in the beginning of the report in the form of introduction.

## Let Us Sum Up

In this unit, you have learned the following:

Once a research project reaches its conclusion, the most important task

ahead of the researcher is to document the entire work done in the form of a well-structured research report.

- There are brief reports which, as the name suggests, are of a shorter length and could be in the form of working papers or short survey reports. These might be expanded while preparing the detailed report.
- The detailed report may vary in scope and style depending on the requirement of the reader for whom it is to be created. These could be in the form of highly structured and comprehensive technical reports or simpler action-oriented business reports.
- No matter what the orientation is, reports generally follow a standardized structure. The entire report can be divided into three main sections—the preliminary section, the main body and endnotes.
- The main report includes the background of the study, as well as the scope, framework and the methodology of the study, including the data collection and sampling plan. The section culminates into the most important part of the report, the study findings and interpretation of these results.
- The last section of the report includes the bibliography and all the supportive documents like measuring instrument (questionnaire), the sample details and any relevant document that needs to be referred to comprehend the report.
- Any well documented report must be clear and explicit in its reporting.
- There must be no ambiguity in either presenting the findings or representativeness of the findings. The designed report must be formulated, keeping the reader and the researcher's capabilities in mind.
- The author must follow a widely mandated and followed protocol for reporting and referencing in the report. The reporting needs to be objective and simple rather than complex and opinionated.
- The researcher at times might need to verbally present the research study. These presentation sessions need to be brief and crisp, with the thrust being more on the methodology and findings.

## Check your Progress

1. Which of the following is not one of the seven major parts to the research report?
2. How to judge the depth of any research?
3. Which is not the types of Publications available in Indexing Database

## Glossary

- **Technical Reports:** These are major documents and would include all elements of the basic report, as well as the interpretations and conclusions, as related to the obtained results.
- **Business Reports:** These reports include conclusions as understood by the business manager.
- **Letter of Transmittal:** This is the letter that goes alongside the formalized copy of the final report. It broadly refers to the purpose behind the study.
- **Bibliography:** This is an important part of the final section as it provides the complete details of the information sources and papers cited in a standardized format.
- **Footnote:** A typical footnote, as the name indicates, is part of the main report and comes at the bottom of a page or at the end of the main text.
- **Citation:** It is the acknowledgement in your writing of the work of other authors and includes paraphrasing and making direct quotes.

## Answer to Check your Progress

1. Footnotes

2. By research objectives

3. Newspaper

## Suggested Reading


1. C.R. Kothari, Research Methodology, Willey International Ltd., New Delhi.

2. Bryman, Alan and Emma Bell. 2015. Business Research Methods. 4th Edition. United Kingdom: Oxford University Press.

3. Gupta, S.L. and Hitesh Gupta. 2012. Business Research Methods. New Delhi: Tata McGraw Hill Education Private Limited.

# Annexure-Case Studies

**Case Study-1: Chemco Case**

Started in 1965, ChemCo is a leading manufacturer of car batteries in the U.K. market. Since then, it has been under the charge of Mr. Jones, the founder-owner of the firm. In 1999, the company decided to go for a diversification by expanding the product line. The new product was batteries for fork-lift trucks. At the same time, Mr. Marek was appointed the Senior Vice President of marketing in the company. However, soon after its successful diversification into fork-lift batteries, the sales in this segment began dropping steadily. Mr. Marek wanted to introduce some radical changes in the advertising and branding of the new business but the proposal was turned down by the old-fashioned Mr. Jones. At this juncture in 2002, the firm is losing heavily in the fork-lift batteries business and its market share in car batteries is also on a decline. Mr. Jones has asked Mr. Marek to show a turnaround in the company within a year.

**Question**

(1).What steps should Mr. Marek take to take the company out of its troubles?

**Case Study-2: Nakamura Lacquer Company**

The Nakamura Lacquer Company (NLC) of Kyoto, Japan, employed several thousand men and produced 500,000 pieces of lacquer tableware annually, with its Chrysanthmum brand becoming Japan's best known and bestselling brand. The annual profit from operations was $250,000.

The market for lacquer ware in Japan seemed to have matured, with the production steady at 500,000 pieces a year. NLC did practically no business outside Japan.

In May 2000, (much to your chagrin!) the ambitious and dynamic, Mr. Nakamura (Chairman, NLC) received two offers from American companies wishing to sell lacquer ware in America.
The first offer was from the National China Company. It was the largest manufacturer of good quality dinnerware in the U.S., with their “Rose and Crown” brand accounting for almost 30% of total sales. They were willing to give a firm order for three years for annual purchases of 400,000 sets of lacquer dinnerware, delivered in Japan and at 5% more than what the Japanese jobbers paid. However, Nakamura would have to forego the Chrysanthemum trademark to “Rose and Crown” and also

undertake not to sell lacquer ware to anyone else in the U.S. The second offer was from Sammelback, and Whittacker (henceforth SSW), Chicago, the largest supplier of hotel and restaurant supplies in the U.S. They perceived a U.S. market of 600,000 sets a year, expecting it to go up to 2 million in around 5 years. Since the Japanese government did not allow overseas investment, SSW was willing to budget $1.5 million for the next two years towards introduction and promotion. Nakamura would sell his “Chrysanthemum” brand but would have to give exclusive representation to SSW for five years at standard commission rates and also forego his profit margin toward paying back of the $ 1.5 million.

**Question**

(1).What should Mr. Nakamura do?

**Case Study-3: Online Booking - Has the Time Come?**

The day is not very far when the Indian travellers can criss-cross the globe with just a few clicks. Taking e-commerce and information technology services a step further, the Indian travel industry is composing itself to usher in the era of e-ticketing On-line booking involves pursuing of available information on travel websites and then making a reservation.

However, if you are not the kind who prefers a particular airline, then you can check out travel sites, which collate flights details of all airlines, and are the apt place to book or bid for air tickets. Travel portals, such as, travelguru.com, arzoo.com, yatra.com, indiatimes.com, rediff.com, makemytrip.com, and cleartrip.com, would provide you all details of flights along with their fares in an ascending order, i.e., the lowest priced, ticket is featured first, on its web page. The number of consumers who book travel tickets online is growing. But a switch from offline environment.

To online environment creates certain doubts in the minds of consumers such doubts have been termed as perceived risks in literature. Also, the Internet revolution has brought about significant changes in market transparency, defined as the availability and accessibility of information to market participants. For example, air travellers can use online travel agencies to browse through hundreds of travel offers to their destination, compared to typically few offers from a traditional travel agent or airline prior to the Internet era. Generally, market transparency seems to benefit consumers because they are able to better discern the product that best fits their needs at a better price. However, there still is a large percentage of population who get their tickets booked through the

traditional queuing system. The advent of e-ticket booking over the past couple of years has led to the mushrooming of online travel agencies. These online service providers have in fact come up with a wide variety of services for faster and more convenient mode of ticket booking. They offer a host of services starting from booking something as mundane as a train or flight ticket to something as exotic as a holiday. They offer various packages which have the entire itinerary for the proposed holiday.

They even offer a convenient pick-up and drop service. With such a range of services being offered at your fingertips, expectations are that more and more number of travellers would start using such easy, fast and convenient services as compared to the conventional booking process across a reservation counter. Yet, we still observe long queues at the various reservation counters. And, we also know that there are a number of people who use the online services available to book their travel than through traditional travel booking counters. Srininandan Rao, CEO of Ghoom.com, a travel portal that has been in existence for the past three years wondered whether he can look at a bigger customer base for his travel booking business or look at an a bigger customer base for his travel booking business or look at an alternative e business.

**Questions:**

1. What is the kind of research study that you can undertake for Mr. Rao?
2. Formulate the research problem and the objectives of your study. Can you suggest research approach that you can take?
3. Develop a working hypothesis for your study.

**Case Study-4**

Danish International (A)Shameem had been with the organization for a fortnight now and was due to meet Raghu. He opened the door and walked in Raghu asked him to be seated and said, 'So doctor, what is the diagnosis?'. Shameem Naqib had been recently hired as the company counsellor at Danish International, as Raghu Narang, the CEO, felt that he was fed up with his team of non-performers. He had hand-picked the Band II decision makers from the most prestigious and growing enterprises. Each one came with a proven track record of strategic turnarounds they had managed in their respective roles. So why this inertia at DI? The salaries and perks were competitive, reasonable autonomy was permitted in decision-making and yet nothing

was moving. There had been two major mergers and the responsibilities had increased somewhat. When Shameem went to meet Sid Malhotra, the bright star who had joined six months back, he was reported absent and seemed to be suffering from hypertension and angina pain. His colleague in the next cabin was not aware that Sid had not come for the past four days. As he was talking to Raghu's secretary, he could hear Kamini Bansal, the HR head, yelling at the top of her voice at a new recruit, who after six weeks of joining had come to ask her about her job role. The Band III executives had been with the company for a tenure of 5—15 years and yet had not been able to make it to the Band II position (except two lady employees).

They were laidback, extremely critical and yet surprisingly were not moving. Raghu also seemed a peculiar guy, he had hidred him as the counsellor and was also making some structural changes as suggested by a Vastu expert, to nullify the effect of 'evil sprits'. He had a history of hiring the best brains, and then trying to fit them into some role in the organization. And in case someone did not fit in, firing him without any remorse. He had changed his nature of business thrice and on the personal front, he was on the verge of his second divorce The company had a great infrastructure, attractive compensation packages and yet the place reeked apathy. It was like a stagnant pool of the best talent. Was it possible to undertake-operation clean up?

**Questions**

1. What is the management decision problem that Shameem is likely to narrate to Raghu Narang?
2. Convert and formulate it into a research problem and state the objectives of your study. Can you suggest a theoretical framework about what you propose to study?
3. Develop the working hypothesis for your study.

**Case Study-5: The Pink Dilemma**

The Indian television industry has seen an exponential growth since the satellite television first came to India Today, though cable penetration is only about 70 per cent (according to various industry estimates), this class of people watching cable TV is defined as the 'consuming class in India. By 2002, the share of cable and satellite television was 86.9 per cent of the total television advertising as against a meagre 31.3 per cent in 1994. Hindi general entertainment television is the fuel for growth in the television industry with a 46.8 per cent share of the total viewership and an even higher 57.4 per cent share of the total advertising revenue.

Sony Entertainment Television is a key player in this space and has been a consistent and strong number two behind Star Plus, which has been the undisputed leader since July 2000. In India, most homes are single-TV homes. Hindi is the preferred language for consuming entertainment across India (except the four southern states) and that makes the Hindi general entertainment television an intensely competitive space. It consists of five players. Star Plus has been the undisputed leader since July 2000 and has significantly consolidated its position thereafter.

In September 2003, Star Plus had nearly five times as much viewership as its nearest rival Sony Entertainment Television. The other contenders are Zee TV, Sahara Wand SAD TV. The key factor is that during primetime (specifically in the 9-10 pm slot) which is the focus of this case, the females influence the choice of channel to view. Sony Entertainment Television dominated the 9-10 pm band, with two of its leading shows, Kkusum and Kutumb until mid-2002 after which the 4 daily shows of Star Plus took over. Despite several high-profile attempts to regain lost audiences, Sony Entertainment Television's share in this band continued to erode Star Plus had established a clear dominance over Sony Entertainment Television. (Star Plus average range of Television Ratings (TVRs) is approximately 13.2 TVR5, as compared to Sony Entertainment Television's 1.3 TVR5). Besides, Sony Entertainment Television was now perceived as a 'me too' to Star Plus. Sony Entertainment Television realized that women were the primary target audience who could get eyeballs for the channel. The challenge, therefore, was to create and sell a distinct viewing alternative, going beyond the cliched family dramas with storylines revolving around family conflicts and kitchen politics which is the predominant fare on general entertainment channels today.

**Questions**

1. What could be the probable sources of establishing the market share of the channel that are used in the case? Can one rely on the authenticity of Sony's dominance? Why/why not?
2. To help Sony achieve its target of understanding what Indian women want, what secondary data sources would

**Case Study-6**

Texas Electric Cooperatives, or TEC, is an organization that provides overall management and coordination of the products and services offered to electric utility consumers throughout the state of Texas. Not

only does TEC provide electric utility service, they also offer many other services including maintaining a large inventory of electrical equipment for distribution. In 2000, TEC established a new division, Utility Supply and Service (US&S), for distribution of electrical utility products. By 2004, they were enjoying very rapid growth.

Sales essentially doubled. They were quick to notice that the technology they were using was not enough to allow them to continue to grow at that rate with effectiveness. Problems such as inconsistency in forecasting their inventory needs, not having enough of the right products on hand, and long delivery times were increasing. These problems delayed some customer orders, and the amount of time and effort necessary to work on orders and procurement needs was becoming a burden.

1. Formulate the research problem
2. What kind of research design to be followed
3. Prepare a research proposal to solve the problem
4. What is research design? Discuss the basis of stratification to be employed in sampling public opinion on demonetarisation.
5. “Experimental method of research is not suitable in management field.” Discuss, what are the problems in the introduction of this research design in business organisation?
6. The company feels that it would be better for the sales organization if the manufacturers' agents were replaced by full-time company salesmen. In exploring the possibility, the personnel manager has put classified ads in newspapers and trade journals. Employment agencies have also been utilized. In spite of all this effort, the results, in so far as obtaining qualified sales personnel is concerned, have not been too satisfactory. The personnel man reported that one agency had sent a number of men who were below his standards and another had sent men who were above his standards. Out of seventy-five interviews, he had found only two men who he felt were desirable enough to be offered a contract for employment.

A very limited amount of sales training is given the new sales- men. The sales manager is of the opinion that the average salesman can learn all he needs to know in one week. Therefore, he concludes that the main job of a salesman in his company is that of knowing the products and customers of the company. In keeping with this idea, he likes to have

salesmen make friends with their customers and prospects from the start. QUESTIONS TO BE ANSWERED I. What is the key problem and how can it be formulated? II. Is research needed? 6. It has been one month since GST was implemented and its benefits can be seen when a poor person opinion that because of GST prices of various items essential for him have come down, and commodities have become cheaper. Doing business has become so much easier.

And most important of all, the trust of customers for the traders is increasing. The GST has impacted the transport and logistics sector; how the movement of trucks has increased. The time required to cover distances has come down drastically. Highways have become clutter-free. Earlier, because of multiple tax structures, maximum resources of the transport and logistics sector were expended in maintaining paperwork and that also led to the need for construction of new warehouses in each state.

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**Questions**

1. What kind of research design will you follow to examine the above facts or opinion?
2. Formulate hypothesis
3. How do you carry out the research to prove / disprove above facts or opinion?

**Case Study-7**

ABC Enterprises is an organization that provides overall management and coordination of insects and pest control products and services offered to all consumers throughout the state of Madurai. Not only does ABC provide pest and insect control service, they also offer many other services including maintaining a large inventory of programs to create Professional pest Management services like cleaning the house and repair services.

In 2016, ABC established a new division, Pest Retard and Service (PRS), for distribution of Pest eliminating products. By 2017, they were enjoying very rapid growth. Sales essentially doubled. They were quick to notice that the technology they were using was not enough to allow

them to continue to grow at that rate with effectiveness. Problems such as updating technology like nano evasive methods to eradicate very minute germs that prevail in air, inconsistency in forecasting their inventory needs, not having enough of the right products on hand, and long delivery times were increasing. These problems delayed some customer orders, and the amount of time and effort necessary to work on orders and procurement needs was becoming a burden.

**Questions**

1. Formulate the research problem
2. What kind of research design to be followed?
3. Prepare a research proposal to solve the problem.
4. What kind of research is required to bring out effective solution to ABC?

Model End Semester Examination Question Paper

**Master of Business Administration (MBA)**

Course Code**: DCMBA-26**

Course Title: **Research Methodology**

**Max. Marks: 70** **Time: 3 hours**

**PART – A (10x2 =20 Marks)**

Answer any TEN questions out of TWELVE questions

[All questions carry equal marks]

(1).What are the criteria generally expected of a good research?

(2).Explain the approaches of Research methodology.

(3).Differentiate exploratory Research from Descriptive Research.

(4).Write a short notes a. Research approaches b. Descriptive and analytical research.

(5).Explain Null & Alternate Hypothesis with example.

(6).What do you understand by secondary data and why is it important to obtain secondary data before primary data?

(7).Explain why questionnaires are popular tools for Data Collection in Research. Discuss qualities of a Good Questionnaire.

(8).Explain the procedure of selecting a sample random sampling.

(9).Distinguish between:

a. Convenience and purposive sampling

b. Systematic and stratified sampling c. Cluster and area sampling

(10).Difference between -Brief report and long report, Technical and business report.

(11).Interpretation is a fundamental component of Research process Explain.

(12).Explain the guidelines for effective report writing.

**PART – B (5X8=40 Marks)**

Answer any FIVE questions out of SEVEN questions

[All questions carry equal marks]

(13).Explain the types of Research in detail.

(14).“Research is much concerned with proper fact finding, analysis and evaluation.” Do you agree with this statement? Give reason in support of your answers.

(15).How does formulating a Research design differ from developing an approach to a problem?

(16).How would you classify Research designs?

(17).What are the different methods of data collection? Which one is most suitable for conducting enquiry regarding employee welfare programme in India?

(18). a) Explain the difference between Questionnaire and Schedule

b) Explain the Procedure of “Testing of Hypothesis”

(19).Report writing is more of an art that hinges upon practice and experience .Discuss.

**PART - C (1x10=10 Marks)**

CASE STUDY (Covering the Whole Course)

(20).You are the manager of market intelligence in a Software Company. Many product managers requested market surveys from you on various products. Design a form for a Research proposal that can be easily completed by your Research staff and the sponsoring manager.

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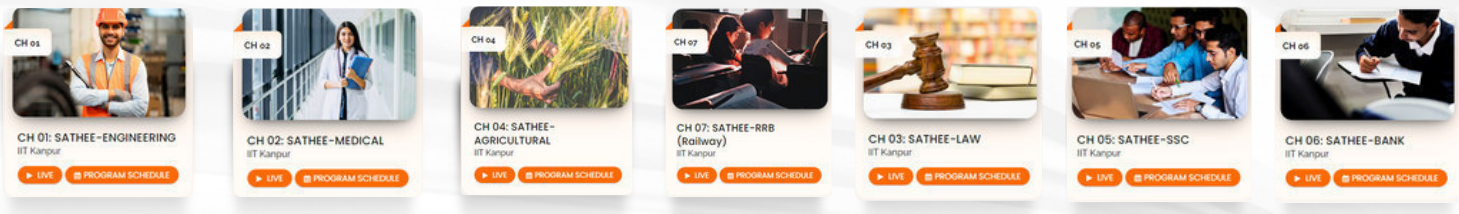


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