RESEARCH METHODOLOGY AND IPR

Course Code 21RMI56

v sem,

Module-1 Research Methodology

Introduction: The word research is composed of two syllables “Re” and “Search”. “Re” is the prefix meaning ‘Again or over again or a new’ and “Search” is the latter meaning ‘to examine closely and carefully’ or ‘to test and try’. Together they form, a careful, systematic, patient study and investigation in some field of knowledge undertaken to establish principles / policies.

Meaning of Research: Research can be defined as

1. Search for knowledge

2. Systematic and scientific search for getting relevant answers on any taken up specific topic.

3. Scientific enquiry into a subject.

4. Research is a movement from the unknown to the known.

5. It is the voyage of discovery

Clifford Woody - Research comprises defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulated hypothesis.

D. Slesinger and M. Stephenson in the Encyclopedia of Social Sciences define research as "the manipulation of things, concepts or symbols for the purpose of generalizing, to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice“.

Bulmer- Research is primarily committed to establishing systematic, reliable and valid knowledge about the social world.

Thus research is the search for knowledge through objective and systematic method for finding solution to a problem.

Objectives of Research: The objective of research is to find answers to the questions by applying scientific procedures. In other words, the main aim of research is to find out the truth which is hidden and has not yet been discovered. Although every research study has its own specific objectives, the research objectives may be broadly grouped as follows:

1. To gain familiarity with a phenomenon or to achieve new insights into it (exploratory or formulative research studies)

2. To portray accurately the characteristics of a particular individual, situation or a group (descriptive research studies)

3. To determine the frequency with which something occurs or with which it is associated with something else (diagnostic research studies)

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

Motivation in Research: The intention of doing research may be one or more of the following:

1. Get a research degree along with its consequential benefits

2. Face the challenges in solving the unsolved problems, i.e., concern over practical problems initiates research

3. Intellectual joy of doing some creative work

4. Service to society

5. Get respect.

Factors like directives of government, employment conditions, curiosity about new things, desire to understand causal relationships, social thinking and awakening, and the like may as well motivate people to carry research.

Types of Research:

1. Descriptive Vs Analytical Research

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. The most distinguishing feature of this method is that the researcher has no control over the variables here. He/she has to only report what is happening or what has happened. Majority of the ex post facto research projects are used for descriptive studies in which the researcher attempts to examine phenomena, such as the consumers' preferences, frequency of purchases, shopping, etc. Despite the inability of the researchers to control the variables, ex post facto studies may also comprise attempts by them to discover the causes of the selected problem. The methods of research adopted in conducting descriptive research are survey methods of all kinds, including correlational and comparative methods. Meanwhile in the

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

Descriptive is fact finding to describe the state of affairs

Analytical Research is using already available information and analyse to make a critical evaluation of the material.

2. Applied Vs Fundamental Research

An attempt to find a solution to an immediate problem encountered by a firm, an industry, a business organization, or the society is known as applied research. Researchers engaged in such researches aim at drawing certain conclusions confronting a concrete social or business problem

Fundamental research mainly concerns generalizations and formulation of a theory. In other words, ―Gathering knowledge for knowledge‘s sake is termed pure or basic research (Young in Kothari, 1988). Researches relating to pure mathematics or concerning some natural phenomenon are instances of Fundamental Research. Likewise, studies focusing on human behaviour also fall under the category of fundamental research.

Applied aims at finding a solution to the problem faced by the society/ organisation.

Fundamental Research is concerned with generalization and formulation of a theory

3. Quantitative Vs Qualitative Research

Quantitative research relates to aspects that can be quantified or can be expressed in terms of quantity. It involves the measurement of quantity or amount. Various available statistical and econometric methods are adopted for analysis in such research. Which includes correlation, regressions and time series analysis etc

Qualitative research is concerned with qualitative phenomena, or more specifically, the aspects related to or involving quality or kind. For example, an important type of qualitative research is Motivation Research‘, which investigates into the reasons for certain human behavior. The main aim of this type of research is discovering the underlying motives and desires of in-depth interviews. The other techniques employed in such research are story completion tests, sentence completion tests, word association tests, and other similar projective methods. Qualitative research is particularly significant in the context of behavioral sciences, which aim at discovering the underlying motives of human behaviour.

Quantitative research is based on quantitative measurements of some characteristics

Qualitative research is concerned with qualitative phemomenon

4. Conceptual vs. Empirical

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.

Empirical Research, on the other hand, exclusively 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. In this type of research, the researcher first formulates a working hypothesis, and then gathers sufficient facts to prove or disprove the stated hypothesis. He/she formulates the experimental design, which according to him/her would manipulate the variables, so as to obtain the desired information.

The results obtained by using the experimental or empirical studies are considered to be the most powerful evidences for a given hypothesis.

Conceptual research is related to some abstract ideas
Empirical research is data based research which relies on observation or experience.

5. Some other types of research

- **one-time research or longitudinal research-** depends upon the time of doing research
- **field-setting research or laboratory research or simulation research-** depends upon the environment in which research is carried on.
- **clinical or diagnostic research-** in-depth approaches or case study method may be employed to analyse the basic causal relations
- **Exploratory research-** consist of substantial structure and specific hypotheses to be verified
- **Historical Research-** sources like historical documents, remains, etc. Are utilized to study past events or ideas.

Research Approaches: The above description of the types of research shows that there are two basic approaches to research, viz., quantitative approach and the qualitative approach.

Quantitative approach can be further sub-classified into

Inferential research - inferential approach to research is to form a data base from which to infer characteristics or relationships of population. This usually means survey research where a sample of population is studied (questioned or observed) to determine its characteristics, and it is then inferred that the population has the same characteristics

Experimental research- characterized by much greater control over the research environment and in this case some variables are manipulated to observe their effect on other variables

Simulation research- Simulation approach involves the construction of an artificial environment within which relevant information and data can be generated. This permits an observation of the dynamic behavior of a system (or its sub-system) under controlled conditions

Qualitative approach to research generates results either in non-quantitative form or in the form which are not subjected to rigorous quantitative analysis. Generally, the techniques of focus group interviews, projective techniques and depth interviews are used.

Significance of Research:

- Research inculcates scientific and inductive thinking and promotes the development of logical habits of thinking.
- Research provides the basis for all government policies in our economic system.
- Research has its special significance in solving various operational and planning problems of business and industry
- Research is equally important for social scientists in studying social relationships and in seeking answers to various social problems.

(a) To those students who are to write a master's or Ph.D. thesis, research may mean a careerism or a way to attain a high position in the social structure

(b) To professionals in research methodology, research may mean a source of livelihood

(c) To philosophers and thinkers, research may mean the outlet for new ideas and insights

(d) To literary men and women, research may mean the development of new styles and creative work

(e) To analysts and intellectuals, research may mean the generalizations of new theories.

Research Methods versus Methodology:

Research methods may be understood as all those methods/techniques that are used for conduction of research. Research methods or techniques thus, refer to the methods the researchers use in performing research operations.

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them

Research Method	**Research methodology**
Research methods refers to all those methods/techniques that are used for conduction of research. Research methods or techniques	**Research methodology is a way to systematically solve the research problem.** **The scope of research methodology is wider than that of research methods**
It involves conduction of experiments, tests, surveys etc	**Techniques that can be used to conduct the experiments, tests etc**

Aims at finding a solution to the research problem	Aims at employment of correct procedure to find the solution

Research and Scientific Method:

The two terms, research and scientific method, are closely related. Research, as we have already stated, can be termed as "an inquiry into the nature of, the reasons for, and the consequences of any particular set of circumstances, whether these circumstances are experimentally controlled or recorded just as they occur. Further, research implies the researcher is interested in more than particular results; he is interested in the repeatability of the results and in their extension to more complicated and general situations."

The philosophy common to all research methods and techniques, although they may vary considerably from one science to another, is usually given the name of scientific method.

Karl Pearson writes, "The scientific method is one and same in the branches (of science) and that method is the method of all logically trained minds … the unity of all sciences consists alone in its methods, not its material; the man who classifies facts of any kind whatever, who sees their mutual relation and describes their sequences, is applying the Scientific Method and is a man of science."

Scientific method is the pursuit of truth as determined by logical considerations. The ideal of science is to achieve a systematic interrelation of facts.

The scientific method is, based on the following basic postulates:

1. It relies on empirical evidence

2. It utilizes relevant concepts

3. It is committed to only objective considerations

4. It presupposes ethical neutrality, i.e., it aims at nothing but making only adequate and correct statements about population objects

5. It results into probabilistic predictions

6. Its methodology is made known to all concerned for critical scrutiny are for use in testing the conclusions through replication

7. It aims at formulating most general axioms or what can be termed as scientific theories

Scientific method implies an objective, logical and systematic method, i.e., a method free from personal bias or prejudice, a method to ascertain demonstrable qualities of a phenomenon capable of being verified, a method wherein the researcher is guided by the rules of logical reasoning, a method wherein the investigation proceeds in an orderly manner and a method that implies internal consistency

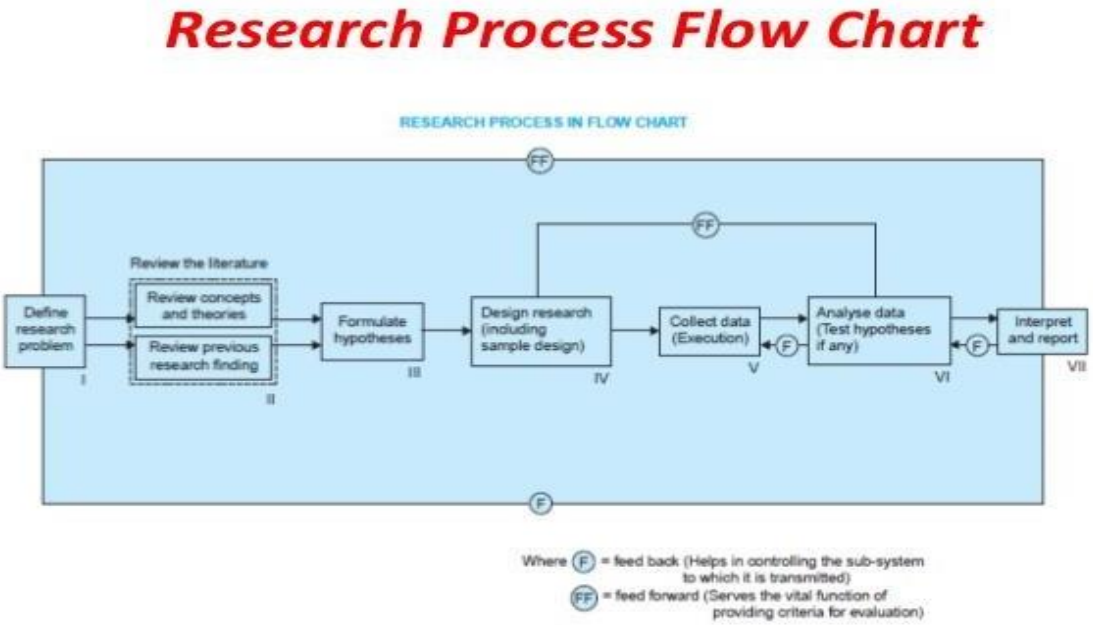
Importance of Knowing How Research is Done:

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

- 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
- The knowledge of doing research inculcates the ability to evaluate and utilize the research findings with confidence;
- The knowledge of research methodology equips the researcher with the tools that help him/her to make the observations objectively and
- The knowledge of methodology helps the research consumers to evaluate research and make rational decisions.

Research Process:

Research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps. The following Figure well illustrates a research process.



The various steps in a research process are as follows:

(1) formulating the research problem

(2) extensive literature survey

(3) developing the hypothesis

(4) preparing the research design

(5) determining sample design

(6) collecting the data

(7) execution of the project

(8) analysis of data

(9) hypothesis testing

(10) Generalisations and interpretation

(11) Preparation of the report or presentation of the results, i.e., formal write-up of conclusions reached.

(1) Formulating a Research problem: In research process, the first step a researcher does is formulate a problem and define it properly. Research forms a circle. It starts with a problem and ends with a solution to the problem.

A research problem is anything that a researcher finds unsatisfactory or unsettling, a difficulty of some sort, a state of affairs that needs to be changed, anything that is not working well as it was expected (Creswell, 2009)

A problem statement consists of four parts:

- the ideal
- the reality or real situation
- the consequences or impacts,
- what the study wants to address or the aim of the study.

(2) Extensive Literature Survey: abstracting and indexing Journals, conference proceedings, government reports, books etc.

(3) Development of Working Hypothesis: A tentative assumption made to test its logical or empirical consequences. The role of hypothesis is to guide the researcher by delimiting the area and keep him on right track

Steps to develop a working hypothesis:

- Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution
- Examination of data and records,
- Review of similar studies in the area or of the studies on similar problems
- Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals.

(4) Prepare the Research Design: state the conceptual structure within which Research will be conducted
Several research designs- Experimental and Non-Experimental Hypothesis testing.
Experimental design can be either informal or formal

(5) Determining Sample Design:
Census Survey, Sample Survey
Types of Sampling

- Deliberate sampling
- Simple random sampling
- Systematic sampling
- Stratified sampling
- Quota sampling
- Cluster sampling and area sampling
- Multi-stage sampling
- Sequential sampling

(6) Data Collection:

- Observation
- Personal Interview
- Telephone Interview
- Questionaires
- Schedules

(7) Execution of the Project: In a systematic manner and time

(8) **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 inferences.

(9) Hypothesis Testing: Various tests, such as Chi square test, t-test, F-test, have been developed by statisticians for testing the hypotheis. The hypotheses may be tested through the use of one or more of such tests, depending upon the nature and object of research inquiry. Hypothesis-testing will result in either accepting the hypothesis or in rejecting it.

(10) Generalization and Interpretations: If a hypothesis is tested and upheld several times, researcher may 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.

(11) **Report or thesis writing:**

(a) layout

- Preliminary pages
- Main text
- End matter

(b) concise and objective style in simple language avoiding vague expressions such as 'it seems,' 'there may be', and the like.

(c) Charts and illustrations should be used only if they present the information more clearly and forcibly.

(d) various constraints experienced in conducting research operations must be mentioned.

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

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

2. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping the continuity of what has already been attained. 3. The procedural design of the research should be carefully planned to yield results that areas objective as possible.

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

5. 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.

6. 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.

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

In other words, we can state the qualities of a good research as under:

1. *Good research is systematic*: It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well-defined set of rules. Systematic characteristic of the research does not rule out creative thinking but it certainly does reject the use of guessing and intuition in arriving at conclusions.

2. *Good research is logical*: This implies that research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research. Induction is the process of reasoning from a part to the whole whereas deduction is the process of reasoning from some premise to a conclusion which follows from that very premise. In fact, logical reasoning makes research more meaningful in the context of decision making.

3. *Good research is empirical*: It implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results.

4. *Good research is replicable*: This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

Problems Encountered by Researchers in India:

Researchers in India, particularly those engaged in empirical research, are facing several problems. Some of the important problems are as follows:

1. The lack of a scientific training in the methodology of research is a great impediment for researchers in our country. There is paucity of competent researchers. Many researchers take a leap in the dark without knowing research methods. Most of the work, which goes in the name of research is not methodologically sound. Research to many researchers and even to their guides, is mostly a scissor and paste job without any insight shed on the collated materials. The consequence is obvious, viz., the research results, quite often, do not reflect the reality or realities. Thus, a

systematic study of research methodology is an urgent necessity. Before undertaking research projects, researchers should be well equipped with all the methodological aspects. As such, efforts should be made to provide short duration intensive courses for meeting this requirement.

2. There is insufficient interaction between the university research departments on one side and business establishments, government departments and research institutions on the other side. A great deal of primary data of non-confidential nature remains untouched/untreated by the researchers for want of proper contacts. Efforts should be made to develop satisfactory liaison among all concerned for better and realistic researches. There is need for developing some mechanisms of a university—industry interaction program so that academics can get ideas from practitioners on what needs to be researched and practitioners can apply the research done by the academics.

3. Most of the business units in our country do not have the confidence that the material supplied by them to researchers will not be misused and as such they are often reluctant in supplying the needed information to researchers. The concept of secrecy seems to be sacrosanct to business organizations in the country so much so that it proves an impermeable barrier to researchers. Thus, there is the need for generating the confidence that thein formation/data obtained from a business unit will not be misused.

4. Research studies overlapping one another are undertaken quite often for want of adequate information. This results in duplication and fritters away resources. This problem can be solved by proper compilation and revision, at regular intervals, of a list of subjects on which and the places where the research is going on. Due attention should be given toward identification of research problems in various disciplines of applied science which are of immediate concern to the industries.

5. There does not exist a code of conduct for researchers and inter-university and interdepartmental rivalries are also quite common. Hence, there is need for developing a code of conduct for researchers which, if adhered sincerely, can win over this problem.

6. Many researchers in our country also face the difficulty of adequate and timely secretarial assistance, including computerial assistance. This causes unnecessary delays in the completion of research studies. All possible efforts be made in this direction so that efficient secretarial assistance is made available to researchers and that too well in time. University Grants Commission must play a dynamic role in solving this difficulty.

7. Library management and functioning is not satisfactory at many places and much of the time and energy of researchers are spent in tracing out the books, journals, reports, etc., rather than in tracing out relevant material from them.

8. There is also the problem that many of our libraries are not able to get copies of old and new Acts/Rules, reports and other government publications in time. This problem is felt more in libraries which are away in places from Delhi and/or the state capitals. Thus efforts should be made for the regular and speedy supply of all governmental publications to reach our libraries.

9. There is also the difficulty of timely availability of published data from various government and other agencies doing this job in our country. Researcher also faces the problem on account of the fact that the published data vary quite significantly because of differences in coverage by the concerning agencies.

10. There may, at times, take place the problem of conceptualization and also problems relating to the process of data collection and related things

Defining the Research Problem:

Research Problem:

The first and foremost stage in the research process is to select and properly define the research problem. A researcher should first identify a problem and formulate it, so as to make it amenable or susceptible to research. In general, a research problem refers to an unanswered question that a researcher might encounter in the context of either a theoretical or practical situation, which he/she would like to answer or find a solution to. A research problem is generally said to exist if the following conditions emerge (Kothari, 1988):

i. There should be an individual or an organization, say X, to whom the Problem can be attributed. The individual or the organization is situated in an environment Y, which is governed by certain uncontrolled variables Z

ii. There should be at least two courses of action to be pursued, say A1 and A2. These courses of action are 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 should be at least two alternative possible outcomes of the said courses of action, say B1 and B2. Of them, one alternative should be preferable to the other. That is, at least one outcome should be what the researcher wants, which becomes an objective.

iv. The courses of possible action available must offer a chance to the researcher to achieve the objective, but not the equal chance. Therefore, if P(Bj / X, A, Y) 10 represents the probability of the occurrence of an outcome Bj when X selects Aj in Y, then P(B1 / X, A1,Y) $\neq$ P (B1 / X, A2, Y). Putting it in simple words, it means that the choices must not have equal efficiencies for the desired outcome.

Above all these conditions, the individual or organization may be said to have arrived at the research problem only if X does not know what course of action to be taken is the best. In other words, X should have a doubt about the solution. Thus, an individual or a group of persons can be said to have a problem if they have more than one desired outcome. They should have two or more alternative courses of action, which have some but not equal efficiency. This is required for probing the desired objectives, such that they have doubts about the best course of action to be taken. Thus, the components of a research problem may be summarized as:

a) There should be an individual or a group who have some difficulty or problem.

b) There should be some objective(s) to be pursued. A person or an organization who wants nothing cannot have a problem.

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

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

Selecting the Problem:

Criteria for selection of research problem depend on the following characteristics.

- Personal Inclination.
- Resources Availability.
- Relative Importance.
- Researcher Knowledge
- Practicality: Practicality is also responsible for the selection.
- Time-lines of the Problem.
- Urgency.

Personal Inclination: The chief motivation in the way of selecting research problem is the personal inclination of the researcher. If a researcher has personal interest in the topic, he would select that problem for his research work

Resources Availability: During the selection, a researcher will see to the resources available. If these resources like money, time, accommodation and transport are available to the selection place, then the selection of the problem is easy.

Data Availability: If the desired data is available to the researcher, then the problem would be selected.

Urgency: Urgency is a pinpoint in the way of the selection of research problem. Urgent problem must be given priority because the immediate solution can benefit the people.

Feasibility: Feasibility is also an important factor for the selection of the research problem. The researcher qualification, training and experience should match the problem.

Area Culture: The culture of the area for which a researcher conducts his research is also responsible for the selection of research problem.

Necessity of Defining the Problem: A problem clearly stated is a problem half solved. 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. Questions like: What data are to be collected? What characteristics of data are relevant and need to be studied? What relations are to be explored. What techniques are to be used for the purpose? 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.

Technique Involved in Defining a Problem:

The technique for the purpose involves the undertaking of the following steps generally one after the other:

(i) statement of the problem in a general way

(ii) understanding the nature of the problem

(iii) surveying the available literature

(iv) developing the ideas through discussions and

(v) rephrasing the research problem into a working proposition.

Module-2
Reviewing the literature:

A literature review is a survey of scholarly sources on a specific topic. It provides an overview of current knowledge, allowing you to identify relevant theories, methods, and gaps in the existing research.
Writing a literature review involves finding relevant publications (such as books and journal articles), critically analyzing them, and explaining what you found. There are five key steps:

- Search for relevant literature
- Evaluate sources
- Identify themes, debates and gaps
- Outline the structure
- Write your literature review

A good literature review doesn't just summarize sources – it analyzes, synthesizes, and critically evaluates to give a clear picture of the state of knowledge on the subject.

Reviewing the literature: -Essential preliminary task in order to acquaint yourself with the available body of knowledge in your area of interest.
Literature review is integral part of entire research process and makes valuable contribution to every operational step. -Reviewing literature can be time-consuming, daunting and frustrating, but is also rewarding. Its functions are:

a. **Bring clarity and focus to your research problem** - The process of reviewing the literature helps you to understand the subject area better and thus helps you to conceptualise your research problem clearly and precisely. It also helps you to understand the relationship between your research problem and the body of knowledge in the area

b. **Improve your methodology** - A literature review tells you if others have used procedures and methods similar to the ones that you are proposing, which procedures and methods have worked well for them, and what problems they have faced with them. Thus you will be better positioned to select a methodology that is capable of providing valid answer to your research questions

c. **Broaden your knowledge-** It ensures you to read widely around the subject area in which you intend to conduct your research study. As you are expected to be an expert in your area of study, it helps fulfill this expectation. It also helps you to understand how the findings of your study fit into the existing body of knowledge.

d. **Contextualise your findings-** How do answers to your research questions compare with what others have found? What contribution have you been able to make in to the existing body of knowledge? How are your findings different from those of others? For you to be able to answer these questions, you need to go back to your literature review. It is important to place your findings in the context of what is already known in your field of enquiry.

Procedure for reviewing the literature:

i) **search for existing literature in your area of study**- To effectively search for literature in your field of enquiry, it is imperative that you have in mind at least some idea of broad subject area and of the problem you wish to investigate, in order to set parameters for your search. -Next compile a bibliography for this broad area. Sources are:

1. **books**- BOOKS comprise a central part of any bibliography. Advantage-material published generally is of good quality and the findings are integrated with other research to form a coherent body of knowledge. Disadvantage-material is not completely up to date, as it can take a few years between the completion of a work and publication in the form of a book. Search for books in your area of interest, prepare a final list, locate these books in the libraries or borrow from other sources. Examine their content, if contents are not found to be relevant to your topic, delete it from your reading list.

2. **journals** -Journals provide you with the most up-to-date information, even though there is a gap of two to three years between the completion of a research project and the publication in a journal. As with books, you need to prepare a list of journals for identifying literature relevant to your study. This can be done as follows: -locate the hard copies of the journal that are appropriate to your study; - use the internet - look at the index of research abstracts in the relevant field to identify and read the articles. Whichever method you choose, first identify the journals you want to look at in more detail for your review of literature. Select the latest issue, examine its content page to see if there is an article of relevance to your research topic. If you feel a particular article is of relevance to you, read its abstract. If you think you are likely to use it, photocopy or prepare a summary and record it for reference for later use.

ii) review the literature selected- After identifying books and articles as useful, the next step is to start reading them critically to pull together themes and issues that are associated. If you do not have a theoretical framework of themes in mind to start with, use separate sheets of paper for each article or book. Once you develop a rough framework, slot the findings from the material so far reviewed into that framework, using a separate sheet of paper for each theme of that framework. As you read further, go on slotting the information where it logically belongs under the theme so far developed. You may need to add more themes as you go. Read critically with particular reference to the following aspects:

• Note whether the knowledge relevant to your theoretical framework is confirmed beyond doubt.
• Note the theories put forward, the criticisms of these and their basis, the methodologies adopted and the criticisms of them.
• Examine to what extent the findings can be generalized to other situations. Ascertain the areas in which little or nothing is known-the gaps that exist in the body of knowledge.

iii) develop a theoretical framework- As you have limited time it is important to set parameters by reviewing the literature in relation to some main themes pertinent to your research topic. As you start reading the literature, you will realize that it deals with a number of aspects that have a

direct `and indirect bearing on your research topic. Use these aspects as a basis for developing your theoretical framework. Until you go through the literature you cannot develop a theoretical framework and until you have developed a theoretical framework, you cannot effectively review the literature. Literature pertinent to your study may deal with two types of information: - universal; - more specifi c(i.e. local trends or specific program) In writing about such information you should start with the general information, gradually narrowing down to the specific.

iv) develop a conceptual framework.

Writing up the literature reviewed: In order to comply with the first function of literature review i.e. to provide theoretical background to your study: -List the main themes that have emerged while reading literature. -Convert them into subheadings. These subheadings should be precise, descriptive of the theme in question, and follow a logical progression. -Now, under each subheading, record the main findings with respect to the theme in question, highlighting the reasons for and against an argument if they exist, and identify gaps and issues. In order to comply with the second function of literature review i.e. contextualising the findings of your study- requires you to very systematically compare your findings with those made by others. Quote from these studies to show how your findings contradict, confirm or add to them. It places your findings in the context of what others have found out. This function is undertaken when writing about your findings i.e. after analysis of your data.

Research Design:

Meaning of Research Design: The most important step after defining the research problem is preparing the design of the research project, which is popularly known as the research design. A research design helps to decide upon issues like what, when, where, how much, by what means etc. With regard to an enquiry or a research study. 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 (Selltizetal, 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. From 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 and
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 analyzed and
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

Features of a Good 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 Researchproblem
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

Important Concepts Relating to Research Design:

1. Dependent and independent variables: A magnitude that varies is known as a variable. The concept may assume different quantitative values like height, weight, income etc. Qualitative variables are not quantifiable 17 in the strictest sense of the term. However, the qualitative phenomena may also be quantified in terms of the presence or absence of the attribute(s) considered. The phenomena that assume different values quantitatively even in decimal points are known as continuous variables. But all variables need not be continuous. Values that can be expressed only in integer values are called _non-continuous variables. In statistical terms, they are also known as discrete variables. For example, age is a continuous variable, whereas the number of children is a non-continuous variable. When changes in one variable depend upon the changes in other variable or variables, it is known as a dependent or endogenous variable, and the variables that cause the changes in the dependent variable are known as the independent or explanatory or exogenous variables. For example, if demand depends upon price, then demand is a dependent variable, while price is the independent variable. And, if more variables determine demand, like income and price of the substitute commodity, then demand also depends upon them in addition to the price of original commodity. In other words, demand is a dependent variable which is determined by the independent variables like price of the original commodity, income and price of substitutes.

2. Extraneous variables: The independent variables which are not directly related to the purpose of the study but affect the dependent variables, are known as extraneous variables. For instance, assume that a researcher wants to test the hypothesis that there is a relationship between children‘s

school performance and their self-confidence, in which case the latter is an independent variable and the former, a dependent variable. In this context, intelligence may also influence the school performance. However, since it is not directly related to the purpose of the study undertaken by the researcher, it would be known as an extraneous variable. The influence caused by the extraneous variable(s) on the dependent variable is technically called the 'experimental error'. Therefore, a research study should always be framed in such a manner that the influence of extraneous variables on the dependent variable/s is completely controlled, and the influence of independent variable/s is clearly evident. Control, One of the most important features of a good research design is to minimize the effect of extraneous variable(s). Technically, the term 'control' is used when a researcher designs the study in such a manner that it minimizes the effects of extraneous variables. The term 'control' is used in experimental research to reflect the restrain in experimental conditions.

3. Confounded relationship: The relationship between the dependent and independent variables is said to be confounded by an extraneous variable, when the dependent variable is not free from its effects.

4. Research hypothesis: When a prediction or a hypothesized relationship is tested by adopting scientific methods, it is known as research hypothesis. The research hypothesis is a predictive statement which relates to a dependent variable and an independent variable. Generally, a research hypothesis must consist of at least one dependent variable and one independent variable. Whereas, the relationships that are assumed but not to be tested are predictive statements that are not to be objectively verified, thus are not classified as research hypotheses.

5. Experimental and non-experimental hypothesis testing research: When the objective of a research is to test a research hypothesis, it is known as hypothesis testing research. Such research may be in the nature of experimental design or nonexperimental design. The research in which the independent variable is manipulated is known as experimental hypothesis-testing research', whereas the research in which the independent Variable is not manipulated is termed as 'non-experimental hypothesis- testing research'.

6. Experimental and control groups: When a group is exposed to usual conditions in an experimental hypothesis-testing research, it is known as 'control group'. On the other hand, when the group is exposed to certain new or special condition, it is known as an 'experimental group'. In the afore-mentioned example, Group A can be called as control group and Group B as experimental group. If both the groups, A and B are exposed to some special feature, then both the groups may be called as 'experimental groups'. A research design may include only the experimental group or both the experimental and control groups together.

7. Treatments: Treatments refer to the different conditions to which the experimental and control groups are subject to.

8. Experiment: Experiment refers to the process of verifying the truth of a statistical hypothesis relating to a given research problem. For instance, an experiment may be conducted to examine the yield of a certain new variety of rice crop developed. Further, Experiments may be categorized into two types, namely, 'absolute experiment' and 'comparative experiment'. If a researcher wishes to determine the impact of a chemical fertilizer on the yield of a particular variety of rice crop, then it is known as absolute experiment. Meanwhile, if the researcher wishes to determine the impact of chemical fertilizer as compared to the impact of bio-fertilizer, then the experiment is known as a comparative experiment.

9. Experimental unit(s): Experimental units refer to the pre-determined plots, characteristics or the blocks, to which different treatments are applied.

Different Research Designs:

Types of research design: There are different types of research designs.

(1) Exploratory research design

(2) Descriptive and diagnostic research design

(3) Hypothesis-testing research design.

1. **Exploratory research design:** The Exploratory Research Design is known as formulative 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, sucharesearchdesignsuitableforsuchastudyshouldbeflexibleenoughto provide opportunity for considering different dimensions of the problem understudy. The inbuilt 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.

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. Generally, 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. However, 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

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.

Basic Principles of Experimental Designs : Professor Fisher has enumerated three principles of experimental designs:

(1) **the Principle of Replication**-the experiment should be repeated more than once. Thus, each treatment is applied in many experimental units instead of one. By doing so the statistical accuracy of the experiments is increased.

(2) **the Principle of Randomization**- The Principle of Randomization provides protection, when we conduct an experiment, against the effect of extraneous factors by randomization. In other words, this principle indicates that we should design or plan the experiment in such a way that the variations caused by extraneous factors can all be combined under the general heading of "chance."

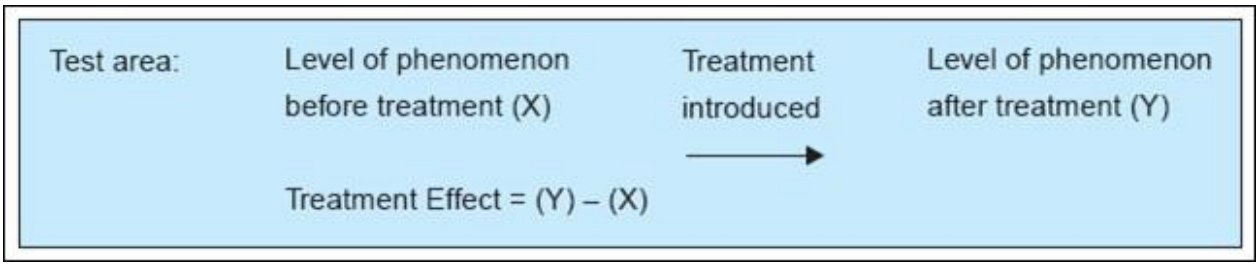
(3) **Principle of Local Control**- the extraneous factor, the known source of variability, is made to vary deliberately over as wide a range as necessary and this needs to be done in such a way that the variability it causes can be measured and hence eliminated from the experimental error. This means that we should plan the experiment in a manner that we can perform a two-way analysis of variance, in which the total variability of the data is divided into three components attributed to, the extraneous factor and experimental error. In other words, according to the principle of local control, we first divide the field into several homogeneous parts, known as blocks, and then each such block is divided into parts equal to the number of treatments. Then the treatments are randomly assigned to these parts of a block. Dividing the field into several homogenous parts is known as 'blocking'. In general, blocks are the levels at which we hold an extraneous factor fixed, so that we can measure its contribution to the total variability of the data by means of a two-way analysis of variance. In brief, through the principle of local control we can eliminate the variability due to extraneous factor(s) from the experimental error.

Important Experimental Designs.

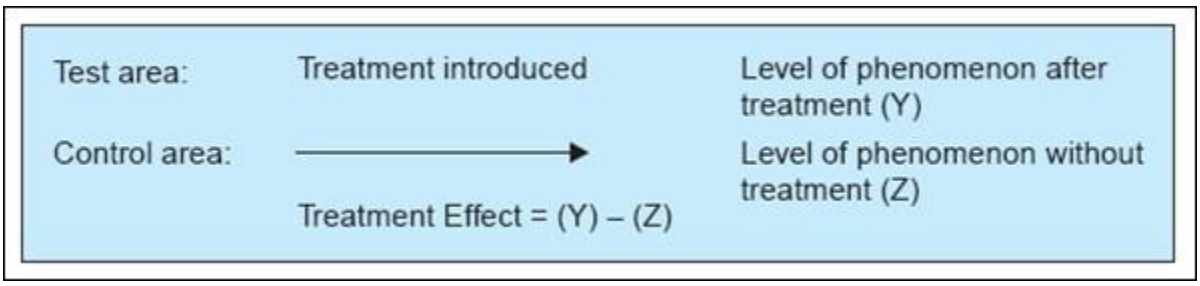
(a) Informal experimental designs:

(i) Before-and-after without control design-A single test group or area is selected and the dependent variable is measured. the treatment is then introduced and then the dependent variable is measured again.

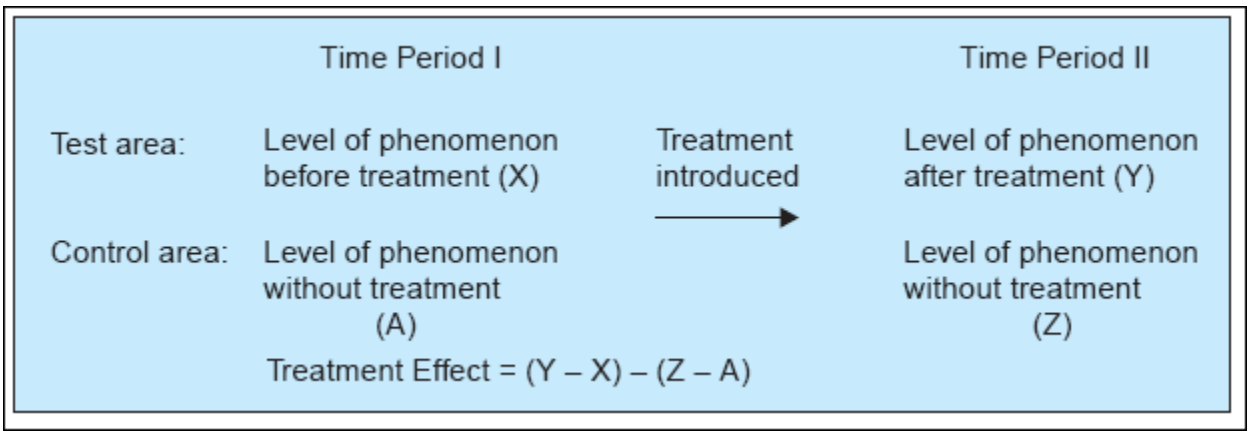
the effect of the treatment:the level of the phenomenon after the treatment-the level of the phenomenon before the treatment.



(ii) After-only with control design-Two groups or areas (test area and control area) are selected and the treatment is introduced into the test area only.

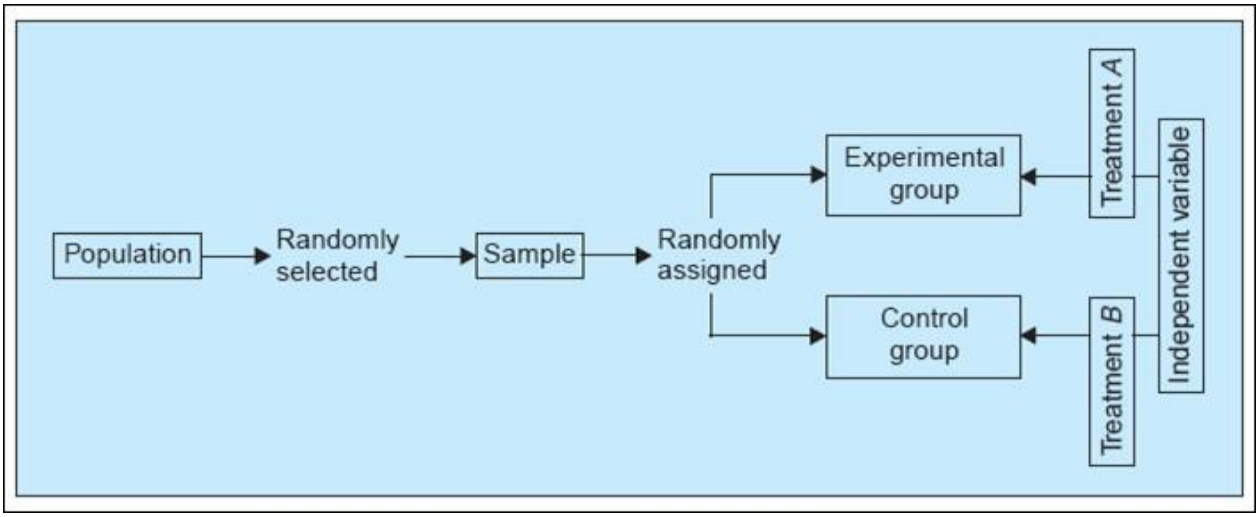


(iii) Before-and-after with control design-



(b) Formal experimental designs:

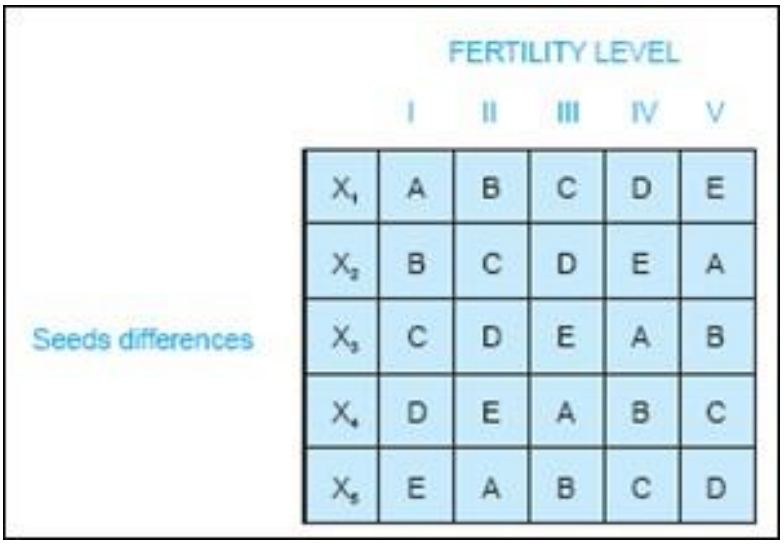
(i) Completely randomized design (C.R. Design).



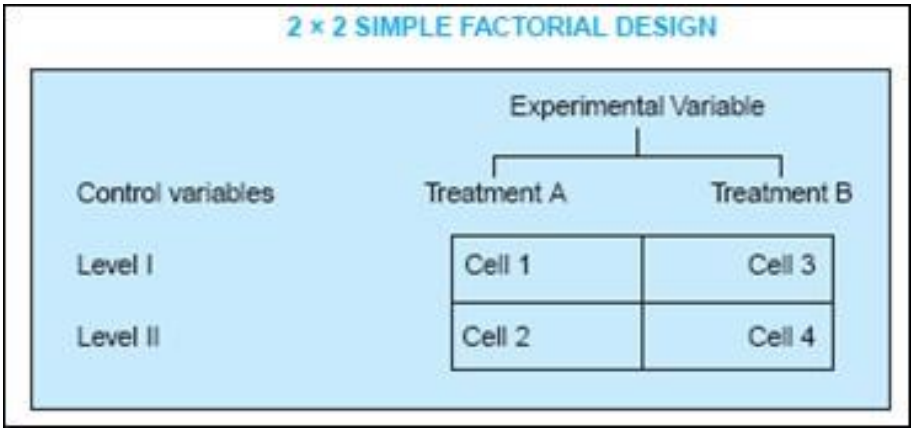
(ii) Randomized block design (R.B. Design).

	Very low I.Q.	Low I.Q.	Average I.Q.	High I.Q.	Very high I.Q.
	Student A	Student B	Student C	Student D	Student E
Form 1	82	67	57	71	73
Form 2	90	68	54	70	81
Form 3	86	73	51	69	84
Form 4	93	77	60	65	71

(iii) Latin square design (L.S. Design).



(iv) Factorial designs



Module-3

Design of Sampling:

Introduction: The use of sampling in making inferences about a population is possible and has been in operation right from beginning. When one has to make an inference about a lot of large size and it is not practicable to examine each individual unit, then few units of the lot are examined and on the basis of the information of those units, one makes decisions about whole lot. For example, a person would like to purchase a bag of rice may examine a handful of rice from the bag and on the basis of that he/she makes his/her decision about the purchase of full bag.

Population - A group of individuals having same characteristics in same surrounding is known as population

Census - In census, we study about each and every unit of the population. Population means total units of investigation area. In census, whole group related to investigation is investigated and the information are collected, i.e. Census of population of a country, Census of import and export, etc

Sample - A finite subset of statistical individuals in a population is called a sample and the number of individuals in a sample is called the sample size.

Sample Design: Essentials of Sampling For obtaining the unbiased and real result by a sampling method, a sample should have the following factors (characteristics):

1. Homogeneity The nature of each and every unit of the population should not contain much difference. If two or more samples are selected then they should be similar in nature not in their response/output.

2. Representativeness The sample should represent all the characteristics of the population that can be possible only when the selection of items or units has been done unbiased and each and every unit have an equal probability of chance to be selected in the sample.

3. Independency Each and every unit of the population should be independent. In other words, the selection of a unit in the sample should not be dependent on the selection of other units.

4. Adequacy The number of units or elements which are to be selected in the sample should be sufficient. If the sample size is not sufficient then results cannot be reliable. The more the sample units in the sample, more reliable results would occur.

PRINCIPLE STEPS IN SAMPLE SURVEY The main steps involved in the planning and execution of a sample survey are under the following heads:

1. Objectives The objective of the survey must be defined in clear and concrete terms. Generally, in survey a investigation team is not quite clear in mind as to what they want and how they are going to use the results. Some of the objectives may be immediate and some far-reaching. The investigator should take care of these objectives with the available resources in terms of money, manpower and the time limit required for the availability of the survey.

2. Defining the Population The population from which sample is chosen should be defined in clear and unambiguous terms. The geographical, demographic and other boundaries of the population must be specified so that no ambiguity arises regarding the coverage of the survey.

3. Sampling Frame and Sampling Units The sampling unit is the ultimate unit to be sampled for the purpose of the survey. The sampling units must cover the entire population and they must be distinct, unambiguous and non-overlapping in the sense that every element of the population belongs to one and only one sampling unit. In a Socio economic survey, whether a family or a member of a family is to be the ultimate sampling unit. Once the sampling units are defined, one must see whether a sampling frame which is a list of all the units in the population, is available. The construction of the frame is often one of the major practical problem since it is the frame which determines the structure of the sample survey. The list of units have to be carefully scrutinized and examined to ensures that it is free from duplicity or incompleteness and are up-to-date. A good frame is hard to come by and only good experience helps to construct a good frame.

4. Selection of Proper Sampling Design This is the most important step in planning a sample survey. There is a group of sampling designs (to be discussed later) and selection of the proper one is an important task. The design should take into account the available resources and the time-limit, if any, besides the degree of accuracy desired. The cost and precision should also be considered before the final selection of sampling design.

5. Method of Collecton of Data For collection of data, either the interview method or the mail questionnaire method is to be adopted. Although the later method is less costly but there is a large scope of non-response in it. In the cases, where the information is to be collected by observation they must decide upon the method of measurement.

6. Data to be Collected Collection of data must be done in conformity with the objectives of the survey and the nature of the data. After it is decided upon, one must prepare a questionnaire or a schedule of enquiry. A schedule or a questionnaire contains a list of items of which information is sought, but the exact form of the questions to be asked is not standardized but left to the judgment of the investigators. A questionnaire should be in a specified order. The questions should be clear, brief, collaborative, non offending and unambiguous and to the point so that not much scope of speculation is left on the part of the respondent or interviewer.

7. Field Work Organization Field work, itself has several stages and so it is to be well organized. The different stages include training the field workers, supervising the field workers, etc. It is absolutely essential that the personnel should be Introduction to Sample Surveys thoroughly

trained in locating the sample units, the methods of collection of required data before starting the field word. The success of a survey to a great extent depends upon the reliable field work. Inspection after field work by the adequate supervisors should also be performed.

8. Summary and Analysis of Data This is the last step wherein inference is to be made on the basis of collected data. This step again consists of the following steps:

a) The filled in questionnaires should be carefully scrutinized to find out whether the data furnished are plausible and consistent;
b) Depending upon the quantity of data, a hand-tabulation or machine tabulation is to be drawn;
c) After the data has been properly scrutinized, edited and tabulated, a very careful statistical analysis is to be made; and
d) Finally a report incorporating detailed statement of the different stages of the survey should be prepared. In the presentation of the result, it is advisable to report technical aspects of the design

Sampling and Non-sampling Errors: The errors involved in the collection, processing and analysis of data may be broadly classified under the following two heads:

1. Sampling Error

2. Non-sampling Error

1. **Sampling Error** The error which arises only in sample survey is termed as sampling error. This error arises because in sample survey a part of the population is only studied. This is the reason why sampling error is absent in census. The main factors of sampling error are:

- Some of the bias is introduced by the use of defective sampling techniques for the selection of a sample
- Substitution of a non-selected a convenient unit of the population in place of a selected unit to which the investigation is difficult leads to some biases in the sample survey;
- Bias due to defective demarcation of sampling units, particularly in area/filed survey; and
- Constant errors due to improper choice of the statistics for estimating the population parameters.

2 **Non-Sampling Error** The non-sampling error arises at the stages of observation, ascertainment and processing of the data. This is the reason why the non-sampling error presents Statistical Techniques in both the census and the sample survey. Non-sampling error can occur at every stage of the planning or execution of census or sample survey. Non sampling errors arise due to the following factors:

- Data specification being inadequate and inconsistent with respect to the objective of the study;
- Error due to location of the units and actual measurement of the characteristics;
- Error due to ill designed questionnaire;
- Lack of trained and qualified investigators and lack of adequate supervisory staff;

- Errors due to lack of correct responses furnished by the respondents;
- Non-response biases occur if full information is not obtained on all the sampling units;
- If the objectives of the survey are not stated clearly, it may result in inclusion of the units which are not to be included and exclusion of the units which are to be included in the sample;
- Due to error in various operations of data processing such as editing and coding of the responses, punching of cards, tabulation and summarizing the observation made in the survey; and
- The errors may be committed during presentation and printing the results of the survey.

Sample Survey versus Census Survey: The advantages of sampling over complete census may be outlined as follows:

1. Sampling requires less time and labor than census because only a part of the population has to be examined. The sampling results also can be analysed much faster;

2. Sampling usually results in reduction in cost in terms of money and man powers. The total cost of the sample survey is expected to be much smaller than a complete census;

3. There is generally a greater scope in a sample survey than in census. Some inquiries may require highly trained personnel or specialized equipment for collection of data, then the census may be inconceivable;

4. In some cases a complete census is ruled out by the nature of the population. If there is a population which is infinite and/or hypothetical, then sampling is the only option;

5. A sample survey gives data of better quality than a complete census, because in a sample survey it may be possible to use better resources than complete census;

6. If the population is too large, as for example, trees in a jungle, leaves in a tree i.e. we are left with no option but to resort to sampling; and

7. If testing is destructive, then complete enumeration is impracticable and sampling design is the only method to be used in such cases. For example, testing the breaking strength of a chalk, testing of lifetime of an electrical bulb, etc.

Types of Sampling Designs : According to the method of selection of sample, the sampling schemes can be categorised as follows:

1. Non-probability sampling

2. Probability or random sampling and

3. Mixed sampling.

1 **Non-Probability Sampling**- In this method, the sample is selected with a definite purpose in view and the choice of the sampling units depends entirely on the discretion and judgment of the investigator. While selecting a sample, investigator tries to include each and every characteristics of population in sample. Non-Probability Sampling scheme can be classified as:

- Purposive Sampling In this sampling the sample is selected with definite purpose in view and the choice of sampling units depends entirely on the discretion of the surveyor. This sampling suffers from drawback of favoritism and nepotism of the surveyor.

- Judgment Sampling In judgment sampling respondents are selected on the judgment of the surveyor with the hope that they will meet requirements of the study. The underling assumptions are that the respondent truly represents the entire population. To find out the potential guide for the food and catering technology a researcher go to the teachers of Hotel Management Department may be the example of judgment sampling.

- Deliberate Sampling In deliberate sampling, deliberate selection of sample is made so that any important unit could not be leftout.

- Convenience Sampling In convenience sampling method, a surveyor selects the sample at his/her own convenience, often as the study is being conducted. Convenience Statistical Techniques sampling is based on assumption that the target population is homogeneous and the individuals selected and interviewed yields similar information with regard to the characteristics under study. If persons selected from restaurants to collect the information about quality of the food, service, etc. are supposed to represent the population of food takers. Such a sampling is known as convenience sampling

- Quota Sampling If the cost of selected random samples in each stratum is very high in stratified sampling then the sampling units are assigned in a quota (fixed number of units) in each stratum and the actual selection of units is left at the decision of the surveyor.

Merits of Non-Probability Sampling

1. This method of sampling is very simple;

2. After sample size determination with the help of planning, a suitable sample may possibly be obtained; and

3. Important units or members may be included in the sample.

Demerits of Non-Probability Sampling

1. Predetermined view of selector effects the selection of sample which impure the result. This effect does directly or indirectly on the process;

2. There is no place for probability in selection of units therefore sampling error cannot be obtained;

3. There is no guaranty of validity of the results from the sample selected by this method; and

4. The attitude and biasedness of the investigator also affect the selection of sample that's why the results obtained by this method are not reliable scientifically.

2 **Random or Probability Sampling** The technique of random sampling is of fundamental importance in the application of Statistics. Probability sampling is the scientific method of selecting samples accordingly to some laws of chance in which each unit in the population has some definite pre-assigned probability of being selected in the sample.

Merits of Random or Probability Sampling

1. No Plan for Selection There is no need to make any detailed plan for the selection of units.

2. Less Expensive In this method, money, time and hard work are very less.

3. Unbiased In this method there is no space for any biasedness. Every unit has same chance of selection

. 4. Inspection of Purity Inspection of purity of one sample can be done by other sample. In this method measure of statistical error can also be done.

5. Random Selection Selector has not to use his mind. He selects units at random.

6. True Representation of Population In this method real characteristics can be represented through sample because it is based on the law of statistical regularity and law of inertia. In real, it becomes a small part of population.

Demerits of Random or Probability Sampling

1. Inappropriate This method is not appropriate where some units are so important to be included necessarily in the sample.

2. Less Representative It may be possible that sample could not represent the population if sample is not sufficiently large.

3. Less Independency This method is useless if the units of the population are dependent.

Difference between Probability and Non-probability Sampling

1. In non-probability sampling the selection of units are pre-decided whether in probability sampling is based on chances.

2. Non-probability sampling is biased but probability sampling is unbiased.

3. In non-probability sampling, the errors are of cumulative in nature whereas in probability sampling errors are less Statistical Techniques

4. If a sample, from a population with homogeneous and important units, is to be selected then non-probability sampling is appropriate where as probability sampling is used in various kinds of population.

3**. Mixed Sampling** If the samples are selected partly according to some laws of chance and partly according to a fixed rule, they are called mixed samples and the method of selecting such samples is known as mixed sampling. The merits of this sampling are the mixture of the merits of both sampling. Selection of units is more reliable in this method because that is the representation of various stages of population. In mixed sample no important characteristics is left which is to be selected in the sample.

Measurement and Scaling: Qualitative and Quantitative Data

	Qualitative	Quantitative
Conceptual	Concerned with understanding human behaviour from the informant's perspective	Concerned with discovering facts about social phenomena
	Assumes a dynamic and negotiated reality	Assumes a fixed and measurable reality
Methodological	Data are collected through participant observation and interviews	Data are collected through measuring things
	Data are analysed by themes from descriptions by informants	Data are analysed through numerical comparisons and statistical inferences
	Data are reported in the language of the informant	Data are reported through statistical analyses

Source: Adapted from Minchiello *et al.* (1990, p. 5)

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Data Collection:

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Methods of Data Collection: There are two types of data

Primary Data— collected for the first time

Secondary Data—those which have already been collected and analysed by someone else.

Methods of Primary Data Collection

OBSERVATION METHOD: Commonly used in behavioural sciences It is the gathering of primary data by investigator's own direct observation of relevant people, actions and situations without asking from the respondent. e.g. • A hotel chain sends observers posing as guests into its coffee shop to check on cleanliness and customer service. • A food service operator sends researchers into competing restaurants to learn menu items prices, check portion sizes and consistency and observe point-of purchase merchandising. • A restaurant evaluates possible new locations by checking out locations of competing restaurants, traffic patterns and neighborhood conditions. Observation can yield information which people are normally unwilling or unable to provide. e.g. Observing numerous plates containing uneaten portions the same menu items indicates that food is not satisfactory.

Types of Observation:

1. Structured – for descriptive research

2. Unstructured—for exploratory research

3. Participant Observation

4. Non- participant observation

5. Disguised observation

Limitations: - feelings, beliefs and attitudes that motivate buying behaviour and infrequent behaviour cannot be observed. - expensive method Because of these limitations, researchers often supplement observation with survey research.

SURVEY METHOD Approach most suited for gathering descriptive information.

Structured Surveys: use formal lists of questions asked of all respondents in the same way.

Unstructured Surveys: let the interviewer probe respondents and guide the interview according to their answers. Survey research may be Direct or Indirect. Direct Approach: The researcher asks

direct questions about behaviours and thoughts. e.g. Why don't you eat at MacDonalds? Indirect Approach: The researcher might ask: "What kind of people eat at MacDonald's?" From the response, the researcher may be able to discover why the consumer avoids MacDonald's. It may suggest factors of which the consumer is not consciously aware.

ADVANTAGES: -can be used to collect many different kinds of information -Quick and low cost as compared to observation and experimental method.

LIMITATIONS: -Respondent's reluctance to answer questions asked by unknown interviewers about things they consider private. -Busy people may not want to take the time -may try to help by giving pleasant answers -unable to answer because they cannot remember or never gave a thought to what they do and why -may answer in order to look smart or well informed.

CONTACT METHODS: Information may be collected by Mail, Telephone, Personal interview
Mail Questionnaires:

Advantages: -can be used to collect large amounts of information at a low cost per respondent. -respondents may give more honest answers to personal questions on a mail questionnaire
-no interviewer is involved to bias the respondent's answers.
-convenient for respondent's who can answer when they have time - good way to reach people who often travel

Limitations: -not flexible
-take longer to complete than telephone or personal interview
-response rate is often very low –
researcher has no control over who answers.

Telephone Interviewing: - quick method –
more flexible as interviewer can explain questions not understood by the respondent –
depending on respondent's answer they can skip some Qs and probe more on others –
allows greater sample control –
response rate tends to be higher than mail

Drawbacks: -Cost per respondent higher –
Some people may not want to discuss personal Qs with interviewer
-Interviewer's manner of speaking may affect the respondent's answers –
Different interviewers may interpret and record response in a variety of ways –
under time pressure ,data may be entered without actually interviewing

Personal Interviewing: It is very flexible and can be used to collect large amounts of information. Trained interviewers are can hold the respondent's attention and are available to clarify difficult questions. They can guide interviews, explore issues, and probe as the situation requires. Personal interview can be used in any type of questionnaire and can be conducted fairly quickly.

Interviewers can also show actual products, advertisements, packages and observe and record their reactions and behaviour. This takes two forms-

Individual- Intercept interviewing Group –

Focus Group Interviewing Intercept interviewing: Widely used in tourism research. -allows researcher to reach known people in a short period of time. - only method of reaching people whose names and addresses are unknown -involves talking to people at homes, offices, on the street, or in shopping malls. -interviewer must gain the interviewee's cooperation -time involved may range from a few minutes to several hours(for longer surveys compensation may be offered) --involves the use of judgmental sampling i.e. interviewer has guidelines as to whom to "intercept", such as 25% under age 20 and 75% over age 60
Drawbacks: -Room for error and bias on the part of the interviewer who may not be able to correctly judge age, race etc. -Interviewer may be uncomfortable talking to certain ethnic or age groups.
Focus Group Interviewing: It is rapidly becoming one of the major research tool to understand people's thoughts and feelings. It is usually conducted by inviting six to ten people to gather for a few hours with a trained moderator to talk about a product, service or organization.The meeting is held in a pleasant place, and refreshments are served to create a relaxed environment. The moderator needs objectivity, knowledge of the subject and industry, and some understanding of group and consumer behaviour. The moderator starts with a broad question before moving to more specific issues, encouraging open and easy discussion to bring out true feelings and thoughts. At the same time, the interviewer focuses the discussion, hence the name focus group interviewing. - often held to help determine the subject areas on which questions should be asked in a later, large-scale, structured-direct interview Comments are recorded through note taking or videotaped and studied later to understand consumer' buying process. This method is especially suited for managers of hotels and restaurants, who have easy access to their customers. e.g. Some hotel managers often invite a group of hotel guests from a particular market segment to have a free breakfast with them. Managers get the chance to meet the guests and discuss what they like about the hotel and what the hotel could do to make their stay more enjoyable and comfortable. The guests appreciate this recognition and the manager gets valuable information. Restaurant managers use the same approach by holding discussion meetings over lunch or dinner.
Drawbacks: -Cost: may cost more than telephone survey -Sampling: group interview studies keep small sample size to keep time and cost down, therefore it may be difficult to generalize from the results. - Interviewer bias.

EXPERIMENTAL METHOD Also called Empirical Research or Cause and Effect Method, it is a data-based research, coming up with conclusions which are capable of being verified with observation or experiment. Experimental research is appropriate when proof is sought that certain variables affect other variables in some way. e.g. -Tenderisers (independent variable) affect cooking time and texture of meat(dependent variable) . - The effect of substituting one ingredient in whole or in part for another such as soya flour to flour for making high protein bread. -Develop recipes to use products. Such research is characterised by the experimenter's control over the

variables under study and the deliberate manipulation of one of them to study its effects. In such a research, it is necessary to get at facts first hand, at their source, and actively go about doing certain things to stimulate the production of desired information. -Researcher must provide self with a working hypothesis or guess as to the probable results. - Then work to get enough facts (data) to prove or disprove the hypothesis. -He then sets up experimental designs which he thinks will manipulate the persons or the materials concerned so as to bring forth the desired information. Evidence gathered through experimental or empirical studies today is considered to be the most powerful support possible for a given hypothesis.

Module-4

Testing of Hypotheses:

A hypothesis test is a formal way to make a decision based on statistical analysis.
Hypotheses. Hypothesis tests are tests about a population parameter .

Characteristics of hypothesis: Hypothesis must possess the following characteristics:

(i) Hypothesis should be clear and precise. If the hypothesis is not clear and precise, the inferences drawn on its basis cannot be taken as reliable.

(ii) Hypothesis should be capable of being tested. In a swamp of untestable hypotheses, many a time the research programmes have bogged down. Some prior study may be done by researcher in order to make hypothesis a testable one. A hypothesis "is testable if other deductions can be made from it which, in turn, can be confirmed or disproved by observation."

(iii) Hypothesis should state relationship between variables, if it happens to be a relational hypothesis.

(iv) Hypothesis should be limited in scope and must be specific. A researcher must remember that narrower hypotheses are generally more testable and he should develop such hypotheses.

(v) Hypothesis should be stated as far as possible in most simple terms so that the same is easily understandable by all concerned. But one must remember that simplicity of hypothesis has nothing to do with its significance.

(vi) Hypothesis should be consistent with most known facts i.e., it must be consistent with a substantial body of established facts. In other words, it should be one which judges accept as being the most likely.

(vii) Hypothesis should be amenable to testing within a reasonable time. One should not use even an excellent hypothesis, if the same cannot be tested in reasonable time for one cannot spend a life-time collecting data to test it.

(viii) Hypothesis must explain the facts that gave rise to the need for explanation. This means that by using the hypothesis plus other known and accepted generalizations, one should be able to deduce the original problem condition. Thus hypothesis must actually explain what it claims to explain; it should have empirical reference.

The null hypothesis (H0) is a statement involving equality ($=, \leq, \geq$) about a population parameter.
The alternative hypothesis (Ha) is a statement that contradicts the null hypothesis. The alternative hypothesis is what we conclude is true if the experimental results lead us to conclude that the null

hypothesis (our assumption) is false. The alternative hypothesis must not involve equality (6=,). The exact statement of the null and alternative hypotheses depend on the claim that you are testing.

We decide to reject the null hypothesis if the sample outcome contradicts our assumption. The logic is as follows:

• To make this decision we calculate the p-value := the probability of our sample outcome or something more extreme occuring ASSUMING the null hypothesis is true.
If the p-value is very small, our sample outcome was very unlikely (a "rare event") based on our assumption, so we reject our assumption.
Recall that our assumption is based on the null hypothesis, so rejecting the assumption is the same as rejecting the null hypothesis.
The smaller the p-value, the larger (in absolute value) the z/t-score, so an "unusual" z/t-score gives us a hint about the p-value.
Example : Skittles. Our null hypothesis (assumption) is that a bag of Skittles contains 95% orange Skittles (and the rest are green), because that is written on the label. We reach in a hand and pull out a big handful of Skittles. They are all green! • Describe the p-value in words.
We can't get the exact p-value, but what do you estimate it to be? • Should we decide to "reject" or "not to reject" our assumption (null hypothesis) that the bag contains 95% orange Skittles? Disclaimer: This scenario is a complete fabrication. Skittles are fabulous.
. Decision. How small must the p-value be to reject the null hypothesis? This can change and is set by the significance level, α, which will be provided in each problem. Common significance levels are 0.01, or 1 100 , and 0.05, or 5 100 .
The decision process is as follows:
• If p-value < α, reject the null hypothesis. (Our outcome contradicts the assumption.)
• If p-value ≥ α, do not reject the null hypothesis. (Our outcome seems reasonable based on the assumption.)

Skipper, p 6 This silly little rhyme is from the Triola textbook "Elementary Statistics" and has been helpful to many students: "If the p is low, the null must go. If the p is high, the null will fly."

Confidence intervals allowed us to find ranges of reasonable values for parameters we were interested in. Hypothesis testing will let us make decisions about specific values of parameters or relationships between parameters.

1. π - population proportion
2. μ - population mean
3. μ1 −μ2 - difference in population means (example: compare average heights of men and women)
4. μd - population mean difference (for paired data) (example: compare average heights of fathers and sons)

5. $\pi 1 - \pi 2$ - difference in population proportions

You will need to be able to distinguish these settings from each other. Notably, to distinguish proportion settings from mean settings, think about the question being asked. Are responses to the question of interest yes or no? If so, you are dealing with proportions. If the response is a numerical value, you are dealing with means.
In hypothesis testing, we use sample data to choose between two competing hypotheses. Think of it like a jury trial. There are two options: innocent and guilty. You assume innocence until shown guilty beyond a reasonable doubt. In hypothesis testing, there are 2 choices, the null hypothesis and the alternative hypothesis. You assume the null hypothesis is true until the alternative is shown beyond "chance". Hypothesis - a claim about a population characteristic (parameter)
Null Hypothesis - the status quo - initially assumed true
Alternative Hypothesis - the researcher's proposal - what you hope to show Main idea:

Reject the null hypothesis in favor of the alternative only with convincing/significant evidence. We do NOT say that we accept the alternative, only that we have significant evidence to reject the null. This is because we could have made a mistake (see below).
Forms of Hypotheses:
Null Hypothesis: H0 : population parameter = some hypothesized value
Alternative Hypothesis:
HA : population parameter is **not equal to** that same hypothesized value (two-sided) OR
HA : population parameter > that same hypothesized value (one-sided to the right) OR
HA : population parameter < that same hypothesized value (one-sided to the left)

ELEMENTS/TYPES OF ANALYSIS

Analysis means the computation of certain indices or measures along with searching for patterns of relationship that exist among the data groups. Analysis, particularly in case of survey or experimental data, involves estimating the values of unknown parameters of the population and testing of hypotheses for drawing inferences. Analysis may, therefore, be categorised as descriptive analysis and inferential analysis (Inferential analysis is often known as statistical analysis).

"Descriptive analysis 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 unidimensional analysis), or in respect of two variables (described as bivariate analysis) or in respect of more than two variables (described as multivariate analysis). In this context we work out various measures that show the size and shape of a distribution(s) along with the study of measuring relationships between two or more variables. We may as well talk of correlation analysis and causal analysis.

Correlation analysis studies the joint variation of two or more variables for determining the amount of correlation between two or more variables. Causal analysis 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

Causal analysis is considered relatively more important in experimental researches, whereas in most social and business researches our interest lies in understanding and controlling relationships between variables then with determining causes per se and as such we consider correlation analysis as relatively more important. In modern times, with the availability of computer facilities, there has been a rapid development of multivariate analysis which 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:

(a) 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.

(b) Multiple discriminant analysis: 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.

(c) 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.

(d) 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.

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.

The chi-squared test

This is a versatile non-parametric test.

Goodness of Fit: whether a sample fits an expected distribution (of arbitrary shape).

Test for Independence: are paired observations on two categorical variables independent.

• Variable X: Gender [Male,Female]
• Variable Y: Voting Preference [Lab,Con,Lib]
• Does gender affect voting preference?

Goodness of Fit - Consider throwing a die many times to see whether or not it's fair. We get a frequency distribution. We expect this to be a uniform distribution: an equal number of 1s, 2s, 3s, etc.

Module-5

Interpretation and Report Writing:

Writing the report is the last, and for many, the most difficult step of the research process. The report informs the world what you have done, what you have discovered and what conclusions you have drawn from your findings. The report should be written in an academic style. Language should be formal and not journalistic.

Written Research Project Report Format- Traditional written reports tend to be produced in the following format.

Title Page -Title of the Research Project, -

Name of the researcher, -

Purpose of the research project, e.g. "A research project submitted in partial fulfillment of the requirements of National Council for Hotel Management and Catering Technology, New Delhi for the degree of B.Sc Hospitality and Hotel Administration" –

Date of Publication

Table of Contents In this section is listed the contents of the report, either in chapters or in subheadings

List of Tables This section includes title and page number of all tables e.g.

List Of Figures This section contains title and page number of all graphs, pie charts etc. e.g.

Acknowledgements Here the researcher may acknowledge Institute Principal, Faculty Guide-both research guide and technical guide, research participants, friends etc.

Introduction This section introduces the research setting out aims and objectives. It includes a rationale for the research.

Theoretical Framework and Review of Literature- In this section is included all your background research which may be obtained from the literature review. You must indicate from where all the information Has come, so remember to keep a complete record of everything you read. If you do not do this, you could be accused of plagiarism which is a form of intellectual theft

Research design: This section includes all practical details followed for research . After reading this, any interested party should be able to replicate the research study. The methods used for data collection, how many people took part, how they were chosen, what tool was used for data collection, how the data was analysed etc.

Research design: This section includes all practical details followed for research . After reading this, any interested party should be able to replicate the research study. The methods used for data collection, how many people took part, how they were chosen, what tool was used for data collection, how the data was analysed etc.

Data Analysis and Interpretation: If you have conducted a large quantitative survey, this section may contain tables, graphs, pie charts and associated statistics. If you have conducted a qualitative piece of research this section may be descriptive prose.

Summary and Conclusion: In this section you sum up your findings and draw conclusions from them, perhaps in relation to other research or literature.

Recommendations If you have conducted a piece of research for a hotel or any other client organization, this section could be the most important part of the report. A list of clear recommendations which have been developed from the research is included- sometimes this section is included at the beginning of the report.
Suggestion for Further Research It is useful in both academic reports and work-related reports to include a section which shows how the research can be continued. Perhaps some results are inconclusive, or perhaps the research has thrown up many more research questions which need to be addressed. It is useful to include this section because it shows that you are aware of the wider picture and that you are not trying to cover up something which you feel may be lacking in your own work.
List of References /Bibliography - List of references contains details only of those works cited in the text. - A bibliography includes sources not cited in the text but which are relevant to the subject.(larger dissertations or thesis) - Small research projects will need only a reference section. This includes all the literature to which you have referred in your report. The popular referencing system Harvard System lists books and periodicals in the following manner:
For Books 1.Authors surname (alphabetically), followed by their initials, 2.Date of publication 3.Title of book in italics 4.Place of publication, Publisher. e.g.
Philip, T.E.; 1986, Modern Cookery for Teaching and Trade, Mumbai, Orient Longman. For Journal Article: The title of the article appears in inverted commas and name of the journal comes in italics, followed by volume number and pages of the article. e.g.
Philip, T.E.; "Influence of British Raj on Indian Cuisine"; Journal of Hospitality Education; 5:5-11

Appendices: If you have constructed a questionnaire or Interview schedule for your research, it may be useful to include them in your report as an appendix. Appendices do not count towards your total number of pages/words. It is a useful way of including relevant material so that the examiner can gain a deeper understanding of your work by reading it.

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property:
INTRODUCTION Intellectual property (IP) refers to the creations of the human mind like inventions, literary and artistic works, and symbols, names, images and designs used in commerce. Intellectual property is divided into two categories: Industrial property, which includes inventions (patents), trademarks, industrial designs, and geographic indications of source; and Copyright, which includes literary and artistic works such as novels, poems and plays, films, musical works,

artistic works such as drawings, paintings, photographs and sculptures, and architectural designs. Rights related to copyright include those of performing artists in their performances, producers of phonograms in their recordings, and those of broadcasters in their radio and television programs. Intellectual property rights protect the interests of creators by giving them property rights over their creations.

The most noticeable difference between intellectual property and other forms of property, however, is that intellectual property is intangible, that is, it cannot be defined or identified by its own physical parameters. It must be expressed in some discernible way to be protectable.

Generally, it encompasses four separate and distinct types of intangible property namely — patents, trademarks, copyrights, and trade secrets, which collectively are referred to as "intellectual property."

In recent times, geographical indications, protection of plant varieties, protection for semi-conductors and integrated circuits, and undisclosed information have been brought under the umbrella of intellectual property.

The Convention establishing the World Intellectual Property Organization (1967) gives the following list of the subject matter protected by intellectual property rights:

• literary, artistic and scientific works;
• performances of performing artists, phonograms, and broadcasts;
• inventions in all fields of human endeavor; • scientific discoveries;
• industrial designs;
• trademarks, service marks, and commercial names and designations;
• protection against unfair competition; and
• "all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields."

With the establishment of the world trade Organization (WTO), the importance and role of the intellectual property protection has been crystallized in the Trade-Related Intellectual Property Systems (TRIPS) Agreement. It was negotiated at the end of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) treaty in 1994.

The TRIPS Agreement encompasses, in principle, all forms of intellectual property and aims at harmonizing and strengthening standards of protection and providing for effective enforcement at both national and international levels.

It addresses applicability of general GATT principles as well as the provisions in international agreements on IP (Part I). It establishes standards for availability, scope, use (Part II), enforcement (Part III), acquisition and maintenance (Part IV) of Intellectual Property Rights. Furthermore, it addresses related dispute prevention and settlement mechanisms (Part V). Formal provisions are addressed in Part VI and VII of the Agreement, which cover transitional, and institutional

arrangements, respectively. The TRIPS Agreement, which came into effect on 1 January 1995, is to date the most comprehensive multilateral agreement on intellectual property.

The areas of intellectual property that it covers are: (i) Copyright and related rights (i.e. the rights of performers, producers of sound recordings and broadcasting organisations); (ii) Trade marks including service marks; (iii) Geographical indications including appellations of origin; (iv) Industrial designs; (v) Patents including protection of new varieties of plants; (vi) The lay-out designs (topographies) of integrated circuits; (vii) The undisclosed information including trade secrets and test data.

After Independence a comprehensive bill on patent rights was enacted in the year 1970 and was called "The Patents Act, 1970". Specific statutes protected only certain type of Intellectual output; till recently only four forms were protected. The protection was in the form of grant of copyrights, patents, designs and trademarks. In India, copyrights were regulated under the Copyright Act, 1957; patents under Patents Act, 1970; trade marks under Trade and Merchandise Marks Act 1958; and designs under Designs Act, 1911. With the establishment of WTO and India being signatory to the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), several new legislations were passed for the protection of intellectual property rights to meet the international obligations.
These included: Trade Marks, called the Trade Mark Act, 1999; Designs Act, 1911 was replaced by the Designs Act, 2000; the Copyright Act, 1957 amended a number of times, the latest is called Copyright (Amendment) Act, 2012; and the latest amendments made to the Patents Act, 1970 in 2005. Besides, new legislations on geographical indications and plant varieties were also enacted. These are called Geographical Indications of Goods (Registration and Protection) Act, 1999, and Protection of Plant Varieties and Farmers' Rights Act, 2001 respectively.

The Patents Act has been amended keeping in view the development of technological capability in India, coupled with the need for integrating the intellectual property system with international practices and intellectual property regimes.

The Trademarks Bill of 1999 was passed by Parliament that received the assent of the President on 30th December, 1999 as Trade Marks Act, 1999 thereby replacing the Trade and Merchandise Mark Act of 1958.

The Designs Act, 2000 The Designs Act of 1911 has been replaced by the Designs Act, 2000. In view of considerable progress made in the field of science and technology, a need was felt to provide more efficient legal system for the protection of industrial designs in order to ensure effective protection to registered designs, and to encourage design activity to promote the design element in an article of production

The Geographical Indications of Goods (Registration and Protection) Act, 1999 Until recently, Geographical indications were not registrable in India and in the absence of statutory protection, Indian geographical indications had been misused by persons outside India to indicate goods not originating from the named locality in India. Patenting turmeric, neem and basmati are the instances which drew a lot of attention towards this aspect of the Intellectual property.

Copyright Act, 1957 Copyright in India is governed by Copyright Act, 1957. This Act has been amended several times to keep pace with the changing times. As per this Act, copyright grants author's lifetime coverage plus 60 years 8 PP-IPRL&P after death. Copyright and related rights on cultural goods, products and services, arise from individual or collective creativity. All original intellectual creations expressed in a reproducible form will be connected as "works eligible for copyright protections". Copyright laws distinguish between different classes of works such as literary, artistic, musical works and sound recordings and cinematograph films. The work is protected irrespective of the quality thereof and also when it may have very little in common with accepted forms of literature or art. Copyright protection also includes novel rights which involve the right to claim authorship of a work, and the right to oppose changes to it that could harm the creator's reputation. The creator or the owner of the copyright in a work, can enforce his right administratively and in the courts by inspection of premises for evidence of production or possession of illegally made "pirated" goods related to protected works. The owner may obtain court orders to stop such activities, as well as seek damages for loss of financial rewards and recognition. A vital field which gets copyright protection is the computer industry. The Copyright Act, 1957, was amended in 1984 and computer programming was included with the definition of "literary work.' The new definition of "computer programme" introduced in 1994, means a set of instructions expressed in works, codes or in any other form, including a machine readable medium, capable of causing a computer to perform a particular task or achieve a particular result. The greatest fear and challenges to the copyright industry is the piracy of works whether, books, musical works, films, television programmes or computer software or computer database.

The Protection of Plant Varieties and Farmers' Rights Act, 2001 The concept of Plant Breeders' Rights arises from the need to provide incentives to plant breeders engaged in the creative work of research which sustains agricultural progress through returns on investments made in research and to persuade the researcher to share the benefits of his creativity with society. The issue of enacting a law relating to Plant Varieties Protection and Farmers' Rights in India assumed importance particularly in the wake of TRIPS agreement under WTO which seeks to promote effective protection of Intellectual Property Rights in all fields of technology. Article 27 of TRIPS Agreement defines patentable subject matter and requires member countries to provide for the protection of plant varieties whether by patenting or by an effective sui generis system or by any combination thereof.

The Semi Conductor Integrated Circuits Layout Design Act, 2000 Electronics and Information technology is one of the fastest growing sectors that has played a significant role in world economy. This is primarily due to the advancements in the field of electronics, computers and telecommunication.

Microelectronics, which primarily refers to Integrated Circuits (ICs) ranging from, Small Scale Integration (SSI) to Very Large Scale Integration (VLSI) on a semiconductor chip - has rightly been recognized as a core, strategic technology world-over, especially for Information Technology (IT) based society. Design of integrated circuits requires considerable expertise and effort depending on the complexity.

Trade Secrets - confidential business information that provides an enterprise a competitive edge. Usually these are manufacturing or industrial secrets and commercial secrets. These include sales methods, distribution methods, consumer profiles, and advertising strategies, lists of suppliers and clients, and manufacturing processes. Contrary to patents, trade secrets are protected without registration. A trade secret can be protected for an unlimited period of time but a substantial element of secrecy must exist so that, except by the use of improper means, there would be difficulty in acquiring the information. Considering the vast availability of traditional knowledge in the country, the protection under this will be very crucial in reaping benefits from such type of knowledge.

Utility Models- A utility model is an exclusive right granted for an invention, which allows the right holder to prevent others from commercially using the protected invention, without his authorization for a limited period of time. In its basic definition, which may vary from one country (where such protection is available) to another, a utility model is similar to a patent. In fact, utility models are sometimes referred to as "petty patents" or "innovation patents."

IPR & BIODIVERSITY In simple terms, the diversity among various life forms within the Biosphere refers to biodiversity. Biodiversity is the foundation of life on Earth. It is crucial for the functioning of ecosystems which provide us with products and services without which we cannot live. By changing biodiversity, we strongly affect human well-being and the well-being of every other living creature. Biodiversity is normally classified under 3 major categories:

The Convention on Biological Diversity establishes important principles regarding the protection of biodiversity while recognizing the vast commercial value of the planet's store of germplasm. However, the expansion of international trade agreements establishing a global regime of intellectual property rights creates incentives that may destroy biodiversity, while undercutting social and economic development opportunities as well as cultural diversity.

The **PCT** created a Union. The Union has an Assembly. Every State party to the PCT is a member of the Assembly. Some of the most important tasks of the Assembly are.

The amendment of the Regulations issued under the Treaty, the adoption of the biennial program and budget of the Union, and the fixing of certain fees connected with the use of the PCT system.

The development of the PCT system is shown by the fact that in 1979, 2,625 international applications were received by the International Bureau, while the corresponding number was 110,065 in 2003. The average number of designations per application was 6.66 in 1979 and 132 in 2003.
The PCT was concluded in 1970, amended in 1979 and modified in 1984 and 2001. It is open to States party to the Paris Convention for the Protection of Industrial Property (1883). Instruments of ratification or accession must be deposited with the Director General of WIPO.

The Patent Cooperation Treaty makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by filing an international patent application. The application may be filed by anyone who is a national or resident of a contracting State, with the national patent office of the contracting State of which the applicant is a national or resident or, at the applicant's option, with the International Bureau of WIPO in Geneva. If the applicant is a national or resident of a contracting State which is party to the European Patent Convention, the Harare Protocol on Patents and Industrial Designs (Harare Protocol) or the Eurasian Patent Convention, the international application may also be filed with the European Patent Office (EPO), the African Regional Industrial Property Organization (ARIPO) or the Eurasian Patent Office (EAPO), respectively.

TRIPS: With the establishment of the world trade Organization (WTO), the importance and role of the intellectual property protection has been Crystallized in the Trade-Related Intellectual Property Systems (TRIPS) Agreement. It was negotiated at the end of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) treaty in 1994. The general goals of the TRIPS Agreement are contained in the Preamble to the Agreement, which reproduces the basic Uruguay Round negotiating objectives established in the TRIPS area by the 1986 Punta del Este Declaration and the 1988-89 Mid-Term Review.
The TRIPS Agreement, which came into effect on 1 January 1995, is to date the most comprehensive multilateral agreement on intellectual property.
The areas of intellectual property that it covers are:
(i) Copyright and related rights (i.e. the rights of performers, producers of sound recordings and broadcasting organisations)
(ii) Trade marks including service marks
(iii) Geographical indications including appellations of origin

(iv) Industrial designs
(v) Patents including protection of new varieties of plants
(vi) The lay-out designs (topographies) of integrated circuits
(vii) The undisclosed information including trade secrets and test data.

The main three features of the TRIPS Agreement are as follows-
Standards: The TRIPS Agreement sets out the minimum standards of protection to be provided by each Member.
Enforcement: The second main set of provisions deals with domestic procedures and remedies for the enforcement of intellectual property rights. The Agreement lays down certain general principles applicable to all IPR enforcement procedures.
Dispute settlement: The Agreement makes disputes between WTO Members about the respect of the TRIPS obligations subject to the WTO's dispute settlement procedures.

Berne Convention for protection of literary and artistic works: The Berne Union has an Assembly and an Executive Committee. Every country member of the Union which has adhered to at least the administrative and final provisions of the Stockholm Act is a member of the Assembly. The members of the Executive Committee are elected from among the members of the Union, except for Switzerland, which is a member ex officio. The Berne Convention, concluded in 1886, was revised at Paris in 1896 and at Berlin in 1908, completed at Berne in 1914, revised at Rome in 1928, at Brussels in 1948, at Stockholm in 1967 and at Paris in 1971, and was amended in 1979. The Convention rests on three basic principles and contains a series of provisions determining the minimum protection to be granted, as well as special provisions available to developing countries.

The three principles

1. Works originating in one of the contracting States must be given the same protection in each of the other contracting States as the latter grants to the works of its own nationals.
2. Such protection must not be conditional upon compliance with any formality.
3. Such protection is independent of the existence of protection in the country of origin of the work. If, however, a contracting State provides for a longer term than the minimum prescribed by the Convention and the work ceases to be protected in the country of origin, protection may be denied once protection in the country of origin ceases.

Enforcement of Intellectual Property Rights:
The provisions on enforcement are contained in Part III of the Agreement, which is divided into five Sections. The first Section lays down general obligations that all enforcement procedures must meet. These are notably aimed at ensuring their effectiveness and that certain basic principles of due process are met. The following Sections deal with civil and administrative procedures and

remedies, provisional measures, special requirements related to border measures and criminal procedures. These provisions have two basic objectives: one is to ensure that effective means of enforcement are available to right holders; the second is to ensure that enforcement procedures are applied in such a manner as to avoid the creation of barriers to legitimate trade and to provide for safeguards against their abuse. The Agreement makes a distinction between infringing activity in general, in respect of which civil judicial procedures and remedies must be available, and counterfeiting and piracy -- the more blatant and egregious forms of infringing activity -- in respect of which additional procedures and remedies must also be provided, namely border measures and criminal procedures. For this purpose, counterfeit goods are in essence defined as goods involving slavish copying of trademarks, and pirated goods as goods which violate a reproduction right under copyright or a related right.

UNESCO Copyright a traditional tool for encouraging creativity nowadays, has even greater potential to encourage creativity in the beginning of the 21st century. Committed to promoting copyright protection since its early days (the Universal Copyright Convention was adopted under UNESCO's aegis in 1952), UNESCO has over time grown concerned with ensuring general respect for copyright in all fields of creation and cultural industries. It conducts, in the framework of the Global Alliance for Cultural Diversity, awareness-raising and capacity-building projects, in addition to information, training and research in the field of copyright law. It is particularly involved in developing new initiatives to fight against piracy. The digital revolution has not left copyright protection unaffected. UNESCO endeavours to make a contribution to the international debate on this issue, taking into account the development perspective and paying particular attention to the need of maintaining the fair balance between the interests of authors and the interest of the general public of access to knowledge and information.

ETHICS IN RESEARCH

Research is the pillar of knowledge, and it constitutes an integral part of progress.

Ethics are broadly the set of rules, written and unwritten, that govern our expectations of our own and others' behaviour.

Research ethics is a core aspect of the research work and the foundation of research design.
Research ethics are the set of ethics that govern how scientific and other research is performed at research institutions such as universities, and how it is disseminated.

When most people think of research ethics, they think about issues that arise when research involves human or animal subjects.

While these issues are indeed a key part of research ethics, there are also wider issues about standards of conduct. These include the importance of publishing findings in a transparent way, not plagiarising others' work, and not falsifying work.

Importance of Research Ethics

Research ethics are important for a number of reasons.

*They promote the aims of research, such as expanding knowledge.

*They support the values required for collaborative work, such as mutual respect and fairness. This is essential because scientific research depends on collaboration between researchers and groups.

*They mean that researchers can be held accountable for their actions. Many researchers are supported by public money, and regulations on conflicts of interest, misconduct, and research involving humans or animals are necessary to ensure that money is spent appropriately.

*They ensure that the public can trust research. For people to support and fund research, they have to be confident in it.

*They support important social and moral values, such as the principle of doing no harm to others.

ETHICAL ISSUES IN RESEARCH

Study design and ethics approval

Good research should be well adjusted, well-planned, appropriately designed, and ethically approved. To conduct research to a lower standard may constitute misconduct. This may appear to be a stringent criterion, but it highlights the basic requirement of a researcher to conduct a research responsibly. To achieve this, a research protocol should be developed and adhered to. It must be carefully agreed to by all contributors and collaborators, and the precise roles of each team member should be spelled out early, including matters of authorship and publications. Research should seek to answer specific questions, rather than just collect data.

The research proposal should discuss potential ethical issues pertaining to the research. The researchers should pay special attention to vulnerable subjects to avoid breech of ethical codes (e.g. children, prisoners, pregnant women, mentally challenged, educationally and economically disadvantaged). Consent should be explained and obtained from the subjects or guardians, and steps should be taken to ensure confidentiality of information provided by the subjects.

Data analysis

It is the responsibility of the researcher to analyse the data appropriately. Although inappropriate analysis does not necessarily

amount to misconduct, intentional omission of result may cause misinterpretation and mislead the readers. Fabrication and falsification of data do constitute misconduct.

To ensure appropriate data analysis, all sources and methods used to obtain and analyse data should be fully disclosed. Failure to do so may lead the readers to misinterpret the results without considering possibility of the study being underpowered. The discussion section of a paper should mention any issues of bias, and explain how they have been dealt with in the design and interpretation of the study.

Authorship

There is no universally agreed definition of authorship. It is generally agreed that an author should have made substantial contribution to the intellectual content, including conceptualising and designing the study; acquiring, analysing and interpreting the data. The author should also take responsibility to certify that the manuscript represents valid work and take public responsibility for the work. Finally, an author is usually involved in drafting or revising the manuscript, as well as approving the submitted manuscript. Data collection, editing of grammar and language, and other routine works by itself, do not deserve an authorship.

It is crucial to decide early on in the planning of a research who will be credited as authors, as contributors, and who will be acknowledged. It is also advisable to read carefully the "Advice to Authors" of the target journal which may serve as a guide to the issue of authorship.

Conflicts of interest

This happens when researchers have interests that are not fully apparent and that may influence their judgments on what is

published. These conflicts include personal, commercial, political, academic or financial interest. Financial interests may include employment, research funding, stock or share ownership, payment for lecture or travel, consultancies and company support for staff.

Such interests, where relevant, should be discussed in the early stage of research. The researchers need to take extra effort to ensure that their conflicts of interest do not influence the methodology and outcome of the research. It would be useful to consult an independent researcher, or Ethics Committee, on this issue if in doubt. When publishing, these conflicts of interest should be declared to editors, and readers will judge for themselves whether the research findings are trustworthy.

Redundant publication and plagiarism

Redundant publication occurs when two or more papers, without full cross reference, share the same hypothesis, data, discussion points, or conclusions. However, previous publication of an abstract during the proceedings of meetings does not preclude subsequent submission for publication, but full disclosure should be made at the time of submission. This is also known as self-plagiarism. In the increasing competitive environment where appointments, promotions and grant applications are strongly influenced by publication record, researchers are under intense pressure to publish, and a growing minority is seeking to bump up their CV through dishonest means.

On the other hand, plagiarism ranges from unreferenced use of others' published and unpublished ideas, including research grant applications to submission under "new" authorship of a complete paper, sometimes in different language.

Therefore, it is important to disclose all sources of information, and if large amount of other people's written or illustrative materials is to be used, permission must be sought.

Research Methods

We know there are numerous research methods. However, when it comes to ethical considerations, some key questions can help us find the right approach for our studies.

i. Which methods most effectively fit the aims of your research?

ii. What are the strengths and restrictions of a particular method?

iii. Are there potential risks when using a particular research method?

Voluntary Participation and Consent

An individual should at no point feel any coercion to participate in a study. This includes any type of persuasion or deception in attempting to gain an individual's trust.

Informed consent states that an individual must give their explicit consent to participate in the study. You can think of consent form as an agreement of trust between the researcher and the participants.

Validity

The research design must address specific research questions. Hence, the conclusions of the study must correlate to the questions posed and the results. Also, research ethics demands that the methods used must relate specifically to the research questions.

Sampling

Sampling is the first step in research design. You will need to explain why you want a particular group of participants. You will have to explain why you left out certain people or groups. In addition, if your sample includes children or special needs individuals, you will have additional requirements to address like parental permission.

Risk of Harm

We should do everything in our power to protect study participants. For this, we should focus on the risk to benefit ratio. If possible risks outweigh the benefits, then we should abandon or redesign the study. Risk of harm also requires us to measure the risk to benefit ratio as the study progresses.

Most ethical codes cover the following areas:

Honesty and Integrity

This means that you need to report your research honestly, and that this applies to your methods (what you did), your data, your results, and whether you have previously published any of it. You should not make up any data, including extrapolating unreasonably from some of your results, or do anything which could be construed as trying to mislead anyone. It is better to undersell than over-exaggerate your findings.

When working with others, you should always keep to any agreements, and act sincerely.

Objectivity

You should aim to avoid bias in any aspect of your research, including design, data analysis, interpretation, and peer review. For example,

you should never recommend as a peer reviewer someone you know, or who you have worked with, and you should try to ensure that no groups are inadvertently excluded from your research. This also means that you need to disclose any personal or financial interests that may affect your research.

Carefulness

Take care in carrying out your research to avoid careless mistakes. You should also review your work carefully and critically to ensure that your results are credible. It is also important to keep full records of your research. If you are asked to act as a peer reviewer, you should take the time to do the job effectively and fully.

Openness

You should always be prepared to share your data and results, along with any new tools that you have developed, when you publish your findings, as this helps to further knowledge and advance science. You should also be open to criticism and new ideas.

Respect for Intellectual Property

You should never plagiarise, or copy, other people's work and try to pass it off as your own. You should always ask for permission before using other people's tools or methods, unpublished data or results. Not doing so is plagiarism. Obviously, you need to respect copyrights and patents, together with other forms of intellectual property, and always acknowledge contributions to your research. If in doubt, acknowledge, to avoid any risk of plagiarism.

Confidentiality

An important ethical principle of research is that the confidentiality of the information supplied by research subjects and the anonymity of respondents must be respected. However, sometimes confidentiality is limited. For example, if a participant is at risk of harm, we must protect them. This might require releasing confidential information.

You should respect anything that has been provided in confidence. You should also follow guidelines on protection of sensitive information such as patient records.

Responsible Publication

You should publish to advance to state of research and knowledge, and not just to advance your career. This means, in essence, that you should not publish anything that is not new, or that duplicates someone else's work.

Legality

You should always be aware of laws and regulations that govern your work, and be sure that you conform to them.

Human Subjects Protection

If your research involves people, you should make sure that you reduce any possible harm to the minimum, and maximise the benefits both to participants and other people.

This means, for example, that you should not expose people to more tests than are strictly necessary to fulfil your research aims. You should always respect human rights, including the right to privacy

and autonomy. You may need to take particular care with vulnerable groups, which include, but are not limited to, children, older people, and those with learning difficulties.

Animal Care

If you are using animals in your research, you should always be sure that your experiments are both necessary and well-designed. You should also show respect for the animals you are using, and make sure that they are properly cared for.

Applying for Ethical Approval

Applications for ethical approval will differ across institutions. Regardless, they focus on the benefits of your research and the risk to benefit ratio concerning participants. Therefore, you need to effectively address both in order to get ethical clearance.

Participants

It is vital that you make it clear that individuals are provided with sufficient information in order to make an informed decision on their participation. In addition, you need to demonstrate that the ethical issues of consent, risk of harm, and confidentiality are clearly defined.

Benefits of the Study

You need to prove to the panel that your work is essential and will yield results that contribute to the scientific community. For this, you should demonstrate the following:

i. The conduct of research guarantees the quality and integrity of results.

ii. The research will be properly distributed.

iii. The aims of the research are clear and the methodology is appropriate.

Integrity

Integrity and transparency are vital in the research. Ethics committees expect you to share any actual or potential conflicts of interest that could affect your work. In addition, you have to be honest and transparent throughout the approval process and the research process.

Conclusion

It is the duty of the researcher to ensure that research is conducted in an ethical and responsible manner from planning to publication. Researchers and authors should familiarise themselves with these principles and follows them strictly. Any potential ethical issues in research and publication should be discussed openly within the research team.

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