

Research | Meaning, Types, Characteristics, Positivism

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When you say that you are undertaking a research study to find answers to a question, you are implying that the process;

- is being undertaken within a framework of a set of philosophies (approaches);
- uses procedures, methods, and techniques that have been tested for their validity and reliability;
- is designed to be unbiased and objective.

Philosophies mean approaches, e.g., qualitative, quantitative, and the academic discipline in which you have been trained.

Validity means that correct procedures have been applied to find answers to a question.

Reliability refers to the quality of a measurement procedure that provides repeatability and accuracy.

Unbiased and objective means that you have taken each step in an unbiased manner and drawn each conclusion to the best of your ability and without introducing your own vested interest.

(Bias is a deliberate attempt to either conceal or highlight something).

Adherence to the three criteria mentioned above enables the process to be called 'research'.

However, the degree to which these criteria are expected to be fulfilled varies from discipline to discipline and so the meaning of 'research' differs from one academic discipline to another.

The difference between research and non-research activity is, in the way we find answers: the process must *meet certain requirements to be called research*. We can identify these requirements by examining some definitions of research.

The word research is composed of two syllables, "**re**" and "**search**." "**re**" is a prefix meaning again, a new or over again and "**search**" is a verb meaning to examine closely and carefully, to test and try, or to probe. Together they form a noun ***describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles.***

Research is a *structured enquiry that utilizes acceptable scientific methodology to solve problems and create new knowledge that is generally applicable.*

Scientific methods consist of systematic observation, classification and interpretation of data.

Characteristics of Research

Research is a process of collecting, analyzing and interpreting information to answer questions. But to qualify as research, the process must have certain characteristics: it must, as far as possible, be controlled, rigorous, systematic, valid and verifiable, empirical and critical.

Controlled– in real life there are many factors that affect an outcome. The concept of control implies that, in exploring causality in relation to two variables (factors), you set up your study in a way that minimizes the effects of other factors affecting the relationship. This can be achieved to a large extent in the physical sciences (cooking, baking), as most of the research is done in a laboratory. However, in the social sciences (Hospitality and Tourism) it is extremely difficult as research is carried out on issues related to human beings living in society, where such controls are not possible. Therefore, in Hospitality and Tourism, as you cannot control external factors, you attempt to quantify their impact.

Rigorous-you must be scrupulous in ensuring that the procedures followed to find answers to questions are *relevant, appropriate and justified*. Again, the degree of rigour varies markedly between the physical and social sciences and within the social sciences.

Systematic-this implies that the procedure adopted to undertake an investigation follow a certain logical sequence. The different steps cannot be taken in a haphazard way. Some procedures must follow others.

Valid and verifiable-this concept implies that whatever you conclude on the basis of your findings is correct and can be verified by you and others.

Empirical-this means that any conclusion drawn are based upon hard evidence gathered from information collected from real-life experiences or observations.

Critical-critical scrutiny of the procedures used and the methods employed is crucial to a research enquiry. The process of investigation must be foolproof and free from drawbacks. The process adopted and the procedures used must be able to withstand critical scrutiny.

For a process to be called research, it is imperative that it has the above characteristics.

Types of Research

Research can be classified from three perspectives:

1. ***Application of research study***
2. ***Objectives in undertaking the research***
3. ***Inquiry Mode employed***

Based on Application:

From the point of view of the application, there are two broad categories of research:

1. ***Pure Research***
2. ***Applied Research,***

Pure research (Fundamental) involves developing and testing theories and hypotheses that are intellectually challenging to the researcher but may or may not have a practical application at the present time or in the future. ***The knowledge produced through pure research is sought in order to add to the existing body of research methods.***

Applied research (Action Research) is done to solve specific, practical questions; for policy formulation, administration and understanding of a phenomenon. It can be *exploratory* but is usually *descriptive*. It is almost always done on the basis of basic research.

Applied research can be carried out by academic or industrial institutions. Often, an academic institution such as a university will have a specific applied research program funded by an industrial partner interested in that program.

Based on Objectives:

From the viewpoint of objectives, research can be classified as

1. *Descriptive*
2. *Correlational*
3. *Explanatory*
4. *Exploratory*

Descriptive research attempts to describe systematically a situation, problem, phenomenon, service or programme, or provides information about, say, the living condition of a community, or describes attitudes towards an issue.

Correlational research attempts to discover or establish the existence of a relationship/ interdependence between two or more aspects of a situation.

Explanatory research attempts to clarify why and how there is a relationship between two or more aspects of a situation or phenomenon.

Exploratory research is undertaken to explore an area where little is known or to investigate the possibilities of undertaking a particular research study (*feasibility study pilot study*).

In practice, most studies are a combination of the first three categories.

Based on Inquiry Mode:

From the process adopted to find the answer to research questions; the two approaches are:

1. *Structured approach*
2. *Unstructured approach*

Structured approach: The structured approach to inquiry is usually classified as ***quantitative research***. Everything that forms the research process- objectives, design, sample, and the questions that you plan to ask of respondents- is predetermined. It is more appropriate to determine the extent of a problem, issue or phenomenon by quantifying the variation.

e.g. how many people have a particular problem? How many people hold a particular attitude?

Unstructured approach: The unstructured approach to inquiry is usually classified as ***qualitative research***. This approach allows flexibility in all aspects of the research process.

It is more appropriate to explore the ***nature*** of a problem, issue or phenomenon *without quantifying it*. The main objective is to describe the ***variation*** in a phenomenon, situation or attitude.

e.g, description of an observed situation, the historical enumeration of events, an account of different opinions different people have about an issue, description of working condition in a particular industry.

Both approaches have their place in research. Both have their strengths and weaknesses.

In many studies, there is a combination of both qualitative and quantitative approaches.

For example, suppose you have to find the types of cuisine/accommodation available in a city and the extent of their popularity.

Types of cuisine are the qualitative aspect of the study as finding out about them entails a description of the culture and cuisine

The *extent of their popularity* is the quantitative aspect as it involves estimating the number of people who visit a restaurant serving such cuisine and calculating the other indicators that reflect the extent of popularity.

Positivism and Post-Positivism Approach

Positivism:

Positivism argues for the existence of a true and objective reality that can be studied by applying the methods and principles of natural sciences and scientific inquiry. It maintains that “the object of study is independent of researchers; knowledge is discovered and verified through direct observations or measurements of phenomena; facts are established by taking apart a phenomenon to examine its component parts.” According to this

paradigm, the role of the researcher is to provide material for the development of laws by testing theories.

Positivists believe in five principles which include

- **Phenomenalism** (knowledge confirmed by the senses can be regarded as knowledge),
- **Deductivism** (the purpose of theory is to generate hypotheses that can be tested to make laws),
- **Inductivism** (the gathering of facts provides the basis for laws and knowledge),
- **Objectivism** (science should be value-free) and
- **Scientific** statements

Post positivism:

Post Positivism is considered a contemporary paradigm that developed as a result of the criticism of positivism. Like positivists, post positivists also believe in the existence of a single reality, however, they acknowledge that reality can never be fully known and efforts to understand reality are limited owing to the human beings' sensory and intellectual limitations.

The aim of post positivist research is also a prediction and explanation. Like positivists, post positivists also strive to be objective, neutral and ensure that the findings fit with the existing knowledge base. However, unlike positivists, they acknowledge and spell out any predispositions that may affect the objectivity

Positivism and post positivism was precluded from use in this study for several reasons. Firstly, research conducted under both of these paradigms is usually quantitative where a hypothesis is tested while the researcher remains objective and separate from the area of investigation.

Ref – Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners*. Sage Publications Limited.

<https://www.ukessays.com/essays/psychology/research-on-positivism-and-post-positivism-psychology-essay.php>

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Research Methods: Experimental, Historical, Descriptive, Qualitative, Quantitative

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Research Methods and Design: When constructing a building there is no point ordering materials or setting critical dates for completion of project stages until we know what sort of building is being constructed. The first decision is whether we need a high-rise office building, a factory for manufacturing machinery, a school, a residential home or an apartment block. Until this is done, we cannot sketch a plan, obtain permits, work out a work schedule or order materials.

Similarly, social research needs a design or a structure before data collection or analysis can commence. A research design is not just a work plan. A work plan details what has to be done to complete the project but the work plan will flow from the project's research design.

The function of a research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible. Obtaining relevant evidence entails specifying the type of evidence needed to answer the research question, to test a theory, to evaluate a programme or to accurately describe some phenomenon. In other words, when designing research, we need to ask: given this research question (or theory), what type of evidence is needed to answer the question (or test the theory) in a convincing way?

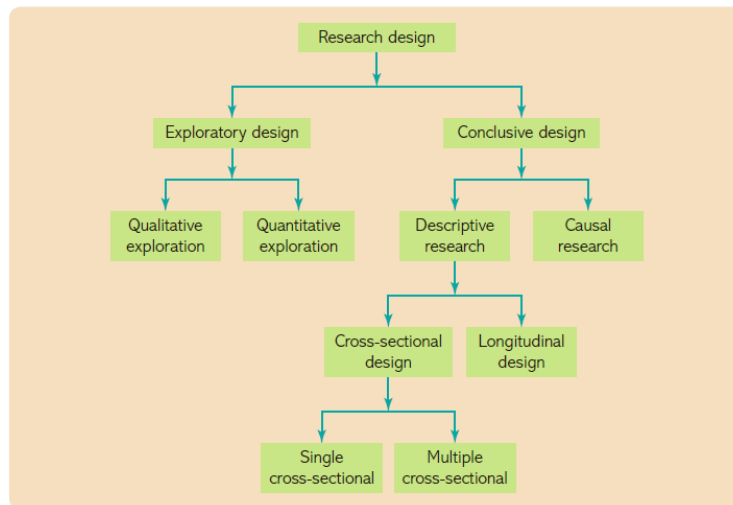
Research design "deals with a logical problem and not a logistical problem."

Before a builder or architect can develop a work plan or order materials, they must first establish the type of building required, its uses and the needs of the occupants. The work plan flows from this. *Similarly*, in social research, the issues of sampling, method of data collection (e.g. questionnaire, observation, document analysis), design of questions is all subsidiary to the matter of 'What evidence do I need to collect?'

So, we can define it as

Research Design is a framework or plan for conducting a research project. It details the procedures necessary for obtaining the information needed to structure or solve research problems.

Types of Research Design (Brief)



(Source: Marketing Research, Malhotra)

Research Methods

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

Research Methods Vs. Research Design

Research methods are the procedures that will be used to collect and analyze data	Research design is the overall structure of the research
Focus on what type of methods are more suitable to collect and analyze the evidence needed	Focuses on what type of study is planned and what kind of results are expected from the research
Depend on the research design	Based on the research question or problem

(Source: Wikimedia)

Types of Research Methods

George J. Mouly has classified research method into three basic types:

- Descriptive or Survey Method
- Historical Method, and
- Experimental Method

Descriptive or Survey Method

It is concerned with the present and attempts to determine the status of the phenomena under investigation. This method has been further classified into four categories:

(a) Descriptive or Normative (b) Analytical (c) School survey and (d) Genetic

(a) Descriptive survey is of four types

- Testing survey method,
- Questionnaire survey method,
- Interview survey method.

(b) Analytical survey is of five types

- Documentary frequency,
- Observational survey,

- Rating survey,
- Critical incident,
- Factor analysis

Historical Method

This method is concerned with the past and which attempts to trace the past as a means for seeing the present perspective.

The historical method collects facts by going to the past in different periods. The sources of information include written records, newspapers, diaries, letters, travellers' accounts, etc. Social researchers generally confine themselves to three major sources of historical information.

1. Documents and various historical sources to which historians have access
2. Materials of cultural history and of analytical history and
3. Personal sources of authentic observers and witnesses.

The historical method can be classified into three types:

- **Historical**
- **Legal, and**
- **Documentary**

Moreover, the documents which you may study maybe personal documents like *biographies, diaries, letters, and memoirs or maybe public documents like magazines and newspapers, and other published data.*

Experimental Method

It is oriented towards the discovery of basic relationship among phenomenon as means of predicting and eventually, controlling their occurrence into four types as given below:

- 1 Simple experimental design
- 2 Multivariate analysis
- 3 Case study
- 4 Predictive or correlation

Qualitative Methods and Quantitative Methods:

Qualitative Research (QR) is a way to gain a deeper understanding of an event, organization or culture. Depending on what type of phenomenon you are studying, QR can give you a broad understanding of events, data about human groups, and broad patterns behind events and people. While traditional lab-based research looks for a specific “something” in the testing environment, qualitative research allows the meaning, themes, or data to emerge from the study.

Qualitative research uses **non-statistical methods** to gain an understanding of a population.

Types of Qualitative Research Methods:

- **Anthropological**
- **Ethical Inquiry**
- **Participant observation**
- **Face-to-face interviewing**

Quantitative Research is about **collecting and analysing data to explain phenomena**.

Information from a sample is used to make generalizations or predictions about a population. Some questions that are easily answered using information from samples include:

- What percentage of high school teachers belong to minority groups?
- How many females in college study mathematics compared to males?
- Has the high school graduation rate in our district increased over time?

However, data doesn't always naturally happen in a numerical way. You may want to answer questions like:

- What do high school students think of their teachers?
- What is the general public opinion of health care reform?
- What do customers at a particular business think of customer service?

Methods for Quantitative Research

- Survey
- Secondary data/ databases
- Panel
- Structured Observation
- Experiment

Differences Between Qualitative Method and Quantitative Methods

Qualitative Methods

Methods include focus groups, in-depth interviews, and reviews of documents for types of themes

Primarily inductive process used to formulate theory or hypotheses

More subjective: describes a problem or condition from the point of view of those experiencing it

Text-based

More in-depth information on a few cases

Unstructured or semi-structured response options

No statistical tests

Can be valid and reliable: largely depends on the skill and rigour of the researcher

Time expenditure lighter on the planning end and heavier during the analysis phase

Less generalizable

Quantitative Methods

Surveys, structured interviews & observations, and reviews of records or documents for numeric information

Primarily deductive process used to test pre-specified concepts, constructs, and hypotheses that make up a theory

More objective: provides observed effects (interpreted by researchers) of a program on a problem or condition

Number-based

Less in-depth but more breadth of information across a large number of cases

Fixed response options

Statistical tests are used for analysis

Can be valid and reliable: largely depends on the measurement device or instrument used

Time expenditure heavier on the planning phase and lighter on the analysis phase

More generalizable

Ref. : <https://egyankosh.ac.in/bitstream/123456789/23391/1/Unit-4.pdf>

https://www.orau.gov/cdcynergy/soc2web/content/phase05/phase05_step03_deeper_qualitative_and_quantitative.htm

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Steps of Research Process | Research Aptitude | Paper 1

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Research Process

Research Process

Research Process: The research process is like undertaking a journey. For a research journey, there are two crucial decisions to make:

- *What you want to find out about* or what research questions (problems) you want to find answers to;
- *How to go about finding their answers?*

There are practical steps through which you must pass on your research journey to find answers to your research questions.

The path to finding answers to your research questions constitutes ***research methodology***.

At each operational step in the research process, you are required to choose from a multiplicity of *methods, procedures, and models* of research methodology, which will help you to best achieve your objectives.

Steps in Research Process:

1. Formulating the Research Problem

2. Extensive Literature Review
3. Developing the Objectives
4. Preparing the Research Design including Sample Design
5. Collecting the Data
6. Processing and Analysis of Data
7. Preparation of the Report or Presentation of Results (Formal write-ups of conclusions reached)

Step 1. Formulating Research Problem

It is the first and *most crucial step* in the research process. The main function is to decide *what* you want to find out *about*.

Sources of research problems: Research in social sciences revolves around **four Ps**:

- **People:** a group of individuals
- **Problems:** examine the existence of certain issues or problems relating to their lives; to ascertain the attitude of a group of people towards an issue
- **Programs:** to evaluate the effectiveness of an intervention
- **Phenomena:** to establish the existence of regularity.

In practice, most research studies are based upon at least a combination of two Ps.

Every research study has two aspects:

Study population:

- **People:** individuals, organizations, groups, communities. (They *provide you with the information or you collect information about them*)

Subject area:

- **Problems:** issues, situations, associations, needs, profiles
- **Program:** content, structure, outcomes, attributes, satisfactions, consumers, Service providers, etc.
- **Phenomenon:** cause-and-effect relationships, the study of a phenomenon itself
(*Information that you need to collect to find answers to your research questions*)

You can examine the professional field of your choice in the context of the four Ps in order to identify anything that looks interesting.

Considerations in selecting a research problem:

These help to ensure that your study will remain manageable and that you will remain motivated.

- **Interest:** a research endeavour is usually time-consuming and involves hard work and possibly unforeseen problems. One should select a topic of great interest to sustain the required motivation.
- **Magnitude:** It is extremely important to select a topic that you can manage within the time and resources at your disposal. Narrow the topic down to something manageable, specific and clear.
- **Measurement of concepts:** Make sure that you are clear about the indicators and measurement of concepts (if used) in your study.
- **Level of expertise:** Make sure that you have an adequate level of expertise for the task you are proposing since you need to do the work yourself.
- **Relevance:** Ensure that your study adds to the existing body of knowledge, bridges current gaps and is useful in policy formulation. This will help you to sustain interest in the study.
- **Availability of data:** Before finalizing the topic, make sure that data are available.
- **Ethical issues:** How ethical issues can affect the study population and how ethical problems can be overcome should be thoroughly examined at the problem formulating stage.

Steps in Formulation of a Research Problem:

Working through these steps presupposes a reasonable level of knowledge in the broad subject area within which the study is to be undertaken. Without such knowledge, it is difficult to clearly and adequately 'dissect' a subject area.

- **Step 1: Identify a broad field or subject area of interest to you.**
- **Step 2: Dissect the broad area into subareas.**
- **Step 3: Select what is of most interest to you.**
- **Step 4: Raise research questions.**
- **Step 5: Formulate objectives.**
- **Step 6: Assess your objectives.**
- **Step 7: Doublecheck.**

So far, we have focused on the basis of your study, *the research problem*. But every study in social sciences has a second element, *the study population* from whom the required

information to find answers to your research questions is obtained.

As you narrow the research problem, similarly, you need to decide very specifically, who constitutes your study population, in order to select the appropriate respondents.

Step 2. Reviewing the Literature:

- The essential preliminary task in order to acquaint yourself with the available *body of knowledge* in your area of interest.
- A literature review is an integral part of the 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:

1. **Bring clarity and focus to the research problem;**
2. **Improve methodology;**
3. **Broaden knowledge;**
4. **Contextualise findings.**

Bring clarity and focus to the 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.

Improve 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 a valid answer to your research questions.

Broaden knowledge base in the research area:

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 fulfil this

expectation. It also helps you to understand how the findings of your study fit into the existing body of knowledge.

Contextualise findings:

How do answers to your research questions compare with what others have found? What contribution have you been able to make into the existing body of knowledge? How are your findings differ 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:

- Search for existing literature in your area of study;
- review the literature selected;
- develop a theoretical framework;
- develop a conceptual framework.

Step 3 – Formulation of Objectives (Hypothesis)

- Objectives are the goals you set out to attain in your study.
- They inform a reader what you want to attain through the study.
- It is extremely important to word them clearly and specifically.

Objectives should be listed under two headings:

- **Main objectives (aims);**
- **Sub-objectives.**

The ***main objective*** is an overall statement of the thrust of your study. It is also a statement of the main associations and relationships that you seek to discover or establish.

The ***sub-objectives*** are the specific aspects of the topic that you want to investigate within the main framework of your study.

- They should be numerically listed.
- Wording should clearly, completely and specifically communicate to readers.
- Each objective should contain only one aspect of the Study.
- Use action-oriented words or verbs when writing objectives.

Identifying Variables:

In a research study, it is important that the concepts used should be operationalised in measurable terms so that the extent of variations in respondents' understanding is reduced if not eliminated.

Techniques about how to operationalise concepts, and knowledge about variables, play an important role in reducing this variability.

Their knowledge, therefore, is important in **'fine-tuning'** your research problem.

For example:

- 'Jet Airways' is a perfect example of *quality* cabin service.
- Food in this restaurant is
- The middle class in India is getting more

When people express these feelings or preferences, they do so on the basis of certain criteria in their minds. Their judgement is based upon indicators that lead them to conclude and express that opinion.

These are *judgements* that require a sound basis on which to proclaim. This warrants the use of a measuring mechanism and it is in the process of measurement that knowledge about *variables* plays an important role.

Variable:

An image, perception or concept that can be measured – *hence capable of taking on different values*– is called a *variable*.

Concept

Concepts are mental images or perceptions, and therefore, their meaning varies markedly from individual to individual.

Difference between Concept and Variable:

A concept cannot be measured whereas a variable can be subjected to measurement by crude/refined or subjective/objective units of measurement. It is therefore important for the concept to be converted into variables.

- Subjective impression
- No uniformity as to its understanding among different people
- As such cannot be measured

Examples;

- Effectiveness
- Satisfaction
- Impact
- Excellent
- High achiever
- Self-esteem
- Rich
- Domestic violence
- Extent and pattern of alcohol consumption, etc.

- Measurable though the degree of precision varies from scale to scale and from variable to variable (e.g. attitude – subjective, income – objective)

Examples;

- Gender (male/female)
- Attitude
- Age (x years, y months)
- Income (\$ __ per year)
- Weight (__ kg)
- Height (__ cm)
- Religion (Catholic, protestant, Jew, Muslim), etc.

Measurement of Scales (Types of DATA)

There are four types of data that may be gathered in social research, each one adding more to the next. Thus, ordinal data is also nominal, and so on.

A useful acronym to help remember this is **NOIR (French for 'black')**.

Nominal or Categorical:

A nominal scale enables the classification of individuals, objects or responses into subgroups based on a common/shared property or characteristic. A variable measured on a nominal scale may have one, two, or more subcategories depending upon the extent of variation.

For example: 'water' or 'tree' has only one subgroup, whereas the variable "gender" can be classified into two sub-categories: male and female. 'Hotels' can be classified into -- sub-categories.

The sequence in which subgroups are listed makes no difference as there is no relationship among subgroups. Nominal items are usually categorical, in that they belong to a definable category, such as 'employees'.

Ordinal or Ranking Scale:

Besides categorizing individuals, objects, responses or property into subgroups on the basis of common characteristic, it ranks the subgroups in a certain order. *They are arranged either in ascending or descending order according to the extent a subcategory reflects the magnitude of variation in the variable.*

For example: 'income' can be measured either quantitatively (in rupees and paise) or qualitatively using subcategories 'above average', 'average' and 'below average'. *The 'distance' between these subcategories are not equal as there is no quantitative unit of measurement.* 'Socioeconomic status' and 'attitude' are other variables that can be measured on an ordinal scale.

Interval Scale:

An interval scale has all the characteristics of an ordinal scale. In addition, it uses a unit of measurement with an arbitrary starting and terminating points.

For example:

Celsius scale: 0°C to 100°C

Fahrenheit scale: 32°F to 212°F

Attitudinal scales: 10-20

21-30

31-40 etc

Ratio Scale:

A ratio scale has all the properties of nominal, ordinal, and interval scales plus its own property: *the zero point of a ratio scale is fixed, which means it has a fixed starting point.* Since the difference between intervals is always measured from a zero point, this scale can be used for mathematical operations.

The measurement of variables like income, age, height, and weight are examples of this scale. A person who is 40 years old is *twice* as old as one who is 20 years old.

Parametric vs. Non-parametric:

Interval and ratio data are parametric and are used with parametric tools in which distributions are predictable (and often Normal).

Nominal and ordinal data are non-parametric and do not assume any particular distribution. They are used with non-parametric tools such as the Histogram.

Continuous and Discrete Variables:

Continuous Variables are measured along a continuous scale, which can be divided into fractions, such as temperature. Continuous variables allow for infinitely fine sub-division, which means if you can measure sufficiently accurately, you can compare two items and determine the difference.

Discrete variables are measured across a set of fixed values, such as age in years (not microseconds). These are commonly used on arbitrary scales, such as scoring your level of happiness, although such scales can also be continuous.

Constructing Hypotheses:

As a researcher, you *do not know* about a phenomenon, but you *do have a hunch* to form the basis of certain *assumptions or guesses*. You test these by collecting information that will enable you to conclude if your notion was right.

The verification process can have one of the three outcomes. Your hunch may prove to be:

1. Right;
2. partially right; or
3. Wrong

Without this process of verification, you cannot conclude anything about the validity of your assumption.

Hence, ***a hypothesis is an intelligent guess, hunch, assumption, suspicion, assertion, or an idea about a phenomenon, relationship, or situation, the reality or truth of which you do not know.*** A researcher calls these assumptions/ hunches hypotheses, and they become the basis of an inquiry.

In most studies, the hypotheses will be based upon your own or someone else's observation.

Hypotheses bring clarity, specificity, and focus on a research problem, but are *not essential* for a study.

- **You can conduct a valid investigation without constructing formal hypotheses.**

Functions of Hypotheses:

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

Types of Hypotheses

1. **Null Hypotheses**
2. **Alternative Hypotheses**

Null Hypotheses: A null hypothesis is a type of hypothesis used in statistics that proposes that no statistical significance exists in a set of given observations. The null hypothesis attempts to show that no variation exists between variables or that a single variable is no different than its mean. It is presumed to be true until statistical evidence nullifies it for an alternative hypothesis.

Alternative Hypotheses: The alternate hypothesis is just an *alternative* to the null. For example, if your null is "I'm going to win up to \$1000" then your alternate is "I'm going to win more than \$1000." Basically, you're looking at whether there's enough change (with the alternate hypothesis) to be able to reject the null hypothesis.

Step 4 – Preparing Research Design

Research design is the conceptual structure within which research would be conducted.

The function of the research design is to provide for the collection of relevant information with minimal expenditure of effort, time, and money.

The preparation of research design, appropriate for a particular research problem, involves the consideration of the following:

1. Objectives of the research study.
2. Method of Data Collection to be adopted
3. Source of information (Sample Design)
4. Tool for Data collection
5. Data Analysis– qualitative and quantitative

Objectives of the Research Study: Objectives identified to answer the research questions have to be listed, making sure that they are:

1. numbered, and
2. the statement begins with an action verb.

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 the investigator's own direct observation of relevant *people, actions, and situations* without asking from the respondent.

Survey Method: Survey Method Approach is most suited for gathering descriptive information.

Contact Methods: Information may be collected by

- Mail
- Telephone
- Personal interview

Experiment Methods: Also called *Empirical Research* or *Cause and Effect Method*, it is data-based research, coming up with conclusions that are capable of being verified with observation or experiment.

Experimental research is appropriate when the 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.*

Further Reading: [Research Methods | Experimental, Historical, Descriptive, Qualitative and Quantitative](#)

Determining Sample Design:

Researchers usually draw conclusions about large groups by taking a sample.

A Sample is a segment of the population selected to represent the population as a whole. Ideally, the sample should be representative and allow the researcher to make accurate estimates of the thoughts and behaviour of the larger population.

Types of Sampling:

- **Probability sampling:** A sampling procedure in which each element of the population has a fixed probabilistic chance of being selected for the sample.
- **Non-probability sampling:** Sampling techniques that do not use chance selection procedures but rather rely on the personal judgment of the researcher.

Probability sampling is further divided into the following:

1. Simple Random Sample: A probability sampling technique in which each element has a known and equal probability of selection. Every element is selected independently of every other element, and the sample is drawn by a random procedure from a sampling frame. This method is equivalent to a lottery system in which names are placed in a container, the container is shaken, and the names of the winners are then drawn out in an unbiased manner. To draw a simple random sample, the researcher first compiles a sampling frame in which each element is assigned a unique identification number. Then random numbers are generated to determine which elements to include in the sample.

2. Systematic Sampling: In systematic sampling, the sample is chosen by selecting a random starting point and then picking every i th element in succession from the sampling frame.²⁵ The sampling interval, i , is determined by dividing the population size N by the sample size n and rounding to the nearest whole number. For example, there are 100,000 elements in the population, and a sample of 1,000 is desired. In this case, the sampling interval, i , is 100. A random number between 1 and 100 is selected. If, for example, this number is 23, the sample consists of elements 23, 123, 223, 323, 423, 523, and so on.

3. Stratified Random Sample: Population is divided into mutually exclusive (heterogeneous) groups (strata) then random sampling is drawn from each group (stratum).

It is a two-step process in which the population is partitioned into subpopulations or strata. The strata should be mutually exclusive and collectively exhaustive in that every population element should be assigned to one and only one stratum and no population elements should be omitted. Next, elements are selected from each stratum by a random procedure, usually Simple Random Sampling.

4. Cluster (area) sample: The population is divided into mutually exclusive groups (Homogeneous) such as blocks, and the researcher draws a sample of the group to interview.

A two-step probability sampling technique where the target population is first divided into mutually exclusive and collectively exhaustive sub-populations called clusters, and then a random sample of clusters is selected based on a probability sampling technique such as SRS. For each selected cluster, either all the elements are included in the sample, or a sample of elements is drawn probabilistically.

Differences between Stratified Sampling and Cluster Sampling

Factor	Stratified sampling	Cluster sampling (one stage)
Objective	Increase precision	Decrease cost
Subpopulations	All strata are included	A sample of clusters is chosen
Within subpopulations	Each stratum should be homogeneous	Each cluster should be heterogeneous
Across subpopulations	Strata should be heterogeneous	Clusters should be homogeneous
Sampling frame	Needed for the entire population	Needed only for the selected clusters
Selection of elements	Elements selected from each stratum randomly	All elements from each selected cluster are included

(Source: Marketing Research, Malhotra)**Non-Probability Sampling** is further divided into the following:

1. Convenience sampling: Convenience sampling attempts to obtain a sample of convenient elements. The selection of sampling units is left primarily to the interviewer. Often, participants are selected because they happen to be in the right place at the right time.

2. Judgemental sampling: It is a form of convenience sampling in which the population elements are selected based on the judgement of the researcher. The researcher, exercising judgement or expertise, chooses the elements to be included in the sample because it is believed that they are representative of the population of interest, or are otherwise appropriate.

3. Quota sampling: It is a two-stage restricted judgemental sampling. The first stage consists of developing control categories or quotas of population elements. In the second stage, sample elements are selected based on convenience or judgement.

4. Snowball Sampling: A strategy used to gather a sample for a research study, in which study participants give the researcher referrals to other individuals who fit the study criteria. Snowball samples cannot be generalized to the population because they are not selected randomly. Snowball samples are usually used to investigate groups that have some unique, rare, or unusual quality and groups in which members know each other through an organization or common experience. For example, snowball samples might be used to identify marathon runners or cancer survivors who attend support groups.

TOOL FOR DATA COLLECTION (RESEARCH INSTRUMENTS)

The construction of a research instrument or tool for data collection is the most important aspect of a research project because anything you say by way of findings or conclusions is based up the type of information you collect, and the data you collect is entirely dependent upon the questions that you ask of your respondents. The famous saying about computers- "garbage in garbage out"- is also applicable for data collection. *The research tool provides the input into study, and therefore, the quality and validity of the output (the findings), are solely dependent on it.*

Guidelines to Construct a Research Tool:

The underlying principle behind the guidelines suggested below is to ensure the validity of your instrument by making sure that your questions relate to the objectives of your study.

Step I: Clearly define and individually list all the specific objectives or research Questions for your study.

Step II: For each objective or research questions, list all the associated questions That you want to answer through your study.

Step III: Take each research question listed in step II and list the information required to answer it.

Step IV: Formulate question(s) to obtain this information.

Questionnaire:

A questionnaire consists of a set of questions presented to a respondent for answers. The respondents read the questions, interpret what is expected and then write down the answers themselves.

Interview Schedule: It is called an Interview Schedule when the researcher asks the questions (and if necessary, explain them) and record the respondent's reply on the interview schedule.

Because there are many ways to ask questions, the questionnaire is very flexible. The questionnaire should be developed and tested carefully before being used on a large scale.

There are three basic types of a questionnaire:

- Closed-ended
- Open-ended
- Combination of both

Step 5: Collection of Data:

Having formulated the research problem, developed a study design, constructed a research instrument, and selected a sample, then collect the data from which you will draw inferences and conclusions for the study. Depending upon your plans, you might commence interviews, mail out a questionnaire, conduct experiments and/or make observations.

Step 6: Processing and Analysing Data:

Processing and analysing data involves a number of closely related operations which are performed with the purpose of summarizing the collected data and organizing these in a manner that they answer the research questions(objectives).

The Data Processing *operations* are:

- 1. Editing-** a process of examining the collected raw data to detect errors and omissions and to correct these when possible.
- 2. Classification–** a process of arranging data in groups or classes on the basis of common characteristics. Depending on the nature of the phenomenon involved.
- 3. Tabulation–** Tabulation is the process of summarizing raw data and displaying the same in compact form for further analysis. It is an orderly arrangement of data in columns and rows. Tabulation is essential because:

1.

1. It conserves space and reduces explanatory and descriptive statements to a minimum.
2. It facilitates the process of comparison.
3. It facilitates the summation of items and the detection of errors and omissions.
4. It provides the basis for various statistical computations.

Tabulation may also be classified as simple and complex tabulation. Simple tabulation generally results in one-way tables that supply answers to questions about one characteristic of data only. Complex tabulation usually results on two-way tables (which give information about two inter-related characteristics of data), three-way tables or still higher-order tables, also known as manifold tables.

Data Analysis Methods:

Qualitative Data Analysis: Qualitative data analysis is a very personal process with few rigid rules and procedures. For this purpose, the researcher needs to go through a process called *Content Analysis*.

Content Analysis means analysis of the contents of an interview in order to identify the main themes that emerge from the responses given by the respondents.

Quantitative Data Analysis: This method is most suitable for large well designed and well-administered surveys using a properly constructed and worded questionnaire. Data can be analysed either *manually* or with the help of a *computer*.

Data Analysis Using a Computer: If you want to analyse data using a computer, you should be familiar with the appropriate program. In this area, knowledge of computers and statistics plays an important role.

The most common software is SPSS. However, data input can be a long and laborious process, and if data is entered incorrectly, it will influence the final results.

Step 7: Reporting the Findings:

Writing the report is the last, and for many, the most challenging stage 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.

Further read: [How to Write a Research Report or Article](#)

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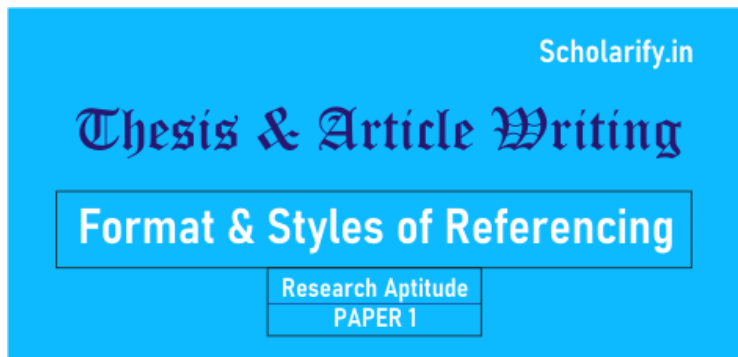
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Thesis and Article Writing: Format and Styles of Referencing

Thesis and Article writing: The thesis is a treatise that represents the fulfilment of the scholarly aspiration of the student. A good thesis should be clear and unambiguous and have a logical structure that should assist the reader's understanding of the argument being presented and not obscure it. In order to achieve this objective, the layout and physical appearance of the thesis should conform to a set pattern.

Note: The following format of thesis writing is the general standard and accepted format. But, universities and institutions have their own prescribed format with this core structure of thesis writing. Please consider the specific format suggested by your institutions, organisations, and universities.

Example: [Guidelines for Thesis writing suggested by an Institution](#)

The generally accepted format of thesis or report writing tend to be produced in the following way:

Title Page

- Title of the Research Project,
- Name of the researcher,

- Purpose of the research project, e.g., “A research project submitted in partial fulfilment of the requirements of National Council for Hotel Management and Catering Technology, New Delhi for the degree of PhD in Hospitality and Hotel Administration”
- Date of Publication

Table of Contents

This section consists of the contents of the report, either in chapters or in subheadings.

List of Tables

This section includes title and page number of all tables

List of Figures

This section contains the title and page number of all graphs, pie charts, etc.

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

This section is included all your background research, which may be obtained from the literature review. You must indicate 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. When you are referring to a particular book or journal article, use the Harvard system.

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.

Recommendation:

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 that 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 that shows how the research can be continued. Perhaps some results are inconclusive, or perhaps the research has thrown up many more research questions that 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. It includes all the literature to which you have referred in your report.

Annexures

List of publications: List of publications obtained by the student from the PhD work should be included in the Thesis. Students are strongly encouraged to place the accepted versions of the manuscripts (maximum two), which were an integral part of thesis work.

Curriculum vitae (optional): Provide one-page giving academic qualifications, academic achievements and list of publications.

Appendices (optional): Appendices may include the formulas, diagrams, protocols, or any similar data that are not contained in the body of the thesis. The number can be given as A-1, A-2 and listed as such in the table of contents.

FORMAT OF CITATIONS/REFERENCES:

Citations or in-text citations are similar to references but occur in the body of the text with direct quotes and paraphrases to identify the author/publication for the material you have used. Citations are used:

- to show which reference supports a particular statement
- for direct quotes – when you repeat a passage from a text (or speech, video, etc.) in your assignment without changing any words
- when you paraphrase – this is when you use your own words to restate the meaning of a text in your assignment.

One of the most important things to remember is that every citation should also have a corresponding entry in your reference list.

A reference list is a list of the resources that you used when writing your assignment or doing your research.

These resources may include:

- books, including electronic books, journals (online and paper-based)
- online sources including websites, blogs, and forums
- speeches
- conference papers, proceedings, and theses
- other sources of information such as film, television, video, etc.

Reference lists come at the end of an assignment and are arranged in alphabetical order, usually by author or editor. If there is not an author or an editor, the title is used.

Comparison Between Citation and Reference

BASIS FOR COMPARISON	CITATION	REFERENCE
Meaning	Citation is a way of disclosing within the main body, that the quote, image, chart, statistics, etc. are taken from an outside source.	Reference is a list that contains all the sources which have been sought or cited while writing the article or assignment.
Use	It informs the readers, the basic source of information.	It informs the reader, the complete source of information.
Purpose	To indicate the source of the material taken.	To support or criticize an argument or point.
Placement	Presented in the bracket.	Presented as endnote or end of the document.
Information	It contains information like publication year and last name of the author.	It contains information like publication date, title of book/journal, author's name, page number.

(source: keydifferences.com)

Types of Citation/ References Styles (Thesis and Article Writing):

The followings are a few important styles of citation or referencing during thesis and article writing:

MLA (Modern Language Association) style:

It is most commonly used to write papers and cite sources within the liberal arts and humanities.

Book – Kothari, Chakravanti Rajagopalachari. Research methodology: Methods and techniques. New Age International, 2004.

Journal – Ghosh, Madhusudan. "Micro-Finance and Rural Poverty in India SHG-Bank Linkage Programme." Journal of Rural Development 31.3 (2012): 347-363.

APA (American Psychological Association):

It is most commonly used to cite sources within the health sciences and social sciences fields.

Book – Kothari, C. R. (2004). Research methodology: Methods and techniques. New Age International.

Journal – Ghosh, M. (2012). Micro-Finance and Rural Poverty in India SHG-Bank Linkage Programme. Journal of Rural Development, 31(3), 347-363.

Chicago Manual of Style, are quite flexible and cover both parenthetical and note citation systems.

Book – Kothari, Chakravanti Rajagopalachari. Research methodology: Methods and techniques. New Age International, 2004.

Journal – Ghosh, Madhusudan. “Micro-Finance and Rural Poverty in India SHG-Bank Linkage Programme.” Journal of Rural Development 31, no. 3 (2012): 347-363.

Parenthetical referencing, also known as Harvard referencing:

It is a citation style in which partial citations—for example, “(Smith 2010, p. 1)”—are enclosed within parentheses and embedded in the text, either within or after a sentence.

Book – Kothari, C.R., 2004. Research methodology: Methods and techniques. New Age International.

Journal – Ghosh, M., 2012. Micro-Finance and Rural Poverty in India SHG-Bank Linkage Programme. Journal of Rural Development, 31(3), pp.347-363.

The Vancouver system:

It is also known as Vancouver reference style or the author–number system, is a citation style that uses numbers within the text that refer to numbered entries in the reference list.

Book – Kothari CR. Research methodology: Methods and techniques. New Age International; 2004.

Journal – Ghosh M. Micro-Finance and Rural Poverty in India SHG-Bank Linkage Programme. Journal of Rural Development. 2012 Sep 1;31(3):347-63.

Standard Format for Printing a report:

<i>Paper:</i>	Bond Paper (need not be executive bond)
<i>Size:</i>	8.5inches X 11inches
<i>Margin:</i>	Left – 1.5inch
	Top – 1inch
	Bottom – 1inch
	Right – 1inch
<i>Font:</i>	Times New Roman
<i>Font Size:</i>	12
<i>Spacing:</i>	Double
<i>Binding:</i>	BlackRexin
<i>Gold Embossing on Cover:</i>	Research Title
	Student Name
	Name of Institute
	Year of Submission

Note: The format of Thesis and Article writing, mentioned above, is a general and standard format. Please follow your universities or institutions guidelines for writing a thesis and articles.

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Application of ICT in Research, Role and Tools of ICT

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Application of ICT in Research

Application of ICT in Research: Information and Communication Technologies (ICT) refers to technologies that provide access to information through telecommunications. It is similar to Information Technology (IT) but focuses primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication mediums.

Information and communication technologies (ICT) have provided society with a vast array of new communication capabilities. For example, people can communicate in real-time with others in different countries using technologies such as **instant messaging**, voice over IP (VoIP), and video-conferencing. Social networking websites like **Facebook** allow users from all over the world to remain in contact and communicate on a regular basis.

ICT, or information and communications technology (or technologies), is the infrastructure and components that enable modern computing.

Although there is no single, universal definition of ICT, the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations (i.e., businesses, nonprofit agencies, governments and criminal enterprises) to interact in the digital world.

Components of an ICT system

ICT encompasses both the internet-enabled sphere as well as the mobile one powered by wireless networks. It also includes antiquated technologies, such as landline telephones, radio and television broadcast – all of which are still widely used today alongside cutting-edge ICT pieces such as artificial intelligence and robotics.

The list of ICT components is exhaustive, and it continues to grow. Some components, such as computers and telephones, have existed for decades. Others, such as smartphones, digital TVs and robots, are more recent entries.

Components of ICT

The term information and communications technology (ICT) is generally accepted to mean all technologies that, combined, allow people and organizations to interact in the digital world.



(source: searchcio.techtarget.com)

Application of ICT in Research

Applications of ICT are mainly used by researchers for its ability to ease the knowledge-gathering process and to enhance resource development. Researcher in general value creativity and originality, thus the ICT tools which provide with the most open situations with great autonomy to the researcher can really help in identifying and solving research problems in the most creative ways. The use of ICT is based on the individual's logical assessment of how various applications increase his/her effectiveness and efficiency in work and provide ease in communication with peers.

Use of ICT tools or application for making research data and information available are plenty in numbers today, but the best use of ICT tools would be to improve cognitive skills and thus help discriminate, analyse and create information rather than simply accumulate. As usually research process deals with a large amount of complex information and requires a lot of skills to analyse and organize these well, any ICT tool which helps the researcher give meaning and precision along with adding value to the information generated would be rated above the ones which help in just gathering information.

Generally, Applications of ICT help the researcher in the following research-related tasks:

- identify appropriate information sources

- critically analyse information
- research effectively
- manage information
- use the information to extend and communicate knowledge across subject fields
- search up to ten databases and electronic resources simultaneously
- receive results in a common format
- link to individual databases for more specialised searching
- select favourite resources and e-journals, save searches and records, and set up email alerts.

Applications of ICT have many effects on research. They can be classified into three categories which include:

1. **Applications of ICT in pre-data analysis**
2. **Applications of ICT in data analysis, and**
3. **Applications of ICT in post-data analysis**

A. Applications of ICT in pre-data analysis:

Applications of ICT in pre-data analysis refers to the activities how ICTs are applied on activities of social science research before reaching the stage of data analysis.

ICT application in pre-data analysis includes:

1. **Literature Search, Article Availability, Thesis and Dissertation Availability**
2. **Content Search**
3. **Literature Tracking**
4. **Data Collection**

1. Literature Search: Last time researchers need to perform a manual search on hard copies of literature in libraries whereby this is a tedious effort and the search results were limited. On the contrary, a lot of research materials, literature and artefacts today can be searched using Internet search engines and databases.

- **ShodhGanga:** Indian theses repository where you can search and download the theses.
- **Google Scholar:** Provides a way to broadly search for scholarly literature across disciplines and sources.
- **Microsoft Academic Search:** Find information about academic papers, authors, conferences, journals, and organizations from multiple sources.

- **Mendeley:** A unique platform comprising a social network, reference manager, article visualization tools.
- **SSRN:** Multi-disciplinary online repository of scholarly research and related materials in social sciences.

Some other Famous Database for Research Articles and literature:

- AMS
- Annual Reviews
- ASME Digital Collection
- Cambridge Core
- Chemical Abstracts Service (CAS)
- Cochrane Library
- eBook Academic collection
- EBSCO Databases, Discovery Service, eBooks, Point of Care Products, DynaMed and Journal Collections
- EBSCO Information Services
- Economic & Political Weekly
- Elsevier
- Emerald eJournals
- Encyclopedia Britannica
- IEEE Xplore
- Indian Citation Index.
- Indian Journals
- IOPscience
- JSTOR
- Portland Press
- Project Euclid
- Project MUSE
- ProQuest databases
- Royal Society of Chemistry Journals
- Royal Society of Chemistry Publications Online
- Sage Online Journals
- Science Mag
- Scitation
- SIAM Journals Online
- Springer Link
- Supreme Court Cases Online

- Taylor & Francis Online
- Web of Knowledge
- Wiley Online Library

2. Content Search – in today's world of research, researchers can utilize the softcopy literature's search or find function (also called content search) to search for specific keywords or phrases in which this is more effective and productive. This observation is also supported what Sekaran (2003) had stated that online search using technology is inexpensive and can improve the identification of relevant sources of literature. Such content search also enables a researcher to evaluate quickly whether a particular article or thesis et al. is worthy for his or her deeper review. Moreover, the content search also helps a qualitative researcher to count the frequency of certain keywords appears in an interviewed transcript more effectively.

3. Literature Tracking – In the past, researchers have to sort, classify and store all their literature or artefacts that they had reviewed into computer folders or physical folders/place holders. Researchers also need to create their own tracking mechanism e.g. in a word document or spreadsheet format to track and manage their reviewed literature so that they can re-use or refer to in future. Doing these manually can be daunting tasks.

With the advancement of ICT, researchers can still use the old approaches but more and more researchers now are using software like [Mendeley](#) which can help manage, share and discover the literature contents and contacts that they had reviewed. Using software like Mendeley to track a researcher's literature is saving time and effort as well as capable to manage lots of literature that the researcher was not possible in the past.

4. Data Collection – with the help of application of ICT, Data collection can be collected via online, web-based or Internet survey. Using this purpose-built software and Internet technology which are greener technology in data collection can reduce the time and cost to collect surveyed responses from the respondents. Not only an online survey can be administered more effectively, but the data collected in its original format can also be input directly into the statistical software.

Important Data Collection Application of ICT:

1. [Google Forms](#)
2. [SurveyMonkey](#)

B. Applications of ICT in data analysis

Application of ICT in data analysis includes the ICTs are applied on activities during the stage of data analysis and can be divided into:

1. **Quantitative Data Analysis**
2. **Qualitative Data Analysis**

1. Quantitative Data Analysis:

The exploratory factor analysis, multiple regression, t-test and Analysis of Variance (ANOVA) are some common data analysis techniques used among researchers conducting quantitative research. There are also some advanced and popular data analysis techniques like path analysis, covariance-based Structural Equation Modeling (SEM), variance-based SEM (partial least squares), hierarchical regression analysis, hierarchical linear modelling et al.

- **Statistical Package for Social Science / SPSS** are more advanced and rich with a lot of features and functionalities
- **R (R Foundation for Statistical Computing)**
- **MATLAB (The Mathworks)**
- **Microsoft Excel**
- **SAS (Statistical Analysis Software)**
- **GraphPad Prism**
- **Minitab**

List of Statistical Software Packages – [click](#)

2. Qualitative Data Analysis:

The following statistical software packages are for qualitative data analysis:

- [NVivo](#)
- [ATLAS.ti](#)
- [MAXQDA](#)
- **SPSS Text Analytics**
- [Transana](#) can be used for video transcribing in certain qualitative research

C. Application of ICT in post-data analysis

Application of ICT in post-data analysis refers to the ICTs are applied on activities of research after completing the stage of data analysis which covers:

1. References and Bibliography Compilation
2. Article and Thesis / Dissertation's Discussion among Researchers, Supervisors, Supervisees etc.
3. Plagiarism Detection
4. Journal Manuscripts Submission

1. References and Bibliography Compilation:

A few years back, researchers tend to compile references and bibliography manually. They literally typing in to build the entire section of the references or bibliography then followed by sorting them in ascending order. Recently, while researchers are writing, they can use citation or reference management software to help select citations and populate the references or bibliography automatically. This type of software can improve researchers' efficiency and accuracy while preparing their articles or theses.

The following software is used for referencing and bibliography compilation:

- [EndNote](#)
- [Zotero](#)
- [Mendeley](#)

2. Article and Thesis / Dissertation's Discussion:

In the course of producing an article, thesis or dissertation, there are needs for discussions or communications among researchers, supervisors, supervisees or during the viva voce. Now, we have the advanced application of ICT to facilitate sharing of research materials, seeking comments from subject matter experts, enable analytics to monitor papers published, as well as following some scholarly works.

There are online platforms or websites which can be used for such discussion:

- [Academia.edu](#)
- [ResearchGate](#)

3. Plagiarism Detection:

In the past, plagiarism acts were slow and hard to detect as the authority of universities or journals dependent on readers to identify them manually while they were reading through the submitted articles or theses/dissertations. With the advancement of ICT, readers or researchers can use plagiarism checker software available in the market like:

- [Grammarly](#)
- [Article Checker](#)
- Turnitin
- [DupliChecker](#) etc.

4. Journal Manuscripts Submission:

In the past, journal manuscript submission used to be via email communications between researchers/authors and journal's editors/coordinators. Now web-based journal manuscript management and peer-review software, electronic manuscript submission or management systems are commonly used among the community of researchers and journals/publishers. Using such systems can reduce their time of submission and checking the status of publishing. Moreover, using such systems can greatly improve the productivity and quality of work to administer the submission as well as the peer-review management in which miscommunication, lost or delay of communication can be minimized.

The following are the Application of ICT for **Manuscripts Submission and publicising**:

- [Elsevier](#)
- [Wiley](#)
- [Sage Publications](#) etc.

Apart from the above-mentioned ICT tools for research, there is a long list of ICT applications which can be used for quality research papers and theses.

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Research Ethics

Research Ethics: The application of moral rules and professional codes of conduct to the collection, analysis, reporting, and publication of information about research subjects, in particular active acceptance of subjects' right to privacy, confidentiality, and informed consent.

Collecting data through any of the methods may involve some ethical issues concerning the participants and the researcher:

- Those from whom information is collected or those who are studied by a researcher become participants of the study.
- Anyone who collects information for a specific purpose, adhering to the accepted code of conduct, is a researcher.

Research Ethics related to Research Participants:

There are many ethical issues in relation to participants of research activity.

Collecting information: Your request for information may put pressure or create anxiety on a respondent. Is it ethical?

Research is required to improve conditions. Provided any piece of research is likely to help society directly or indirectly, it is acceptable to ask questions *if you first obtain the respondents' informed consent*.

If you cannot justify the relevance of the research you are conducting, you are wasting your respondents' time, which is unethical.

Seeking consent: In every discipline, it is considered unethical to collect information without the knowledge of the participant and their expressed willingness and informed consent.

Informed consent implies that subjects are made adequately aware of the type of information you want from them, why the information is being sought, what purpose it will be put to, how they are expected to participate in the study, and how it will directly or indirectly affect them. It is important that the consent should be voluntary and without the pressure of any kind.

Providing incentives: Most people do not participate in a study because of incentives, but because they realize the importance of the study.

Is it ethical to provide incentives to respondents to share information with you because they are giving their time?

Giving a present before data collection is unethical.

Seeking sensitive information: Certain types of information can be regarded as sensitive or confidential by some people and thus an invasion of their privacy, asking for such information may upset or embarrass a respondent.

For most people, questions on drug use, pilferage, income, age, marital status, etc. are intrusive. In collecting data, you need to be careful about the sensitivities of your respondents.

It is not unethical to ask such questions provided that you tell your respondents the type of information you are going to ask clearly and frankly, and give them sufficient time to decide if they want to participate, without any significant inducement.

The possibility of causing harm to participant: When you collect data from respondents or involve subjects in an experiment, you need to examine carefully whether their involvement is likely to harm them in any way. *Harm includes / research that might consist of hazardous experiments, discomfort, anxiety, harassment, invasion of privacy, or demeaning or dehumanizing procedures.* If it is likely to, you must make sure that the risk is minimal, i.e.,

the extent of harm or discomfort is not greater than ordinarily encountered in daily life. If the way information is sought creates anxiety or harassment, you need to take steps to prevent this.

Maintaining confidentiality: Sharing information about a respondent with others for purposes other than research is unethical. Sometimes you need to identify your study population to put your findings into context. In such a situation, you need to make sure that at least the information provided by respondents is kept anonymous.

It is unethical to identify an individual's responses. Therefore you need to ensure that after the information has been collected, the source cannot be known.

Ethical Issues related to Researcher:

Avoiding bias: Bias on the part of the researcher is unethical. Bias is a deliberate attempt to either hiding what you have found in your study or highlight something disproportionately to its actual existence.

Provision or deprivation of a treatment: Both the provision and denial of a treatment/ intervention may pose an ethical dilemma for you as a researcher. Is it ethical to provide a study population with an intervention/ treatment that has not yet been conclusively proven effective or beneficial? But if you do not test, how can you prove or disprove its effectiveness or benefits?

There are no simple answers to these dilemmas. Ensuring informed consent, 'minimum risk,' and frank discussion as to the implications of participation in the study will help to resolve ethical issues.

Using inappropriate research methodology: It is unethical to use a method or procedure you know to be inappropriate, e.g., selecting a highly biased sample, using an invalid instrument, or drawing wrong conclusions.

Incorrect reporting: To report the findings in a way that changes or slants them to serve your own or someone else's interest is unethical.

Inappropriate use of the information: The use of information in a way that directly or indirectly adversely affects the respondents is unethical. If so, the study population needs to be protected.

Sometimes it is possible to harm individuals in the process of achieving benefits for the organizations. An example would be a study to examine the feasibility of restructuring an organization. The restructuring may be beneficial to the organization as a whole but may be harmful to some individuals.

Apart from the above-mentioned issues, anything which will adversely affect the research project can be considered against the research ethics.

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