



Research

Introduction



1.1 Meaning, Objective & Characteristics

Research can be defined as systematic and creative work, which is undertaken to increase the accumulation of knowledge. This process of systematic inquiry includes collection of data, documentation of information, its analysis and interpretation, in accordance with determined methodology

“Research is an honest, exhaustive, intelligent searching for facts and their meanings or implications with reference to a given problem.” – P.M. Cook

“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.” – Clifford Woody

1.1.1 Purpose of Research

Research is conducted to assemble a body of information and reach findings to evaluate the validity of hypothesis and generate questions for further research.

The purpose of research can be widely classified into three categories:

Exploratory	To explore a new problem area which has not been explored before
Descriptive	To expand the existing knowledge on any current issues through data collection
Descriptive	To understand the impact of changes in existing standard procedures/ situation

1.1.2 Objectives of Research

- To gain insights about a new phenomenon
- To review existing knowledge about a phenomenon or issue
- Analyzing a new problem
- To find solutions for existing problems/issue
- Exploring new idea and fields
- Innovation and Creativity
- Expanding the existing knowledge base

The objectives of research can also be classified into three categories:

• Theoretical

To formulate new concepts and theories for enhancement of existing human knowledge

Example: New Principles of Physics, Mathematics etc.



• Factual

To find new facts, including describing facts about event that has already happened in the past.

Example: History



• Application

Research done to find innovative applications of the existing knowledge, rather than adding new knowledge.

Example: Finding new application of Artificial Intelligence



The two very important characteristics of Research are:

• Validity

Validity refers to accuracy of the research. If the research moves in the wrong direction or the research instruments used do not measure what was intended, the research loses its validity.

Example: The Time shown in the clock even if consistent and reliable would be invalid if the time shown is wrong.

• Reliability

Reliability is concerned with the consistency and stability of the research.

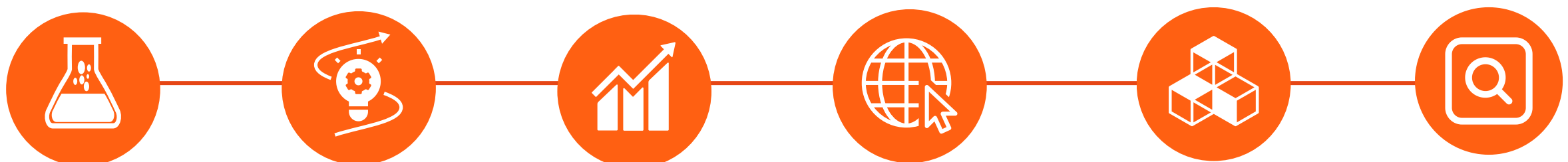
Example: The hour and minute hand in a clock moves at a consistent speed throughout the day. Hence the time shown by the clock is 'Reliable'.

1.1.3 Characteristics of Research

As a general rule, 'Validity' is considered to be more important than 'Reliability' i.e. the authenticity of Information is more important than the consistency in the methodology of conducting the research

The other important characteristics of a research are:

- **Scientific Investigation** - Research is a scientific investigation. It is a systematic approach involving various steps and procedures over a period of time to yield a particular result.
- **Enhancement of existing knowledge** - Research assists in developing new and enhancing existing theories and concepts.
- **Objectivity** - Objectivity as a characteristic ensures that a research is free from personal bias both in approach and evaluation.
- **Accuracy and Suitability of the research** - It implies how suitable is the research to the problem and how accurately the approach and instruments used measure or analyze the problem.
- **Controlled Investigation** - While undertaking the results, various factors capable of affecting the outcome of the result can be controlled or kept constant by the researcher to understand the effect of research under default conditions.
- **Generalization** – The degree to which the findings of the research can be applied to a larger population.
- **Credibility** - The research must be conducted after gathering information from credible sources and following best procedures in research. As a general rule, primary data is considered to be the most credible in research as there are fewer chances of manipulation and personal bias.



1.2 Types of Research

1.2.1 On the basis of Objective

- **Descriptive Research**

It focuses on expanding the knowledge on current issues by way of data collection. The information so collected is done without manipulating the variables. This research focuses more on 'what is/was' rather than 'why'. The aim is to enable the researcher to describe the situation, explaining and validating the research finding.

It is a pre-planned structured approach that is conducted by formulation of specific hypothesis and employs secondary data for quantitative analysis.

Examples: Research undertaken to analyse the attitude of women in metro cities towards abortion laws in India.

- **Explanatory Research**

Also known as 'Causal Research', this form of research is conducted to understand the effect of changes in the existing procedures. It aims to explain the extent and nature of relationship between various variables.

Some of the advantages of explanatory research include explaining how an event occurred or to understand a particular event. This type of research is good in analyzing and predicting future events based on the observations made in present time.

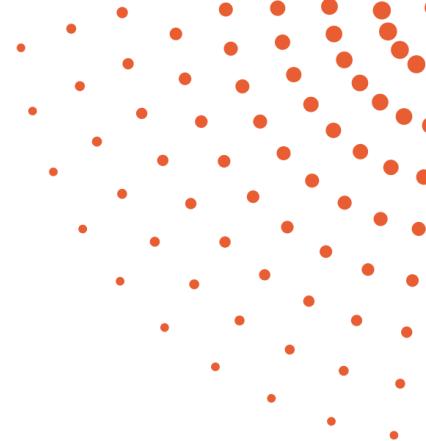
Example: Research to analyze work habits and environments to determine the cause of heavy drinking in certain section of population.

- **Exploratory Research**

This research method is used to explore new problem areas which have not been explored before. It is adopted when the researcher has observed something new and attempts to understand it more.

Generally it is initially undertake as initial research or pilot study to analyze the possibility of detail investigation in future, with the aim to gain background information to establish research priorities and help in establishing a research hypothesis.

Example: Researching on new method of Carbon Control



- **Experimental Research**

Experimental research is undertaken to study the relationship between variables wherein the researcher manipulates some variables while keeping other constant. This is done to establish the cause and effect of an event. The research begins with question regarding the relationship between two or more variables; and the researcher later develops hypothesis to explain the nature of expected relationship between the variables.

The general characteristics of experimental research are:

- Manipulation of independent variable
- All other variables are kept constant
- The effect of independent variable on the dependent variable is observed

Example: Research to understand the effect of changed packaging on the sale of the product

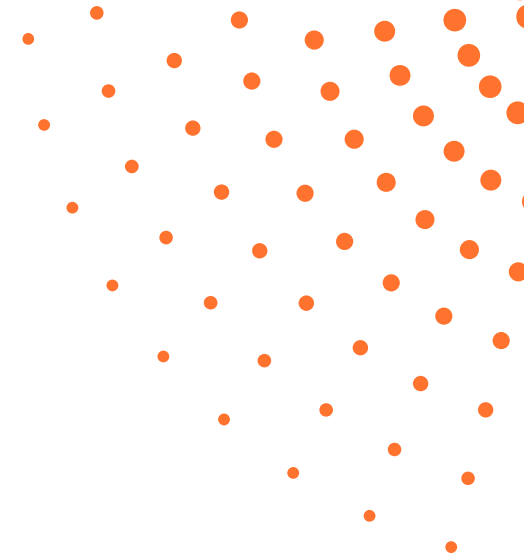
It is important in this context to understand the meaning to independent, dependent and controlled variables. Consider an experiment to understand the effect of a certain brand of pesticide on a specific crop.

Independent variable refers to the variable which the researcher changes in the course of the experiment. So in the context of above example, the application of the pesticide in the experiment is the independent variable.

Dependent variable refers to the variable which is affected as a result of changes in the independent variable. In the above example, the application of pesticide in the crops shall affect the growth of plant, number and size of the leaves and the quality of fruits. These are the dependent variables in the experiment.

Controlled variable refers to those things which the researcher wishes to keep constant throughout his experiment. In the above example, the researcher in order to maintain the consistency and accuracy pre-determines the type of crop to be used, the amount to water supplied, the temperature and other overall ecosystem in which the crops are. These variables are the controlled variables which the researcher keeps constant to check the effect of the pesticide on certain crops.

In addition to these variables there are two more types of variables which plays important part in a research i.e. confounding variable and intervening variable.



Confounding variable refers to those variables which are not independent variable but can still affect the outcome of the experiment. In addition to independent variable, confounding variables can also have an effect on the dependent variable, thereby decreasing the accuracy of the results. It is generally referred to as 'outside influence' on the experiment.

Example: In an experiment to determine the relationship of different activities (independent variable) on a person's weight loss (dependent variable), the age factor of the participant or the sample population can be the confounding variable which can affect the weight of a person.

Intervening variable on the other hand is a hypothetical variable which helps in explaining the causal relationship between independent and dependent variable.

Example: Income is the intervening variable in experiment explaining the effect of person's level of education and his spending.

• Historical Research

This method focuses on the historical aspect of a research problem. The aim of this research is to describe and explain the development and evolution of certain event or issue. This goal is generally accomplished using primary and secondary data available. However, while undertaking such research great emphasis has to be given to the accuracy of the source of data used in the research.

Example: Evolution of Modern Education system in India; The history of Indian Independence movement

• Correlational Research

This method is used when the researcher attempts to establish or find relationship or connection between two variables or events. Correlational research shows as to how two or more things are connected to each other using a numerical index known as 'Correlation Coefficient' to measure the strength and weakness of the relationship between the variables or events.

It differs from 'Causal research' as correlational research examines the relationship of variables but does not show if one causes change in the other, therefore it only examines the association between variables but does not establish their causal relationship.

Example: Research to find relationship between the wealth of a person and the number of child he has.

1.2.2 On the basis of Application

- **Fundamental/Basic/Pure Research**

It refers to an investigation on some basic principle for occurrence of a particular event or phenomenon. It is a theoretical work undertaken to obtain new knowledge of some natural phenomenon which can have universal application.

These may not lead to immediate application and are generally not concerned with solving an immediate practical problem. However, these researches form the basis for applied research. Fundamental research has been defined philosophically as the type of study done for gathering knowledge for the sake of knowledge.

Example: Research to prove 'String Theory'; Study to show affect of caffeine on human brain

- **Applied Research**

This kind of research is conducted to solve a specific problem in a society and the result of it has a practical application. Majority of experimental research, case studies and inter-disciplinary researches can be categorized as applied research.

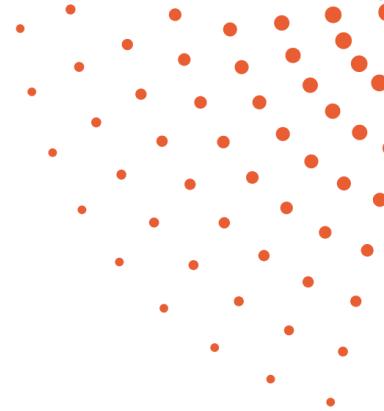
It holds high importance as the outcome of such research is used for policy formulation, understanding a phenomenon, or to find solution to a practical problem. It uses basic/fundamental research as its base and is carried on by academic or industrial organization.

Some of the characteristics of applied research are:

- Researches on specific cases without the aim to generalize
- Attempts to show how things can be changed/improved
- Reports in common language
- Does not have universal application

Example: Research undertaken to study the ways to improve the productivity of workers in a workplace.





- **Action Research**

Action research refers to a research method which aims to solve problems and help researchers develop solutions to the problem quickly and effectively. It is a scientific process for finding solutions of current problems especially of social studies; it focuses on improving and modifying the current practices and does not contribute to the fund of knowledge.

The process of action research is:

Plan: Planning actions or methods to solve a problem

Act: Carrying out the actions as planned

Observe: Analyze the data to evaluate the success or failure of the action

Reflect: Self reflect to see the strength and weaknesses of the actions taken

However, it must not be understood as mere simple problem solving as it is a systematic and collaborative process, involving specification of problem, development of something new and also critical analysis of the effectiveness of the actions taken.

Example: Learning initiatives with ICT tools in education and professional training.

1.2.3 On the basis of Logic

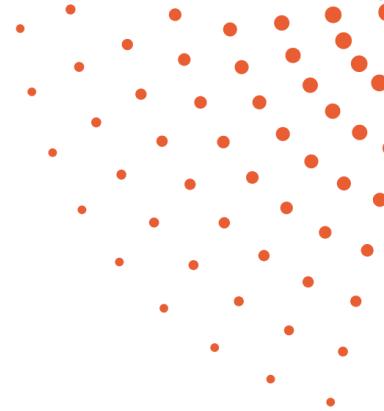
- **Inductive Research (Specific to General)**

This type of research is also known as 'Bottom-Up Approach'. It refers to arriving at a conclusion through a process of generalization using specific data or facts. It usually comprises of three steps:

- Observe various phenomenon
- Search for a pattern
- Make decision to accept or reject the hypothesis

It is called a 'bottom-up approach' because it starts with a conclusion i.e. hypothesis. Researcher makes specific observations and then draws general conclusions based on those observations. It should also be noted that since inductive reasoning makes general conclusions, merely because the observations were correct won't necessarily mean that the general conclusion is correct.

Example: The CEO has used PPT in the last few meetings; therefore he will use the PPT in tomorrow's meeting.



- **Deductive Research (General to Specific)**

Referred to as 'Top-Down Approach', this type of research begins with a theory and attempts to prove it right with the help of information/data available with the researcher. This form of research deduces new information or conclusions from known facts or information. It comprises of three steps:

- Stating the hypothesis based on a theory
- Data Collection to test the stated hypothesis
- Accepting or rejecting the hypothesis based on the analysis of the data.

It is considered as 'top-down' approach because it starts with a premise. The final step and purpose of the research is always to draw conclusions about a research problem. In order to complete that purpose it is essential to prepare a report which highlights the findings and conclusion at which the researcher has arrived after following the complete research process. This report shall become the basis of further research on a similar problem by a different or the same researcher. Deductive reasoning is a specific conclusion derived from a general theory. Therefore the conclusion will be correct if all observations in the general theory are correct.

Example: All students in the class love Cricket. Rahul is a student in the class; therefore Rahul loves cricket.

1.2.4 On the basis of Process

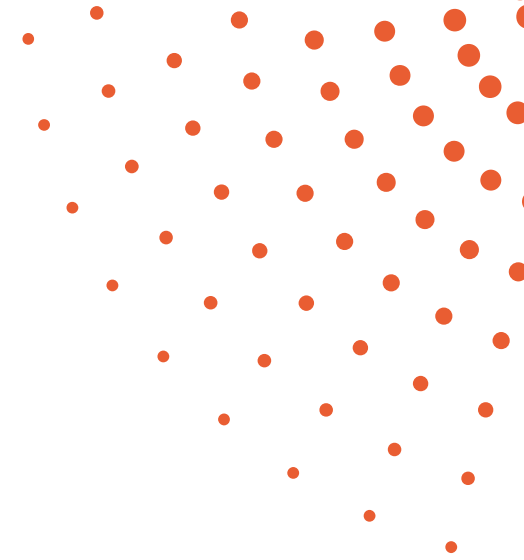
- **Quantitative Research**

It is used to quantify the research problem by generating data that can be converted into statistics. It quantifies opinions, behaviors and other variables and generalizes the same for a larger sample population, to formulate facts and recognize new patterns through research.

The primary characteristics of this type of research are:

- Data collection and analysis
- Hypothetico-deductive
- Generalization of population characteristics
- Recommends future course of action

It generally uses closed-ended questions which include questionnaires, surveys and structured observations. It uses the data to quantify any variations, to predict relationships, and describe characteristics of populations by way of data analysis.



The various forms of research that can be also qualified as quantitative research includes descriptive research, experimental research, deductive research, inter-disciplinary research and applied research etc.

Example: Empirical study to analyze the rising menace of false allegation of various sexual offences in India

• Quantitative Research

This form of research is used to describe a problem rather than to measure it. It seeks to analyze the problem to gain information and bring depth of understanding to the problem. Often this form of research is used to provide new insights and formulate hypothesis which can be later quantified.

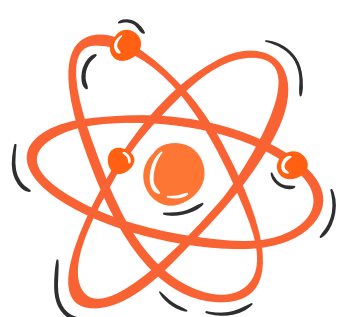
Qualitative research is concerned with formulating understanding regarding 'why' and 'how' of the research question. Therefore, this form of research is considered to be subjective and the findings of the research are gathered in written format.

The primary characteristics of this research are:

- It is a scientific method
- It focuses on the participant's view
- Open end questions
- Often takes the form of words
- Inquiry that seeks in-depth understanding

There are various forms of research which can also be categorized as Qualitative research such as fundamental research, action research, historical research, case studies, explanatory research and inductive research etc.

Example: Research undertaken to understand the stand of judiciary on Standard Essential Patents (SEP)



1.2.5 On the Basis of Time

- Cross-Sectional Research (Single Period of Time, Different Subjects)

It refers to the research that is confined to a single point of time. It analyzes data collected at one given point of time across the sample population. It is usually described as one time interaction or one time data collection. This type of research helps the researchers to collect actionable data quickly which help in decision making.

Example: A research to understand how people of various socio-economic backgrounds react to a certain changes in a price of everyday product.

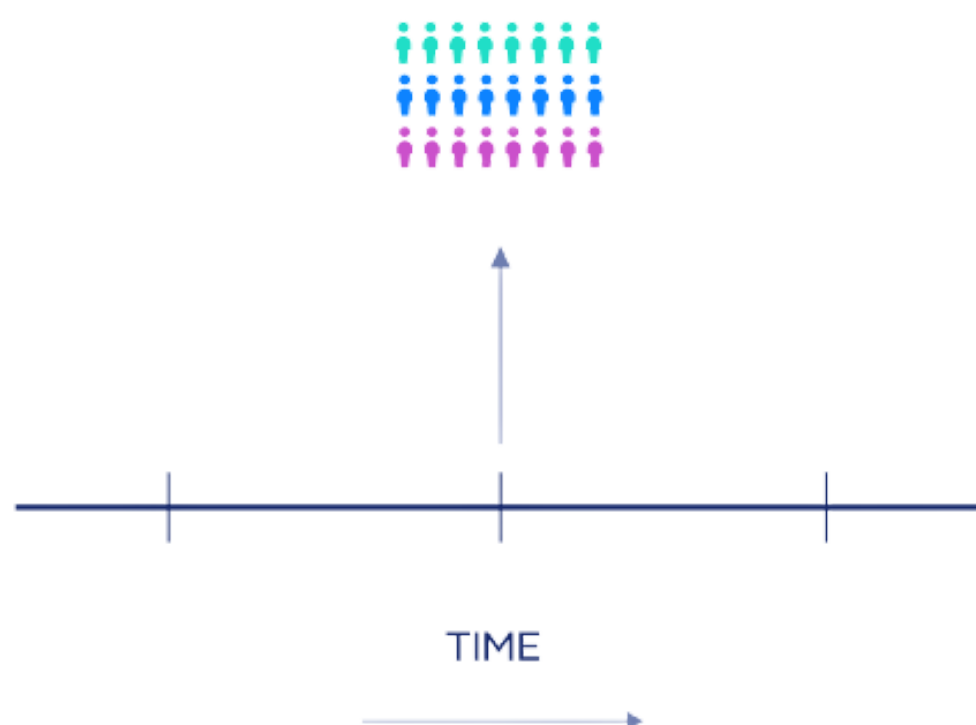
- Longitudinal Research (Over a Period of Time, Same Subjects)

It refers to the research wherein the researcher collects data of the same subject over a period of time. It is done to detect developments or changes in the characteristics of the subjects at both individual and group level. These types of research are common in the field of medicine, economics and social sciences.

Example: A research to measure the side effects and efficiency of a new cancer medicine, over a period of time.

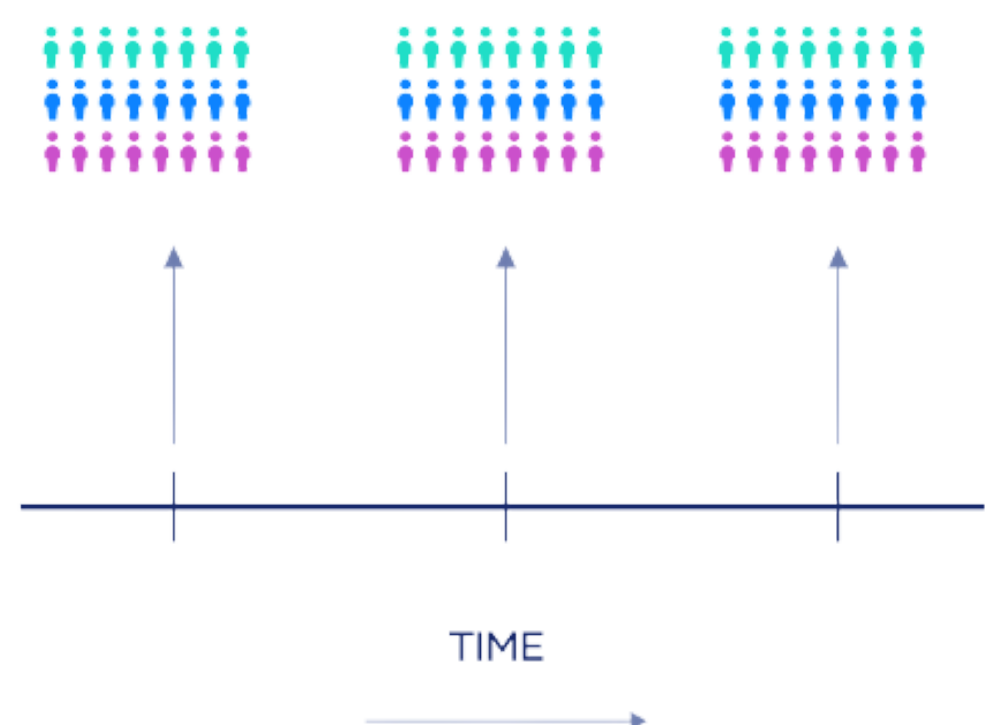
Cross-sectional study

Data collected at one point in time



Longitudinal study

Data collected repeatedly over time



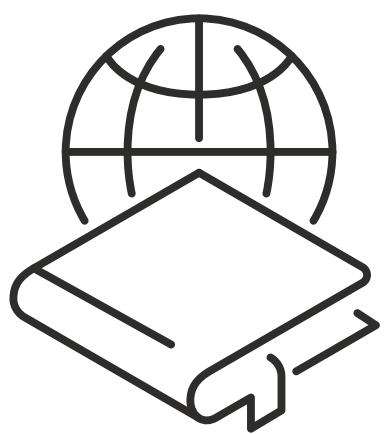
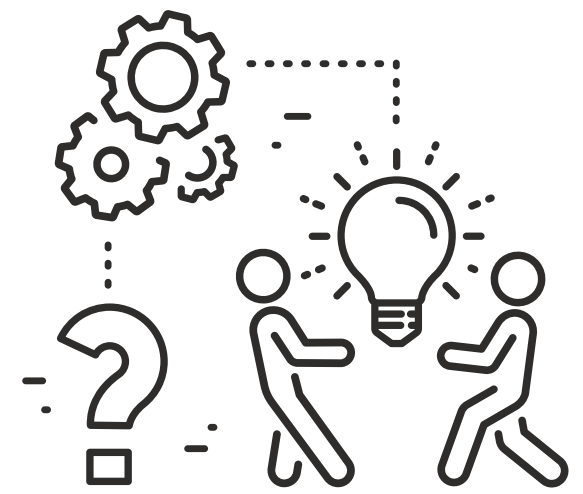
1.2 Research Process

In general, Research can be understood as a multi-step process starting with identification of problem and ending with writing of the research report/findings. Each type of research carries its unique approach due to differences in method, time, environment etc., however there are certain common stages which form a general research process

The eight steps in the research process are:

Step 1: Identifying the problem

Selection of topic is the first and one of the most critical parts of research process as the outcome and the entire research relies on the selection of topic. The problem should be practical, important, and ethically and politically acceptable.



Step 2: Literature Review

Literature review is done to check the availability of literature on the research problem and also to broaden the knowledge of the researcher on the problem. In addition to it, it helps in improving the research methodology and brings clarity, which in turn helps to bring more authenticity to research.

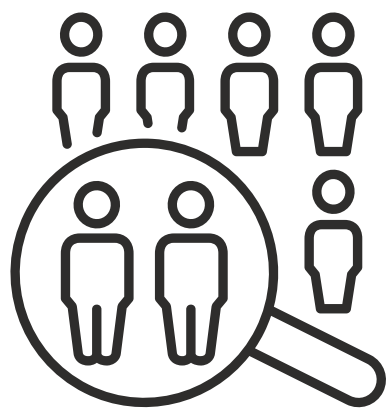
Step 3: Research Question/Hypothesis

- Research questions/hypothesis are formulated to narrow the area of research to help researcher staying on the right path. In general, it can be understood as institution of the researcher which is framed to make predictions about the outcomes of the research undertaken.
- It is a simple tentative proposition specifying the logical relationship of variables, the validity of which is unknown.



Step 4: Research Design

The conceptual structure of the problem should be made depending on the nature and purpose of the research. Any information pertaining to the source, time and finance are taken into consideration before finalizing the research design.

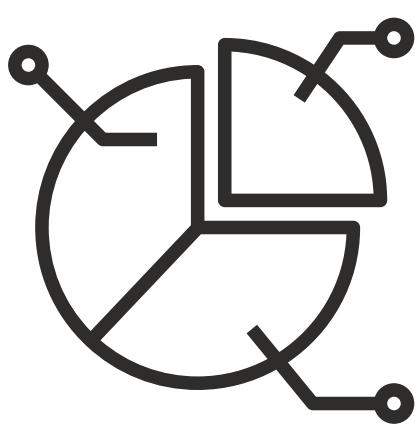


Step 5: Sample Design

This involves any procedure and plan to collect small number of samples of the population to represent the whole population

Step 6: Data Collection

The collection of data is the most important part of the research process, as it ultimately determines the outcome of the research. The method of data collection depends on the research and sample design, and the time, finance and personnel available to undertake the research.



Step 7: Data Analysis

This process refers to the conversion of the raw data collected by the researcher into a meaningful category in the context of the research problem to test the hypothesis (if any) or answer/analyze the research questions formulated

Step 8: Report Writing

The final step and purpose of the research is always to draw conclusions about a research problem. In order to complete that purpose it is essential to prepare a report which highlights the findings and conclusion at which the researcher has arrived after following the complete research process. This report shall become the basis of further research on a similar problem by a different or the same researcher

