



A brief introduction to Research methodology

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Abstract

Research begins by asking the correct question and choosing an appropriate method to solve the problem. It can be useful in both scientific and non-scientific fields. Research is an important aspect that is primarily implemented in higher education institutions. It is conducted by making use of books, articles, journals and social media. It involves systematic steps and procedures and individuals are required to possess knowledge regarding these in order to carryout their research in a productive manner. Research is a scientific enquiry which is carried out scientifically, systematically or critically. Research provides the basis for many government policies . Inventions can be made only through research. Industry and business is in need of research in order to increase the productivity, quality of the products and enhance profits. Numerous types of research methods such as applied, descriptive, conceptual, explorative exist. They can be classified into various categories depending on the point of view under which the research activity is conducted and initiated. Certain ethics like plagiarism should be considered while conducting research and writing research papers.

Keywords: Research, research methodology, research design, sampling, research ethics, research problem, plagiarism

1.Introduction

The term "research" is derived from the French word 'recherche', which means quest, seek, pursuit, and search for truth. Research is an organised inquiry that uses accepted scientific technique to solve problems and provide new information that is broadly applicable. Research methodology is a systematic approach to issue solving. It is a scientific examination of how research should be conducted. Research technique refers to the procedures used by researchers to describe, explain, and forecast events. It is also defined as the study of the processes used to attain knowledge. The goal is to provide a research work plan. Science and technology are not the only topics of research. Other disciplines offer numerous research opportunities, including languages, literature, history and sociology. Whatever the subject, research must be an active, diligent, and systematic process of investigation in order to find, understand, or revise facts, events, behaviours, and hypotheses. Applying research findings to refine knowledge in other fields or to improve the quality of human life is also considered research and development. Research is conducted by study, experimentation, observation, analysis, comparison, and reasoning. Indeed, research is pervasive. [1] The word research consists of two syllables: re and seek. The prefix "re" means "again, anew," or "over again." The verb "search" means to closely investigate, test, or explore. They combine to make a noun that describes a meticulous, systematic, and patient study and examination in some subject of knowledge in order to determine facts or principles. Research is an organised inquiry that uses accepted scientific technique to solve problems and provide new information that is broadly applicable.[2] Research is a methodical and scientific research aimed at discovering new knowledge, validating existing knowledge, or resolving issues. It entails a disciplined and structured approach to study, led by defined objectives and research questions. Natural sciences, social sciences, and humanities are all possible areas of research. Data is often collected and analysed using a variety of methodologies and procedures, including surveys, experiments, observations, and interviews. The purpose of research is to contribute to the growth of knowledge and understanding in a variety of domains. It offers evidence-based answers to complicated problems, thereby improving the quality of life for individuals and communities. Research also creates opportunity for innovation and promotes economic progress and development. Research

is a rigorous problem-solving process that aims to uncover new knowledge. Research can entail describing a new phenomena, defining a new relationship, creating a new model, or applying an existing concept or process to a new setting. Research is methodical, logical, empirical, reductive, reproducible, transmissible, and generalizable. Research can be categorised into several categories: fundamental, applied, or translational; hypothesis generation or hypothesis testing; retrospective or prospective; longitudinal or cross-sectional; observational or experimental and quantitative or qualitative. Adequate planning is critical to the long-term success of a research effort. "Research" can be roughly described as the process of addressing issues and answering previously unsolved questions. This is accomplished through serious consideration or examination of a topic or situation. Although the approach and exact aims may differ, the ultimate purpose of research is always to discover new information. In biomedical research, this can entail describing a new phenomena, defining a new relationship, creating a new model, or applying an existing principle or process to a new situation. The methodology of research is becoming recognised as an academic subject in its own right, with unique principles and needs for obtaining evidence that, while applicable across disciplines, necessitate specialised study.[3]

2. Characteristics of Research:

Research is the process of gathering, analysing, and interpreting data to answer questions. However, in order to be considered research, the method must meet certain criteria: it must be generalised, controlled, rigorous, systematic, valid and verifiable, dependable, empirical, accurate, and critical.[29]

1. Generalised- The researcher usually distributes the population that was determined into smaller samples based on the available resources at the time of research. This sample is thought to be an appropriate representation of the indicated group, so the findings should be applicable as well as roughly representative of the complete community. The analytical information collected from examining these samples should provide a reasonable representation of the overall population who adhere to a specific ideology, beliefs, societal stigmas, driving force, and so on.

2. Controlled - in real life, there are numerous elements that influence the outcome. The notion of control suggests that while investigating causation between two variables, you design your study so that the effects of other factors influencing the relationship are minimised.

3. Rigorous - one must be meticulous in ensuring that the techniques used to get answers to questions are relevant, suitable, and justified. Again, the level of rigour differs significantly between the physical and social sciences, as well as within the social sciences. [15]

4. Systematic - this means that the procedures used to conduct an investigation follow a specific logical sequence. The various procedures cannot be taken in arbitrary order. Some procedures must be carried out in order.

5. Valid and verifiable - This concept suggests that whatever conclusions you reach based on your findings are correct and can be verified by yourself and others. Validity is determined by the strength of a diverse set of evidence. In terms of research, validity is the ability to determine if study conclusions, assumptions, or assertions are accurate or untrue. Validation refers to the precision of a measurement, whether or not it measures what it is intended to measure. It also determines how research is used to solve problems in various situations. This provides a clear direction for the research work. A study's findings should be verifiable by both the researcher and anyone else who wishes to perform a comparable study.

6. Reliable: This is the extent to which the outcome of a computation, specification, or measurement can be relied upon to be accurate. It is difficult to quantify precisely, however there are currently tools that can determine the reliability of a study. It refers to the degree to which an experiment, test, measurement method, research, research instrument, tool, or procedure produces consistent results on subsequent trials. A study is considered credible if the results are consistent each time it is conducted with a similar population and methodologies.

7. Empirical - this means that whatever inferences formed are based on hard evidence acquired from real-life experiences or observations. [24]

8. Analytical & Accurate - A research ought to concentrate not only on what is taking place, but additionally on how and why a specific occurrence or process leads to certain findings. Any information collected that does not produce findings or is unsuitable for further studies or applications undermines the goal of research. To allow for easy analysis, data collected should be reasonable and error-free. Accuracy also refers to the degree to which each study procedure, instrument, and tool is linked to one another. Accuracy also determines whether research tools were chosen optimally and whether research processes were appropriate for the study challenge. The selection of adequate data collection technologies is critical for any investigation.

9. Critical - A thorough examination of the techniques and methods used is essential to any research study. The investigative method must be error-free and without imperfections. The process and practices used must withstand critical inspection.[2]

3. Purpose of research

1)Progress and good life : The research aims to promote progress and well-being. Progress occurs when knowledge and wisdom occupy the place of ignorance. Knowledge and wisdom motivate people to live a good life in order.

2)Development of scientific attitude : Developing a scientific perspective involves asking why and how answers are found. This know-y and know-how mentality fosters talent.

3)Creativity and innovativeness : Research aims to promote creativity and innovation. The world is becoming more dynamic as new products, processes, and applications emerge. A dynamic world cannot exist without the introduction of new elements on a regular basis, which can only be accomplished through creativity and invention. [11]

4)Texting hypothesis and establishing theory: Texting hypotheses and developing new theories generates knowledge. A proven hypothesis becomes a theory.

5)Problem Solving : Any research is designed to solve a specific problem. That entails taking steps to address knowledge loss, inefficiency, and productivity issues, as well as investigating the underlying causes.

6)Schematic Evaluation : Research is conducted to examine an organization's processes or practices to find strengths and shortcomings and areas for development.

7) Impact analysis: Research is conducted to evaluate how new measures or changes affect key variables. Impact studies are useful for decision making in areas such as social, biological, business, and economics.

8) Methodological Improvement: Measuring and scaling techniques have advanced significantly. Research has to be conducted to determine whether they can be effectively employed in the specific fields of research. Validation, de-validation, and revalidation of methodological characteristics are essential components of research. Methodological enrichment is one of the goals of research.

4. Possible motives for conducting research

No one would want to conduct study unless it included some compelling elements. Some of the motivations are as follows:

(1) To obtain a research degree (Doctor of Philosophy (Ph.D.)), which comes with benefits such as improved employment, promotion, income increase, and so on.

(2) obtain a research degree and then get a teaching post in a college or university or become a scientist in a research institute.

(3) Want to work as a researcher in nations such as the United States, Canada, Germany, England, Japan, and Australia and eventually reside there.[14]

(4) tackle the unsolvable and tough challenges.

(5) to find satisfaction in completing creative activity.

(6) To generate new concepts and theories for future research and development.

- (7) To gain respectability.
- (8) to gain popularity.
- (9) Discover unknown details about an event.
- (10) Identify new chances for creativity or technological growth.
- (11) Driven by curiosity to discover new things.
- (12) Committed to addressing societal issues. [1]

5. Research Objectives:

The goal of research is to uncover answers to questions using scientific processes. The primary goal of research is to uncover hidden truths that have yet to be revealed. Though each research project has its own distinct purpose, we can think of research objectives as fitting into one of the following major groups:

1. To become acquainted with a phenomena or obtain fresh insights into it (studies with this purpose in mind are known as exploratory or formulative research investigations)
2. To correctly represent the features of a specific individual, circumstance, or group (studies having this purpose in mind are known as descriptive research studies);
3. Determine the frequency with which something occurs or is related with something else.
4. To test a hypothesis regarding a causal relationship between variables.[4]

6. Research methodology and research method

Research Methods and Research Methodology are often used interchangeably. They are not identical, and they differ from one another. One of the key distinctions between them is that research methods are the means by which you conduct research on a subject or issue. On the other side, research methodology describes the methods you can use to conduct your research. Experiments, tests, surveys, and other similar approaches are used in research. On the other side, research methodology include studying the many approaches that can be utilised to perform research as well as tests, experiments, surveys, and critical studies. The technical distinction between the two terms namely, research methods and research methodology.[2] Research methods or techniques are the ways that researchers employ to conduct research operations. In other words, research methods refer to all of the procedures utilised by the investigator in order to explore the subject of his study. Considering the goal of research, particularly applied research, is to find a solution to a given problem, the accessible data and unknown parts of the problem must be linked together in order for a solution to be attainable. Research methodology is a systematic approach to solving a research challenge. [18] It might be defined as the study of how scientific research is conducted. In it, we analyse the many steps that a researcher usually takes when examining his research problem. along with the logic behind them. The researcher must be familiar with both the research methodologies and procedures, as well as the approach. Researchers must not only know how to create specific indices or tests, how to calculate the mean, mode, median, standard deviation, or chi-square, and how to apply specific research techniques, but they must also understand which of these methods or techniques are relevant and which are not, as well as what they mean and indicate and why. Researchers must also grasp the assumptions underlying various techniques, as well as the criteria used to determine whether particular techniques and processes are applicable to specific issues and which are not. This means that the researcher must design his methodology for his problem, as it may vary from problem to problem. For example, when designing a building, an architect must carefully assess the foundation of his decisions, i.e., why and on what basis he chooses a specific size, quantity, and position of doors, windows, and ventilators, utilises some materials over others, and so on. Similarly, in research, the scientist must subject the study decisions to evaluation before they are applied. He must define clearly and precisely what decisions he makes and why, so that others can evaluate them as well. Based on the information presented above, we may conclude that research methodology has numerous dimensions, and research methods are an integral element of it. The scope of research methodology exceeds that of research methodologies. Thus, when we talk about research methodology, we not only talk about the research methods, additionally we consider the

reasoning beneath the techniques that we use in the framework of the research we study and explain why we are using a specific approach or methodology and why we are not using others as well, so that outcomes of research can be analysed either by the person conducting the study himself or by others.[4]

7. Functions of Research

The primary goal of research is to improve research techniques through the refinement and expansion of information. The refinement of current information or the acquisition of new knowledge is essentially an intermediate phase in improving the social studies process.

(a) The purpose of research is to help make a judgement on the refinement or extension of knowledge in this specific field.[21]

(b) The purpose of research is to improve students' learning and classroom problems encountered by teachers. More effective teaching strategies can be developed.

(c) Research can also help social studies administrators enhance their systems. The researchers should contribute to both the theory and practice of study studies. It should convey the impression of a useful mechanism that researchers or research scholar can utilise in some way to better the process.

8. Importance of Research

The research is important since it can contribute to the growth of knowledge and understanding in a variety of sectors. Research is essential in both scientific and non-scientific sectors. Every day, we face new challenges, events, phenomena, and processes. Practical, implementable ideas and suggestions are necessary for addressing new concerns. Scientists must conduct research on them to determine their causes, solutions, explanations, and applications. Indeed, study helps us understand nature and natural events. It contributes to the creation of new knowledge. Research gives fresh facts, ideas, and hypotheses that can expand our understanding of a particular subject or occurrence. [27]It also aids decision-making and policy formulation. Research identifies evidence-based solutions to complicated problems and assists decision-makers in developing effective policies and procedures. It enhances practices and processes: Research may help find new opportunities for innovation while also improving practices and processes in a variety of fields, including healthcare, education, and business. Also helps solve real-world problems: Research sheds light on the causes and elements that contribute to social, economic, and environmental issues, allowing for the identification of effective remedies. Research helps economic growth and development by resulting in the development of new technologies and products that can create jobs, increase economic growth, and improve the quality of life. Individuals and communities can benefit from research because it provides evidence-based solutions to healthcare, education, and societal challenges. A research challenge is a difficulty that a researcher, a scientific community, an enterprise, a government organisation, or a society faces. It could be a hypothetical or practical situation. It requires a detailed understanding and viable remedy. Existing theories and notions can be researched to determine their scope and applications. It is the source of knowledge and provides guidance for issue solving. [4]Numerous government policies are founded on research findings. For example, research on people's needs and desires, as well as the availability of revenues to meet those demands, assists a government in preparing a budget. It is crucial in industry and business to increase profits and production while also improving product quality. Mathematical and logical research into business and industry optimises the issues they face. It leads to the discovery and characterisation of new materials, living creatures, and stars. Inventions can only be developed through research; for example, new and original phenomena and procedures like superconductivity and cloning were discovered alone through research. Social research contributes to the discovery of solutions to social problems. They explain social phenomena and seek solutions to societal issues. Research leads to a new way of life, making it joyful and wonderful.[1]

9. Types of Research

9.1 Analytical Research

Analytical research requires the researcher to use previously known facts or information and analyse them in order to provide a critical judgement of the content. This type of study necessitates employing critical thinking skills and evaluating data and information relevant to the project at hand. Identifies the causal relationships between two or more variables. The analytical analysis seeks to uncover the causes and mechanisms underlying the movement of the trade deficit over a given period. It is used by a variety of specialists, including psychologists, doctors, and students, to determine the most relevant information during investigations. Analytical research provides valuable knowledge that allows individuals to add new ideas to their work. Some researchers use it to unearth material that supports ongoing study, hence increasing the validity of their findings. Other scholars conduct analytical study to generate new insights on the issue. The purpose of analytical research is to create fresh ideas that are more credible by synthesising multiple small details.[31]

9.2 Applied Research

Applied research is also known as action research. It seeks a solution to an immediate problem confronting a society or an industrial/business entity. Applied research is defined as study that seeks specific results (such as a solution) in response to a specific societal or business challenge. Examples of applied research include study to discover social, economic, or political trends that may affect a certain institution, copy research (which determines if certain communications will be read and understood), marketing research, and evaluation research. Thus, the primary goal of applied research is to identify a solution to an urgent practical problem.[24]

9.3 Fundamental research

Fundamental research is sometimes referred to as pure research or basic research. It is mostly focused with making generalisations and developing theories. 'Pure' or 'basic' research is defined as gathering knowledge solely for the purpose of knowledge. Fundamental research includes studies of natural phenomena and pure mathematics. Similarly, research investigations on human behaviour conducted with the goal of making generalisations about human behaviour are examples of fundamental research. Basic research is focused on discovering information that has a wide range of applications and hence contributes to the previously organised corpus of scientific knowledge. It is a scientific research that aims to tackle many practical challenges in everyday life. It seeks explanations or solutions to everyday. It seeks answers or remedies to everyday issues, cures illnesses, and develops revolutionary technologies.[28]

9.4 Conceptual Research

Conceptual research focuses on abstract ideas or theories. It is commonly employed by philosophers and thinkers to create new concepts or reinterpret old ones. Conceptual research is defined as a methodology in which research is conducted by observing and analysing existing knowledge on a certain issue. Conceptual research does not entail any real experiments. It refers to abstract concepts or ideas. Philosophers have traditionally utilised conceptual inquiry to build new theories or interpret current theories in a different light.[17]

9.5 Comparative research

Comparative study examines the similarities and contrasts between two individuals, subjects, or groups. The comparative research method is a research methodology that examines certain elements of social science or life from various cultures or countries. It is a qualitative strategy or analysis in which researchers employ various approaches, such as case study analysis, to determine the similarities and contrasts across entities or countries. The comparative research approach merges theoretical principles with data acquisition. Causality is a fundamental concern in comparative research. Causality comparative research focuses on identifying the causes of distinctions and parallels between two assertions or groups of individuals. Researchers may make errors in establishing the specific cause of the problem in comparative research due to the lack of a standardised scale for both circumstances.[5]

9.6 Cross-sectional research

Cross-sectional, or synchronous, research examines a group or subgroup at a single point in time. Participants are typically recruited based on common factors such as age, gender, or income, and researchers look for similarities and variances within and between groups. The group is frequently cited as an example of a bigger population. Example: A corporation investigates and analyses the sales strategies of its top 10% of salespeople to those of its worst 10%. This gives the company information on the most and least successful sales strategies.[21]

9.7 Correlational research

Co-relational research looks for variables that appear to interact with one another, so that when one variable changes, you may predict how the other variable will change. Correlational research examines the relationship between two or more variables without defining cause and effect. Examples include the correlation between obesity and diabetes mellitus, as well as the correlation between smoking and cancer.[31]

9.8 Conclusion-oriented research

While conducting conclusion-oriented research, a researcher is free to pick up an issue, reorganise the inquiry as he goes, and conceptualise as he sees fit.

9.9 Decision-oriented research

Decision-oriented research is always for the benefit of a decision maker, and the researcher in this instance is not free to do study based on his own interests. Operations research is an example of decision-oriented research since it is a scientific method that provides executive departments with a quantitative foundation for decisions about operations under their control.[11]

9.10 Descriptive Research

Descriptive research involves many types of surveys and fact-finding inquiries. Descriptive research is primarily concerned with describing the current state of circumstances. Ex post facto research is a word commonly used in social science and business research to refer to descriptive studies. This form of research provides an accurate representation of the features of a specific individual, scenario, or group. Also referred to as statistical research. It deals with anything that can be counted and researched that affects people's lives. The main feature of this method is that the researcher has no control over the variables; he can only report what has occurred or is happening. Most ex post facto research projects are descriptive studies in which the researcher aims to quantify items such as shopping frequency, personal preferences, or similar data. Ex post facto studies encompass researchers' attempts to find causes when they are unable to control the factors. Descriptive research uses a variety of survey approaches, including comparative and correlational methods. Descriptive research seeks to comprehensively characterise a scenario, problem, phenomena, service, or programme, as well as to provide information on, say, a community's living conditions or views towards an issue. It focuses on enhancing understanding about current situations through data collection. Descriptive study examines the behaviour of a sample population. The study requires only one variable. The three basic goals of descriptive studies are to describe, explain, and validate the results. [25]

9.11 Deductive research.

Deductive, or theory-testing, research is the inverse of inductive research, moving from broad to specific. Researchers select a hypothesis and test its accuracy via experimentation or observation. Researchers discovered that 12 international firms implemented in-house carbon emissions regulations in the same year. They conduct deductive research to compare worldwide emission levels before and after the policies were implemented.[18]

9.12 Empirical Research

It is based solely on experience or observation, frequently with little respect for system or theory. It is data-driven research, resulting in results that may be verified through observation or experiment. We can also refer to it as experimental research. In this type of research, it is vital to obtain facts personally, at their source, and

to actively engage in activities that stimulate the development of desired knowledge. In this type of research, the researcher must first develop a working hypothesis or prediction about the likely outcomes. He then strives to collect enough facts (data) to either prove or reject his hypothesis. He then creates experimental designs that he believes will manipulate the individuals or materials involved in order to bring forth the desired information. Such research is distinguished by the experimenter's control over the variables under consideration, as well as his deliberate manipulation of one of them to investigate its effects. Empirical research is appropriate when proving that some factors influence other variables in some way. Evidence acquired from experiments or empirical investigations is now regarded as the most powerful support for a particular hypothesis. [17]

9.13 Exploratory research

It is used to investigate an unknown area or to investigate the feasibility of doing a certain research project. As the name implies, researchers perform exploratory investigations to investigate a specific set of issues. The answers and analytics may not provide a resolution to the perceived problem. It is undertaken to address fresh problem areas that have not before been explored. This exploratory data analysis procedure establishes the groundwork for more thorough data collecting and analysis. Exploratory research focuses on developing hypotheses rather than testing them, whereas formalised research investigations have a substantial structure and particular hypotheses to test..[32]

9.14 Explanatory research

It seeks to explain why and how a link exists between two or more features of a situation or occurrence. Causal or explanatory research is used to determine the influence of specific modifications in existing standard practices. The most common method is to run experiments. It is research whose major goal is to explain why events happen, as well as to construct, elaborate, extend, or test theories. It is primarily concerned with displaying, explaining, and presenting what we already have. It is the process of turning over 100 rocks to uncover maybe one or two precious jewels. Explanatory survey research may investigate the aspects that contribute to customer satisfaction and establish the relative weight of each factor, or it may attempt to model the variables that lead to customers switching to department stores from small shops from which they have previously purchased. An exploratory survey placed on a social networking site may unearth the fact that an organization's clients are unhappy, allowing the organisation to take the appropriate corrective actions.[9]

9.15 Ethnographic Research

This form of research entails investigating a culture by conducting an in-depth study of its individuals. It entails systematically collecting, describing, and analysing evidence in order to build cultural behaviour hypotheses. Anthropological studies investigate persons, ethnic groups, ethnic formations, and social welfare traits. It is done by observations, interviews, questionnaires, and data collecting.[7]

9.16 Field Research

Field research is conducted wherever the participants or subjects are, or "on location." This kind of research necessitates onsite observation and data collection. For example, a manufacturing factory engages an environmental engineering firm to evaluate the plant's air quality to ensure that it meets federal health and safety standards. The researchers visit the plant to collect samples.[19]

9.17 Flexible research

Flexible research allows procedures to vary over the course of the investigation. There are several types of flexible research, including:

1. Case studies: Case studies are detailed analyses and observations about a specific person or issue.
2. Ethnographic studies: Ethnographic studies are detailed analyses and observations of a group of people.
3. Grounded theory research: Grounded theory studies are intended to generate ideas based on carefully gathered and analysed evidence.

For example, a doctor may utilise a case study methodology to track a patient's symptoms, treatment, and recovery.[20]

9.18 Fixed research

Fixed research involves predetermined processes, such as how frequently testing will take place, where it will take place, the quantity of volunteers, and their sorts. To decrease variability, the research relies on precise settings and adherence to predefined protocols. Experimentation is widely used in fixed research. For example, a researcher wishes to see how different labels effect consumer ratings of a sports drink. Participants are given the same drink with different labels and asked to complete a survey regarding their flavour and overall thoughts. The timing of each drink and subsequent surveys is essential to the study's validity.[5]

9.19 Ground Theory Research

It investigates the difficulties that exist in a specific social setting, as well as how those involved deal with them. It works virtually in reverse of traditional research, with four stages: codes, concepts, categories, and theory. Example: Create a situation and observe how others react to it.[29]

9.20 Historical research.

It is the use of historical materials such as papers, remains, and so on to examine past events or ideas, as well as the philosophy of individuals and groups at any time in history.[22]

9.21 Inductive research

Inductive research, also known as theory-building research, collects evidence that can be used to generate a new hypothesis about a process or occurrence. It investigates observations and patterns, and proposes several ideas to explain them. Inductive research is frequently the first step in theory formation, and it may lead to subsequent research, such as deductive research, to examine potential theories. Example: Researchers discovered that when 12 multinational firms implemented in-house carbon emissions standards in the same year, global emissions fell. According to the experts, imposing in-house emissions regulations by multinational firms might dramatically reduce global emissions.[23]

9.22 Longitudinal research

Longitudinal study examines how particular metrics evolve over time without affecting any deciding variables. Longitudinal research can take various forms, such as

1. Trend study: Research tracks population characteristics across time.
2. Cohort study: Research that follows a subpopulation across time.
3. Panel study: The research follows the same sample across time.

For example, a researcher investigates whether and how employee satisfaction changes in the same employees after one, three, and five years with the same organisation.[21]

9.23 Laboratory research

Laboratory research is conducted in a controlled environment rather than in the field. The study frequently requires tight adherence to specific requirements, such as the elimination of variables or the timing of events. Chemical and pharmacological experiments are two types of laboratory study. For example, a pharmaceutical company studies a novel medicine formula to see if it can benefit diabetics. Before proceeding to the next phase, researchers carefully monitor chemical interactions in the laboratory.[12]

9.24 Mixed research.

Mixed research combines qualitative and quantitative data. The findings are frequently presented as a combination of graphs, words, and visuals. For example, a vehicle manufacturer requests that customers submit a survey after purchasing a red or white sedan. inquiries focus on how much the colour influenced their selection, among other opinion-based inquiries.

9.25 Policy research

Policy research investigates the consequences of present government or societal policies, as well as the potential implications of proposed policies affecting resource allocation. Policy researchers frequently work within government institutions, doing the following types of studies:

1. Cost analysis.
2. Cost-effectiveness analysis.
3. Programme Evaluation
4. Demands analysis

9.26 Phenomenological Research

It aims to describe a real experience that a person has had. For example, consider a person suffering from cancer and their quality of life at the time.[20]

9.27 Quantitative Research

Quantitative research relies on the measurement of quantity or amount. It applies to phenomena that can be stated quantitatively. Quantitative approaches focus on statistics and measurable forms. It employs a systematic method of investigating occurrences or data. It provides answers to queries that justify links between quantifiable variables in order to explain, predict, or regulate a phenomenon.[19]

9.28 Qualitative research

It is concerned with qualitative phenomena, which are those that relate to or include quality or kind. For example, when we are interested in researching the causes for human conduct (i.e., why individuals think or do particular things), we frequently refer to 'Motivation Research', which is an essential sort of qualitative research. This form of research tries to uncover the underlying motivations and desires through in-depth interviews. Other study methodologies include word association tests, sentence completion tests, story completion tests, and other projective procedures. Qualitative research includes attitude or opinion research, which is aimed to determine how individuals feel or think about a specific subject or institution. Qualitative research is especially essential in the behavioural sciences, where the goal is to uncover the underlying motivations behind human conduct. Such research allows us to examine the many reasons that push people to behave in a certain way or cause them to enjoy or detest a specific object. It should be noted, however, that applying qualitative research in practice is a challenging task, and hence, when conducting such research, one should seek help from experimental psychologists. Qualitative research is a means of gathering data through conversational approaches, typically open-ended inquiries. The responses gathered are primarily non-numerical. [25]

10. Criteria of a Good Research

Whatever the kinds of research works and examinations, one thing is certain: they all have a common foundation in the scientific process they apply. Scientific research should satisfy the following criteria:

1. The research's objective should be clearly specified, and common ideas employed.[6]
2. The study process employed should be explained in sufficient detail to allow another researcher to replicate the research for future advancement while maintaining the continuity of what has already been accomplished.
3. The research's procedural design should be properly developed in order to produce the most objective results possible.
4. All good research must be logical. This suggests that research is governed by logical thinking norms, and the logical processes of induction and deduction are extremely useful when conducting research.
5. The researcher should fully disclose shortcomings in procedural design and evaluate their impact on the findings.

6. Data analysis should be sufficient to disclose its relevance, and the procedures utilised should be appropriate. The authenticity and trustworthiness of the data should be carefully examined.
7. Conclusions should be limited to those that are supported by the study data and for which the data give an appropriate basis.
8. More trust in research is justified if the researcher is experienced, has a high reputation in research, and is a person of sincerity. [26]

11. Research Process

The research process is a systematic and structured technique to collecting, analysing, and interpreting data or information in order to answer a specific research question or solve a particular problem.[7]The research process includes identifying a research topic, understanding its context through a literature review, developing research questions and objectives, designing a research project, selecting a sample, collecting data, analysing the data, and reporting the findings in a research report. The research process consists of a series of steps or actions required for effectively conducting research while formulating the research problem, extensive literature survey, developing hypothesis, preparing the research design, determining sample design, collecting data, executing the project, data analysis, hypothesis testing, generalisation and interpretation, and preparation of the report or presentation of the results. Research supports scientific and inductive thinking, as well as the development of logical thinking and organisational skills. The Research Process is a series of scientific steps taken when performing research. Each step is linked to the ones before it. The process begins with a research problem. Then it moves on to the next steps in sequence. A researcher typically follows a seven-step research process. A Research Proposal is the primary requirement for research work. It is because the proposal approves the research study, regardless of whether you are able to perform research. So, when writing a research proposal, convey the detailed strategies and particular objectives of your research properly.[8]

Step 1: Identify and define the Research Problem : The first stage is to identify an issue or formulate a research topic. The research challenge could be anything the agency perceives as a problem, some knowledge or information that the agency requires, or a desire to discover a national recreational trend. However, the study problem arises from a continuous phenomenon or issues. A research problem is a statement about an area of concern, a condition to be improved, a difficulty to be eliminated, or a troubling question that exists in scholarly literature, theory, or practice and indicates the need for meaningful understanding and deliberate investigation. In various social science areas, the research problem is usually presented in the form of a question. A research challenge does not specify how to achieve anything, make an ambiguous or wide claim, or pose a value question.[28]

Step 2: Review the Literature: Once the research problem has been established and defined, the following stage is to review previous research. The researcher needs to understand more about the topic under examination. To accomplish this, the researcher needs examine the literature relevant to the research problem. This step offers basic information regarding the problem area. The examination of literature also informs the researcher about previous investigations, how they were conducted, and the findings in the problem area.[24]

Step 3. Formulating a Hypothesis: Hypothesis can be defined as a proposition or set of propositions presented as an explanation for the occurrence of a certain group of occurrences, or as a tentative guess to lead a research in light of documented facts. A research hypothesis is typically a predicted assertion that may be tested using scientific methods involving independent and dependent variables.

A hypothesis should include the following characteristics: -

- i. A hypothesis should be explicit and clear. If it is not exact and unambiguous, the inferences derived from it will be unreliable.
- ii. The theory must be testable. Quite often, research initiatives fail because they are incapable of being tested for validity. As a result, the researcher may need to do some preliminary research in order to test a hypothesis. A theory "is tested if other deductions can be made from it, which in turn can be confirmed or disproved by observation"
- iii. Relational hypotheses require a hypothesis to state the relationship between two variables.

iv. A hypothesis should be specific and limited in scope. This is because the researcher will find it easier to examine a simpler hypothesis. As a result, he or she must come up with hypotheses.

v. A hypothesis should be described in the simplest language feasible in order for all parties involved to understand it. However, the simplicity of a hypothesis does not correlate with its relevance.[24]

Step 4: Research Design There are several types of study designs. They can be divided into three categories: exploratory research design, descriptive and diagnostic research design, and hypothesis-testing research design.

1. **Exploratory Research Design** The exploratory research design is also known as formulative research design. The primary goal of utilising such a research design is to establish a research problem for a more in-depth or precise inquiry, or to develop a working hypothesis from an operational perspective. The primary goal of these investigations is to discover new ideas and insights. As a result, a research design appropriate for such a study should be adaptable enough to allow for the consideration of various aspects of the subject under investigation. The in-built flexibility in research design is essential since the initial research topic will be turned into a more precise one in the exploratory investigation, which may entail adjustments in the research technique for collecting relevant data. Typically, the following three strategies are considered when developing a research strategy for such studies. They are: (a) a survey of related literature; (b) an experience survey; and (c) an analysis of 'insight-stimulating' cases.

2. **Descriptive and Diagnostic Research Design** A descriptive research design focuses on describing the features of a specific individual or group. Meanwhile, a diagnostic research design determines how frequently a variable happens or how it relates to another variable. In other words, a diagnostic research study involves determining whether one characteristic is connected with another. On the other hand, a research that is concerned with particular predictions or the narration of facts and features connected to an individual, group, or circumstance is an example of descriptive research studies. Generally, the majority of social research designs fall under this group. As a study design, descriptive and diagnostic investigations have similar needs, hence they are categorised together. However, the process and research design must be carefully prepared. The research design must also include sufficient provisions for bias protection, maximising reliability while completing the research project in an efficient manner. The study design in such investigations should be strict, not fluid. Furthermore, it must focus emphasis on the following: a) Determination of the study's objectives b) Proper design of data collection procedures c) Sample selection d) Data collection e) Processing and analysis of the collected data f) Reporting the findings. [27]

3. **Hypothesis- Testing Research Design** Hypothesis-testing Research designs involve testing the notion of a causal relationship between two or more variables. These investigations require approaches that not only reduce bias and improve reliability, but also make it easier to draw causal inferences. Generally, experiments meet such requirements. As a result, when study design is considered in such studies, it is frequently associated with experiment design. **Characteristics of Good Research Design** A strong study design is frequently adaptable, appropriate, efficient, and cost-effective. A good study design is one that minimises bias while increasing the reliability of the data collected and examined. A study strategy that excludes even the tiniest experimental error is believed to be the best for exploration. Furthermore, the most appropriate and efficient research design is one that gives the most information and allows for the examination of all aspects of a research subject. Thus, the question of a good design is related to the aim or objective, as well as the nature of the research problem being studied. A good study design may not be applicable for all studies. In other words, it may be missing in one or more aspects in certain other research difficulties. As a result, no single research design can be used to address all types of research challenges. [31]

Step 5. Primary Data Collection Primary data might be acquired through experiments or surveys. If a researcher conducts an experiment, he observes certain quantitative measurements, or data, with the goal of determining the truth of his hypothesis. However, when conducting a survey, data can be obtained in any of the following ways:

(i) **Through observation:** This method entails gathering information from the investigator's own observation, rather than conducting interviews with respondents. The information gained is relevant to what is now happening and is not influenced by respondents' past behaviour or future plans or opinions. This method is,

without a doubt, expensive, and the information it provides is limited. As a result, this strategy is unsuitable for queries involving large samples.

(ii) Through personal interviews: The investigator follows a strict protocol and seeks answers to preconceived questions through personal interviews. This kind of data collection is typically carried out in a systematic manner, with the interviewer's ability playing a significant role in the outcome.

(iii) Telephone interviews: This method of data collection involves contacting respondents by telephone. This is not a common method, but it is useful in industrial surveys in industrialised countries, especially when the survey must be completed in a short period of time.

(iv) By mailing of questionnaires: If this survey approach is used, the researcher and the respondents will interact with one another. Questionnaires are mailed to respondents, with a request to return once completed. It is the most often used approach for conducting economic and business surveys. Before using this strategy, a pilot study is normally conducted to test the questionnaire and identify any shortcomings. The questionnaire to be utilised must be carefully developed in order to be effective in collecting essential information. [30]

(v) Through schedules: This method involves the appointment and training of enumerators. They are given schedules with appropriate questions. These enumerators approach respondents using these schedules. Enumerators collect data by filling out schedules based on responses provided by respondents. In terms of this approach, enumerator capacity is critical. Some field checks on the enumerators' work may be necessary to verify sincerity.

Step 6. Determination of sample design

A researcher should consider the following aspects while establishing a sample design:

1. Type of Universe: The first stage in establishing a sample design is to clearly identify the number of cases, also known as the universe. A universe can be finite or limitless. In a finite universe, the number of items is known; in an infinite universe, the number of items is unknown. For example, whereas a city's population or the number of people in a factory are finite universes, the number of stars in the sky or the roll of a die represents an infinite universe.

2. Sampling Unit: Before picking a sample, a choice must be made on the sampling unit. A sample unit can be a geographical area such as a state, district, or town, a social unit such as a family, religious organisation, or school, or even an individual. At times, the researcher would have to select one or more of these units for his or her study.

3. Source List: The source list, also known as the 'sampling frame', is used to choose the sample. The source list includes the names of all the things in a universe. When there is no source list accessible, the researcher must create one. The source list must be reliable, complete, correct, and relevant. It's important.

4. Size Of Sample: The size of the sample refers to the number of items selected from the universe to create the sample. For a researcher, this is a huge issue. The sample size must be optimal. An ideal sample can be characterised as one that meets the requirements of authenticity, adaptability, effectiveness, and reliability. When determining the size of the sample, a researcher should consider the desired precision and acceptable confidence level for the estimate. The amount of the population variance should be evaluated, as a bigger variance typically necessitates a larger sample size. The size of the population should be considered because it restricts the sample size. [32]

A researcher should choose one of several sample design options for his or her study. It is obvious that the researcher should choose the design that results in the smallest error for a given sample size and budget. Types of Sample Designs: Sample designs can be divided into categories based on two factors: the representation basis and the element selection technique. According to the representational basis, the sample can be characterised as non-probability sampling or probability sampling. While probability sampling is based on random selection, the nonprobability sampling method relies on 'non-random' sample selection.

1. **Non-Probability Sampling:** Non-probability sampling is a sampling process that provides no foundation for determining the likelihood that each item in the population has an equal chance of being included in the sample. Non-probability sampling is often referred to as deliberate sampling, judgement sampling, or intentional sampling. Under this sort of sampling, the researcher consciously selects the sample items, and his or her decision is final. In other words, in non-probability sampling, researchers choose a specific unit of the universe to form a sample on the assumption that the small number chosen from a large one will be typical or representative of the entire population.[28] For example, to investigate the economic situations of individuals living in a state, a few towns or villages may be purposefully chosen for thorough research on the grounds that they are typical of the entire state. In such cases, the researcher's judgement is paramount in this sampling strategy. Quota sampling is also a type of non-probability sampling. Under this sampling method, the researchers simply assume that quotas will be supplied from various strata, with some limits on how they should be chosen. This type of sampling is extremely convenient and reasonably inexpensive. However, the samples chosen using this method clearly do not meet the requirements of random sampling. These are essentially judgement samples.

2. **Probability Sampling:** Probability sampling is also known as 'choice sampling' and 'random sampling'. This sampling design gives every item in the universe an equal chance of being included in the sample. In a sense, it is a lottery system in which individual units are chosen from the entire group, not consciously, but through some mechanical mechanism. As a result, whether or not an item is included in the sample is entirely up to chance. The findings produced through probability or random sampling would be guaranteed in terms of probability. That is, the researcher can assess the estimating errors or the importance of the results acquired from the random sample. This demonstrates the superiority of random sampling over purposeful sampling design. Random sampling follows the principle of statistical consistency law, which states that if the sample picked is random on average, it will have the same composition and features as the entire universe. This is why random sampling is regarded as the most effective way for selecting a representative sample.[34]

Step 7: Execution of the project: After developing a suitable research design, the researcher should proceed to the following stage of execution. At this point, the researcher begins implementing the research design. Surveyors should receive training as well as a working manual. The acquisition of data should be handled with caution.

Step 8. Analysis of data: Soon after collecting the data, the researcher begins the process of analysing it. Raw data will be tweaked. Many tools are used for analysis, including coding, tabulation, editing, and statistical analysis. Data will be obtained using questionnaires or schedules. As a result, the data obtained in short forms will be extended using code. Editing might take place during the data collection process. The researcher removes all faults from the project by revising it. It'll be refined. Tabulation is the process by which researchers prepare tables. square test, t-test, F-test, have been developed by statisticians for the purpose. The hypotheses may be tested through the use of one or more of such tests, depending upon the nature and object of research inquiry. Hypothesis-testing will result in either accepting the hypothesis or in rejecting

Step 9. Hypothesis-testing: After examining the data as described above, the researcher is in a position to test any hypotheses he had previously formulated. Do the facts support the hypotheses, or are they contrary? This is the standard question that should be addressed when testing hypotheses. Statisticians have devised a variety of tests for this purpose, including the Chi square test, t-test, and F-test. Depending on the nature and purpose of the research, one or more of these tests may be used to examine the hypotheses. Hypothesis testing will determine if the hypothesis is accepted or rejected. If the researcher had no hypotheses to begin with, generalisations generated on the basis of evidence can be stated as hypotheses to be tested by subsequent researches in times to come.

Step 10. Generalisations and interpretation: If a hypothesis is tested and supported multiple times, the researcher may be able to generalise, i.e., construct a theory. In fact, the true usefulness of research is its ability to arrive at certain generalisations. If the researcher did not have a hypothesis to begin with, he may attempt to explain his findings using a theory. It's called as interpretation. The interpretation process frequently generates new questions, which can lead to additional research.

Step 11. Preparation of the report or the thesis: Finally, the researcher must submit a paper detailing his work. Writing a report requires careful consideration of the following: 1. The format of the report should be as follows: (i) Preliminary pages; (ii) Main content; and (iii) End matter. The report's first few pages should include the title and date, as well as acknowledgements and a foreword. The table of contents should then be followed by a list of tables, as well as a list of any graphs or charts included in the report. The main text of the report should include the following sections: (a) Introduction: It should include a clear statement of the research's purpose as well as an explanation of the technique used to carry it out. This section should also include the study's scope and limits. (b) Summary of findings: Following the introduction, there will be a statement of findings and suggestions in non-technical language. If the results are extensive, they should be summarised. (c) Main Report: The major content of the report should be presented in logical order and divided into easily recognised sections. (d) Conclusion: Towards the end of the main paragraph, the researcher should state the findings of his research clearly and exactly. In fact, this is the ultimate summary. [9]

12. Research ethics

Ethics are ethical ideals that guide a person's actions. Research ethics may be defined as doing what is morally and legally correct in research. They actually represent norms that distinguish between what is good and wrong, as well as acceptable and undesirable actions. Even virtually few aspects of research ethics have been codified in legislation, moral standards largely control the conduct of research. Ethical considerations have become increasingly important within the research community. With growing public concern about the scope of the investigation and regulatory changes in human rights and data protection, ethical questions have risen to the forefront of social research. With the advancement of technology, new ethical dilemmas have emerged in the field of communication research. [30] Despite dealing primarily with human and animal participation, different fields of social sciences employ various approaches and ethical concerns. Aside from decisions guided by common beliefs and experiences, ethical principles may allow the researcher to make personal ethical judgements in addition to professional ethics. Researchers must bear full responsibility for the ethical conduct of their own study. To put it simply, ethics are the obligation of researchers. The first and greatest responsibility of a researcher is to ensure the safety, dignity, rights, and well-being of participants. Researchers must address a variety of other difficulties at different stages of the research process. Both the researcher and the people taking part play essential roles. One's rights are another's obligations. Researchers must protect the rights of participants and conduct research from their perspective. Throughout the research process, the researchers must fulfil a variety of tasks. They must do their research with honesty, objectivity, and integrity. The researcher must obtain the participants' consent for their participation. They must respect individuals, their cultures, values, beliefs, socioeconomic status, and so on. Researchers have an obligation to protect the confidentiality and personal information or identity of participants regardless of what she chooses. Researchers ought to prevent studies that may endanger both those who participate and themselves. Aside from those who participated, the researcher has a commitment towards society, her coworkers or other investigators, and the project's financiers [10] Researchers should also attempt to be as ethical as feasible when analysing study findings. Researchers should do their utmost not to overinterpret or misinterpret the data and to accurately represent the possible findings. Researchers can employ triangulation techniques or interview individuals to validate their conclusions, as well as other techniques presented in qualitative methodologies.[11]

12.1 Objectives of research ethics

1. The primary and overarching goal is to protect human participants.
2. The second purpose is to ensure that research is conducted in a way that benefits individuals, groups, and/or society as a whole.
3. Finally, the third purpose is to analyse particular study operations and initiatives for their ethical robustness, looking at concerns such as risk management, confidentiality protection, and informed consent processes.[33]

12.2 Importance of Research Ethics

Research ethics is crucial for a variety of reasons.

- 1.They promote the goals of research, such as increasing knowledge.

2. They endorse the ideals necessary for collaborative work, such as mutual respect and fairness.
3. This is critical since scientific research requires collaboration among researchers and groups.
4. They imply that researchers should be held accountable for their conduct. Many researchers get public funding, and policies governing conflicts of interest, misbehaviour, and research involving humans or animals are required to guarantee that funds are spent wisely.
5. They make sure that the public trusts science. People must believe in research before they will support or fund it.[33]

12.3 Principles of Research Ethics

Ethical principles are essential in our conception of what makes acceptable scientific conduct, and they are reflected in professional codes and guidelines, institutional and journal policies, and government rules and regulations [13]. The principles are as follows:

- **Honesty:** Prioritise honesty in scientific discourse. Provide accurate data, results, methods and procedures, and publication status. Do not invent, falsify, or distort information. Do not mislead coworkers, grant agencies, or the public. [35]
- **Objectivity :** Maintain objectivity in all stages of research, including experimental design, data analysis, interpretation, peer review, personnel decisions, grant writing, and expert testimony. Avoid or reduce bias and self-deception. Disclose any personal or financial interests that may influence research.
- **Integrity :** Keep your pledges and agreements; act honestly; seek for consistency in thought and action.
- **Carefulness :** Critically evaluate your own and others work to avoid casual errors and neglect. Keep detailed records of your research efforts, including data gathering, research design, and correspondence with agencies or publications.
- **Openness:** Be open and share data, outcomes, ideas, tools, and resources. Be open to feedback and new ideas.[16]
- **Respects for Intellectual Property:** Respect patents, copyrights, and other types of intellectual property. Do not use unpublished data, techniques, or results without authorization. Give credit where it's due. All scientific contributions should be acknowledged or credited appropriately. Never plagiarise.
- **Confidentiality :** Protect private communications, including papers, grants, personnel data, records of patient as well as trade or military secrets.
- **Responsible Publication:** Publish responsibly to improve research and scholarship, not just your personal career. Avoid wasteful and duplicative publications.
- **Responsible Mentoring:** Educate, mentor, and advise pupils. Promote their well-being and provide them the freedom to make their own decisions. .
- **Respect for colleagues :** Respect coworkers and treat them fairly.
- **Social Responsibility:** Prioritise social responsibility by conducting research, educating the public, and advocating for positive change.
- **Non-Discrimination :** Prohibit discrimination against colleagues or students based on gender, race, ethnicity, or other criteria unrelated to their scientific competence and integrity.
- **Competence :** Maintain and increase professional competence and expertise through lifelong education and learning. Take initiatives to promote scientific competence in general.
- **Legality:** Abide by applicable laws, institutional policies, and government regulations.
- **Animal Care :** When conducting research with animals, it's important to care for and respect them. Avoid conducting superfluous or poorly designed animal studies.[12]
- **Stewardship of resources:** Effective resource stewardship requires scientists to use physical, financial, and other resources efficiently.
- **Fair credit:** Scientists must distribute recognition honestly.
- **Freedom:** Scientists ought to uphold the right to free inquiry and discussion.[13]

12.4 Ethical Dilemmas in Research

Ethical principles may contradict with one another or with other norms or beliefs. When this happens, researchers face ethical quandaries and must decide which course of action to pursue. Some common ethical difficulties in research are as follows.

- **Analysing data:** Researchers confront challenges while analysing data, including dealing with outliers and missing data, altering data, utilising statistical tools to make conclusions, and representing data digitally. Tensions may arise between honestly reporting all of the data in an unbiased manner and presenting convincing and clear outcomes. [13]
- **Sharing data:** The obligation of sharing data may conflict with other obligations and interests, such as protecting human subjects' privacy and confidentiality, protecting proprietary business information as well as intellectual property rights, adhering to highly classified research rules, and ensuring scientific priority and credit for one's accomplishments. Scientists can employ a range of tactics, such as data sharing and confidentiality agreements, to balance the requirements to disclose data and safeguard privacy.
- **Assigning authorship:** Choosing an author for a scientific paper can be difficult since people have various ideas about what constitutes a meaningful contribution. Though journal rules can assist settle some of these difficulties, it is also beneficial to clarify authorship issues at the beginning of a scientific partnership. [26]
- **Conflicts of interest:** A conflict of interest in research occurs when an investigator has a professional, personal, or financial stake that is likely to influence his or her judgement or behaviour. Difficult considerations can arise when evaluating which types of interests should be revealed and whether certain forms of conflicts should be disallowed [14]
- **Peer review:** Peer review improves the quality of published research. The most qualified reviewers in a given field frequently have a vested interest in advancing their own theories or censoring competing research organisations. Ethical difficulties can arise when considering how to establish methods that encourage fair and effective review while minimising prejudice. [15]
- **Intellectual property:** Patenting encourages scientific and technological innovation, however others say that certain biological systems, such as organisms, DNA, and human cell lines, should not be patented. Others are concerned that pharmaceutical and technological patents undercut access to cheap medications [15]
- **Reporting misconduct:** The need to disclose suspected misconduct (described below) frequently conflicts with self-interest, because the individual who makes an accusation may incur professional or personal consequences, as well as the loss of significant time and effort. Although organisations have policies to protect whistleblowers against direct retribution, these rules do not guarantee that those who report misbehaviour will face no unfavourable personal repercussions. Individuals still confront difficult choices when determining whether to reveal unlawful or unethical activities.[14].
- **Human subjects research:** Human subjects research raises a wide range of ethical concerns. Most of these quandaries focus around the fundamental conflict between furthering scientific research and defending human rights and well-being. For example, quandaries can emerge while choosing whether placebos should be used in clinical experiments. Placebo control groups are frequently used to assure scientific rigour. However, those who are given placebos will not obtain an effective treatment. Failure to provide an effective treatment to a subject taking part in a clinical study violates the physician/investigator's duty to benefit his patients. [27]
- **Animal research:** The most fundamental ethical concern with animal research is whether it should be performed at all. Some animal rights activists claim that all animal research is unethical and should be prohibited, while proponents of animal research argue that the knowledge gained from animal experimentation has significant benefits to human health. Even supporters of animal research admit that difficult dilemmas may arise when trials that enhance biomedical science inflict severe pain or suffering to animals.
- **Social responsibility:** Scientists who join in political disputes may face ethical quandaries. Though scientists have the right and obligation to provide expertise and recommendations to the public, taking a strong stance on a subject may jeopardise their objectivity. Dilemmas can also occur when scientists

determine whether and how to communicate with the media, as journalists may misinterpret study findings. Scientists may be inclined to oversimplify their findings in order to guarantee that the public gets the right message.[13]

12.5 Research misconducts

Fabrication, falsification, or plagiarism in proposing, conducting, or evaluating research, as well as reporting study results, is considered as research misconduct.[16]

Honest errors or differences of opinion are not considered research misconduct. There are various sorts of research misconduct, including scientific misconduct and unethical activities in research. The most significant ethical violations are fabrication, falsification, and plagiarism in research. Some of the most common types of research misconduct are described below.

(a) Fabrication entails making up data or findings and recording or reporting them. Fabrication implies that data is just invented. Research misconduct includes not only the act of fabrication, but also the sharing, discussing, or publishing of created data or results.

(b) Falsification entails manipulating research materials or changing or omitting data or outcomes so that the research is inaccurately represented in the research record. Falsification occurs when existing data is 'pruned' to take on the required form or 'massaged' to produce the intended outcome. This sort of scientific misconduct involves the deliberate modification of data, materials, methods, or equipment to reach a predetermined conclusion. One such example is purposefully missing or modifying data, resulting in an inaccurate depiction of research results.

(c) Plagiarism is the use of another person's ideas, techniques, results, or words without proper credit. Passing off someone else's intellectual property (knowledge or ideas) as one's own without citing the original source e.g., research papers. Particularly in the era of the Internet, this type of wrongdoing is gaining tremendous relevance.

(d) Authorship: This sort of scientific misconduct in research involves attempting to assign fraudulent authorships without sufficient contribution to the research, citing authors without their consent, or failing to include authors who are primary contributors. Naming authors out of order or inaccurately is also deemed unethical.[32]

(e) Conflicts of interest: This is regarded as general scientific fraud because researchers failed to declare any conflicts of interest in their research effort. These conflicts of interest might be financial, personal, or professional, and must be reported properly to prevent ethical concerns.

(f) Approvals. One of the most crucial aspects of human or animal subject research is to follow all ethical and regulatory rules. Failure to comply this ethical duty is considered a serious kind of research misconduct.[16]

Conclusion

Lack of knowledge in scientific methods is causing some issues for researchers when they undertake research. To maintain research integrity, research scholars and research organizations are required to adhere to specific research ethics. Before conducting research and producing research results in a paper, plagiarism should be carefully evaluated since it is an essential component of research ethics. A component of research methodology is research methods, but research methodology's scope and scale are larger than those of research methods. In the modern world, research is an important instrument for increasing knowledge and promoting learning. It is now used in practically all industrial sectors and educational institutions, albeit only in small amounts. There should be a constant increase in awareness among the among the people about research in order to facilitate research to be carried out effectively, efficiently and honestly without any hurdles.

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