

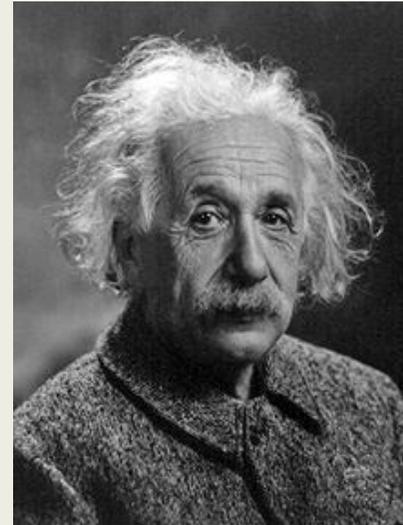
RESEARCH METHODOLOGY

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INTRODUCTION TO RESEARCH

“IF WE KNEW WHAT WE WERE DOING, IT WOULDN'T BE CALLED RESEARCH, WOULD IT?”

Albert Einstein?



DEFINITION OF RESEARCH

- Research is the process of asking questions and answering them in an organized way through:
 - Survey
 - Experiment
- It involves:
 - Examination of limits of knowledge
 - Assessing what is known up to that point
 - Defining unanswered questions
 - Devising ways of answering them in an organized and meaningful way
- It will be within the capability of every thinking person

DEFINITION OF RESEARCH

Research is a systematized effort to gain new knowledge.

-Redman and Mory.



Research is the systematic process of collecting and analyzing information (data) in order to increase our understanding of the phenomenon about which we are concerned or interested.

DEFINITION OF RESEARCH

- Research is knowledge acquisition gained
 - through reasoning
 - through intuition
 - but most importantly through the use of appropriate methods (The scientific method)

-Polgar, Thomas

- Research is an endeavour to discover answers to intellectual and practical problems through the application of scientific method.

SCIENTIFIC METHOD

- Scientific method is the systematic collection of data (facts) and their theoretical treatment through-
 - *proper observation,*
 - *experimentation and*
 - *interpretation.*
- Scientific method attempts to achieve a systematic interrelation of facts by experimentation, observation, and logical arguments from accepted postulates (Hypothesis) and a combination of these three in varying proportions.

BASIC POSTULATES IN SCIENTIFIC METHOD

- ❖ It relies on empirical (Experimental) evidence.
- ❖ It utilizes relevant concepts.
- ❖ It is committed to only objective considerations.
- ❖ It presupposes ethical neutrality.
- ❖ It results in to probabilistic predictions.
- ❖ The methodology is made known.
- ❖ Aims at formulating scientific theories.

OBJECTIVES OF RESEARCH

- ❖ **The purpose of research is to discover answers through the application of scientific procedures.**
- ❖ **The objectives are:**
 - To gain familiarity with a phenomenon or to achieve new insights into it – Exploratory or Formulative Research.
 - To portray accurately the characteristics of a particular individual, situation or a group – Descriptive Research.
 - To determine the frequency with which something occurs or with which it is associated with something else – Diagnostic Research.
 - To test a hypothesis of a causal relationship between variables – Hypothesis-Testing Research.

CHARACTERISTICS OF RESEARCH

- ❖ Research is directed towards the **solution of a problem.**
- ❖ Research is based upon **observable experience or empirical evidence.**
- ❖ Research demands **accurate observation and description.**
- ❖ Research involves **gathering new data** from primary sources or **using existing data** for a new purpose.
- ❖ Carefully designed procedures characterize research activities.
- ❖ Research requires **expertise, i.e., the skill necessary to carry out an investigation, search the related literature, and understand and analyze the data gathered.**
- ❖ Research is **objective and logical** – applying every possible test to validate the data collected and conclusions reached.
- ❖ Research involves the **quest for answers to unsolved problems.**
- ❖ Research requires **courage.**
- ❖ Research is characterized by **patient and unhurried activity.**
- ❖ Research is carefully **recorded and reported.**

GOOD RESEARCH PROCESS

- Research is an extremely cyclic process.
- This isn't a weakness of the process but is part of the built-in error correction machinery.
- Because of the cyclic nature of research, it can be difficult to determine where to start and when to stop.

STEPS OF A GOOD RESEARCH PROCESS

- Raising a Question.
- Suggest Hypothesis.
- Literature Review.
- Literature Evaluation.
- Acquire Data.
- Data Analysis.
- Data Interpretation.
- Hypothesis Support.

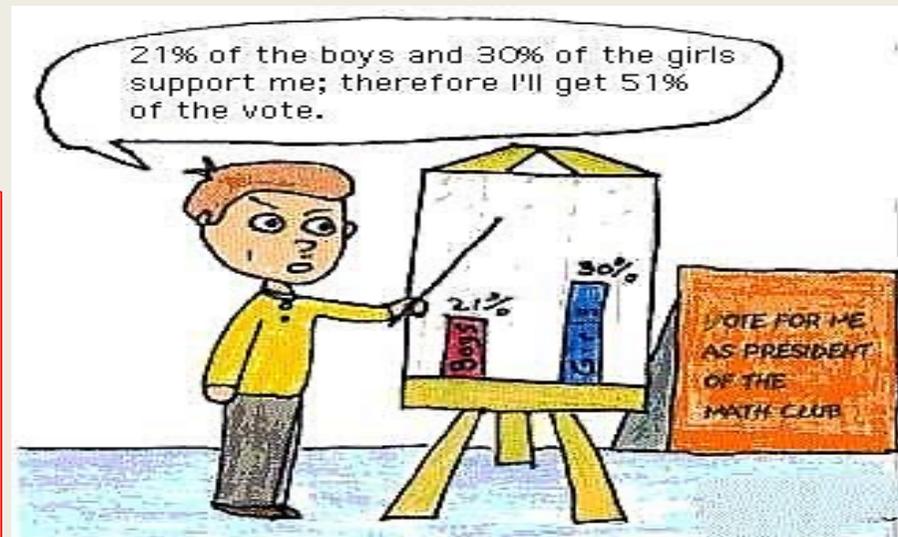
STEP 1 A QUESTION IS RAISED

- A question occurs to or is posed to the researcher for which that researcher has no answer.
 - Example: What is the impact of microplastics on the growth and reproduction of aquatic animals in the Ganga River, India?
- The question needs to be converted to an appropriate problem statement, like that documented in a research proposal.
 - Example: What if microplastics affect the growth and reproduction of aquatic animals in the Ganga River, India?

STEP 2 SUGGEST HYPOTHESIS

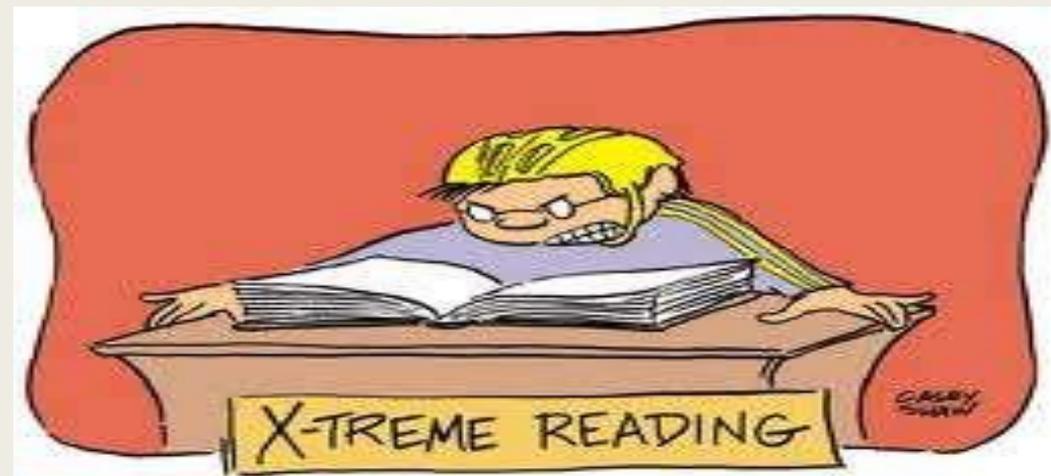
- The researcher generates intermediate hypotheses to describe a solution to the problem.
 - This is at best a temporary solution since there is as yet no evidence to support either the acceptance or rejection of these hypothesis.

The impact of microplastics on aquatic animals in the Amazon River was reported; therefore, microplastics will affect aquatic animals in the Ganga River



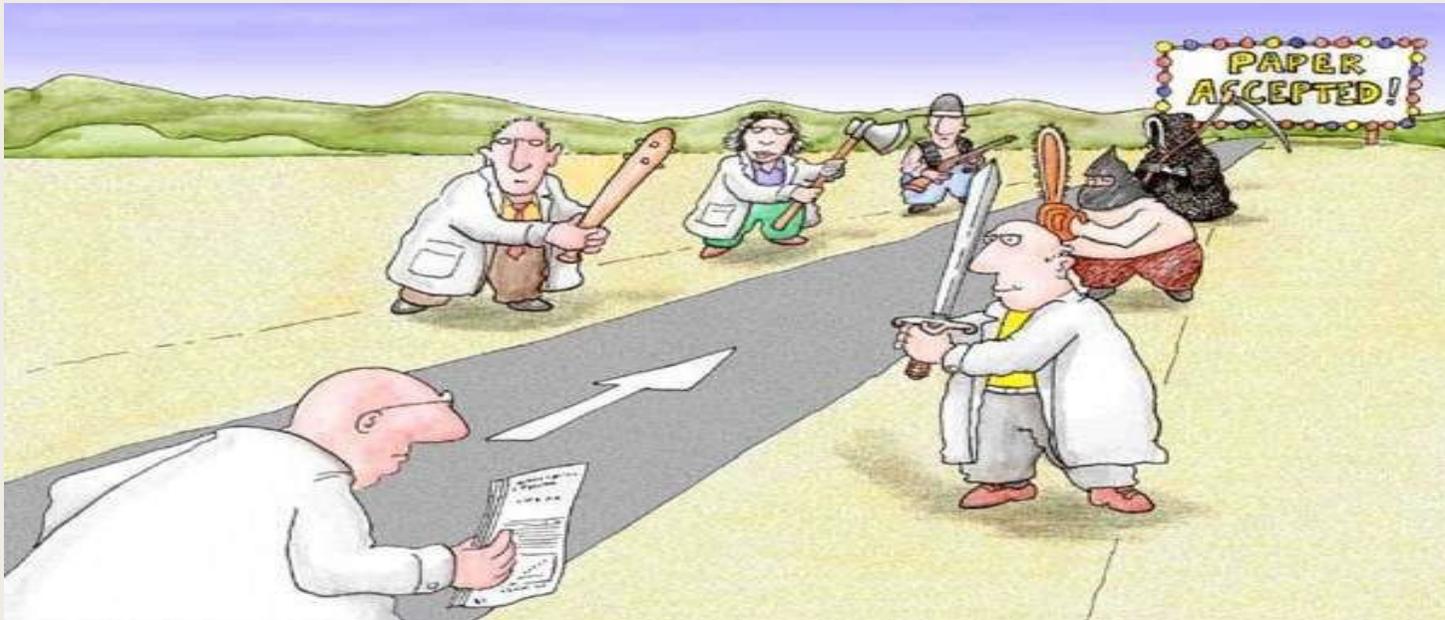
STEP 3 LITERATURE REVIEW

- The available literature is reviewed to determine if there is already a solution to the problem.
 - Existing solutions do not always explain new observations.
 - The existing solution might require some revision or even be discarded.



STEP 4 LITERATURE EVALUATION

- ❑ It's possible that the literature review has yielded a solution to the proposed problem.
- ❑ On the other hand, if the literature review turns up nothing, then additional research activities are justified.



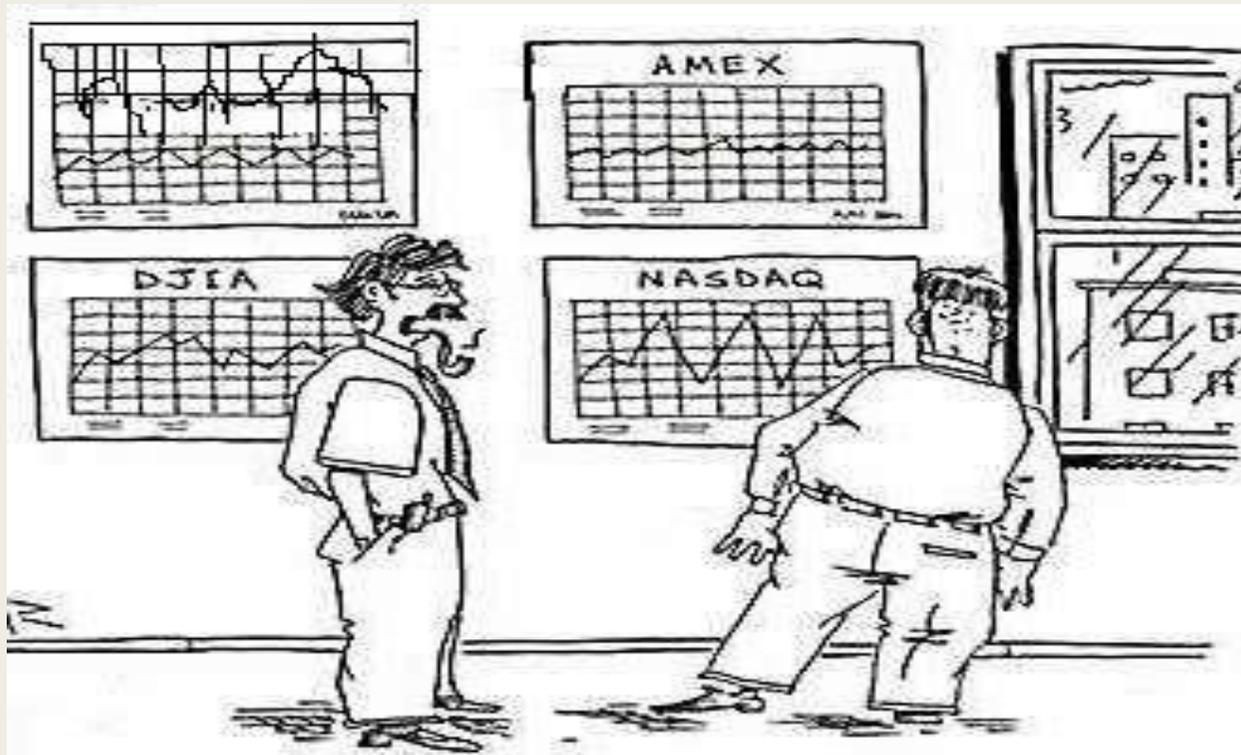
STEP 5 ACQUIRE DATA

- The researcher now begins to gather data relating to the research problem.
- The means of data acquisition will often change based on the type of the research problem.



STEP 6 DATA ANALYSIS

- ❖ The data that were gathered in the previous step are analyzed as a first step in ascertaining their meaning.



STEP 7 DATA INTERPRETATION

- The researcher interprets the newly analyzed data and suggests a conclusion.
 - *This can be difficult.*
 - *Keep in mind that data analysis that suggests a correlation between two variables can't automatically be interpreted as suggesting causality between those variables.*



STEP 8 HYPOTHESIS SUPPORT

- The data will either support the hypotheses or they won't.
 - *This may lead the researcher to cycle back to an earlier step in the process and begin again with a new hypothesis.*
 - *This is one of the self-correcting mechanisms associated with the scientific method.*



TYPES OF SCIENTIFIC RESEARCH

- ❑ The research is broadly classified into two main classes:
 - 1. *Fundamental or basic research*
 - 2. *Applied research.*
- ❑ Both basic and applied researches are generally of two kinds:
 - 1. *Normal research*
 - 2. *Revolutionary research.*
- ❑ In addition, both basic and applied researches can be classified into three types:
 - *Quantitative*
 - *Qualitative*
 - *Even both (mixed research).*

TYPES OF SCIENTIFIC RESEARCH

- *Fundamental or basic research*
 - *Study or investigation of some natural phenomenon or relating to pure science are termed as basic research.*
 - *It is also called theoretical research.*
 - *Basic research is an investigation on basic principles and reasons for occurrence of a particular event or process or phenomenon.*
 - *It is not concerned with solving any practical problems of immediate interest.*
 - *But it is original or basic in character.*

TYPES OF SCIENTIFIC RESEARCH

□ *Fundamental or basic research*

- *It provides a systematic and deep insight into a problem and facilitates the extraction of a scientific and logical explanation and conclusion on it.*
- *It helps build new frontiers of knowledge.*
- *The outcomes of basic research form the basis for many applied research.*

Main Characteristics

- *Seeks generalization*
- *Aims at basic processes*
- *Attempts to explain why things happen*
- *Tries to get all the facts*
- *Reports in technical language of the topic*

TYPES OF SCIENTIFIC RESEARCH

□ *Applied research*

- *In an applied research one solves certain problems using well known and accepted theories and principles.*
- *Most of the experimental research, case studies and inter-disciplinary research are essentially applied research.*
- *Applied research is helpful for basic research.*
- *A research, the outcome of which has immediate application is also termed as applied research.*

TYPES OF SCIENTIFIC RESEARCH

□ *Applied research*

Main Characteristics

- *Studies individual or specific cases without the objective to generalize*
- *Aims at any variable which makes the desired difference*
- *Tries to say how things can be changed*
- *Tries to correct the facts which are problematic*
- *Reports in a common language*

TYPES OF SCIENTIFIC RESEARCH

□ *Normal research*

In any particular field, normal research is performed in accordance with a set of rules, concepts and procedures called a paradigm, which is well accepted by the scientists working in that field.

□ *Revolutionary research*

In the context of science and technology, a revolution can be defined as a complete or marked change in rules, concepts and procedures called a paradigm. A revolutionary research will result in a paradigm shift that provides a new or perhaps highly revised map of the knowledge as it is currently understood.

TYPES OF SCIENTIFIC RESEARCH

- *Quantitative research*
 - *It is numerical, non-descriptive, applies statistics or mathematics and uses numbers.*
 - *It is an iterative process whereby evidence is evaluated.*
 - *The results are often presented in tables and graphs.*
 - *It is conclusive.*
 - *It investigates the what, where and when of decision making.*

TYPES OF SCIENTIFIC RESEARCH

□ *Qualitative research*

- *It is non-numerical, descriptive, applies reasoning and uses words.*
- *Its aim is to get the meaning, feeling and describe the situation.*
- *Qualitative data cannot be graphed.*
- *It is exploratory.*
- *It investigates the why and how of decision making.*

□ *Mixed research*

- *Mixed research that involves the mixing of quantitative and qualitative methods or paradigm characteristics.*
- *Nature of data is mixture of variables, words and images.*

OTHER TYPES OF RESEARCH

□ *Exploratory research*

- *Exploratory research might involve a literature search or conducting focus group interviews.*
- *The exploration of new phenomena in this way may help the researcher's need for better understanding, may test the feasibility of a more extensive study, or determine the best methods to be used in a subsequent study.*
- *For these reasons, exploratory research is broad in focus and rarely provides definite answers to specific research issues.*
- *The objective of exploratory research is to identify key issues and key variables.*

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TYPES OF SCIENTIFIC RESEARCH

□ Descriptive research

The descriptive research is directed toward studying “what” and how many off this “what”. Thus, it is directed toward answering questions such as, “What is this?”.

□ Explanatory research

- *Its primary goal is to understand or to explain relationships.*
- *It uses correlations to study relationships between dimensions or characteristics off individuals, groups, situations, or events.*
- *Explanatory research explains (How the parts of a phenomenon are related to each other).*
- *Explanatory research asks the “Why” question.*

TYPES OF SCIENTIFIC RESEARCH

□ Longitudinal Research

- ❖ Research carried out longitudinally involves data collection at multiple points in time.
- ❖ Longitudinal studies may take the form of:
 - *Trend study*- looks at population characteristics over time, e.g. organizational absenteeism rates during the course of a year
 - *Cohort study*- traces a sub-population over time, e.g. absenteeism rates for the sales department;
 - *Panel study*- traces the same sample repeatedly over time, often many year, e.g. graduate career tracks over the period 1990 – 2000 for the same starting cohort.

TYPES OF SCIENTIFIC RESEARCH

□ Cross-sectional Research

- One-shot or cross-sectional studies are those in which data is gathered once, during a period of days, weeks or months.
- Many cross-sectional studies are exploratory or descriptive in purpose.
- They are designed to look at how things are now, without any sense of whether there is a history or trend at work.
- While longitudinal studies will often be more time consuming and expensive than cross-sectional studies, they are more likely to identify causal relationships between variables.

TYPES OF SCIENTIFIC RESEARCH

□ Action Research

- Action research can be defined as “an approach in which the action researcher and a client collaborate in the diagnosis of the problem and in the development of a solution based on the diagnosis”.
- Action study assumes social world to be constantly changing, both, researcher and research being one part of that change.

□ Policy-Oriented Research

- Reports employing this type of research focus on the question ‘How can problem ‘X’ be solved or prevented?’

TYPES OF SCIENTIFIC RESEARCH

❑ Classification research

- It aims at categorization of units in to groups
- To demonstrate differences
- To explain relationships

❑ *Comparative research*

- To identify similarities and differences between units at all levels

❑ *Causal research*

- It aims at establishing cause and effect relationship among variable

❑ *Theory-testing research*

- It aims at testing validity of a unit

❑ *Theory-building research*

- To establish and formulate the theory

PROBLEMS AND BOTTLENECKS FACED BY RESEARCHERS OF INDIA

Lack of commitment in research work because of-

- *Less research related job*
- *No incentive for good research*
- *No institutional system for filling a patent application for any invention and sharing the benefit between researcher and institute*



PROBLEMS AND BOTTLENECKS FACED BY RESEARCHERS OF INDIA

- Lack of research-friendly curriculum
- Lack of knowledge and experience in research work
- Lack of good supervision for research. A good supervision ensures-
 - *sufficient time,*
 - *hands-on training,*
 - *regular meeting*
- Allocation of inadequate time resulting in excess workload for research work
- Lack of required instruments and reagents

PROBLEMS AND BOTTLENECKS FACED BY RESEARCHERS OF INDIA

□ Inadequate and problematic fund for research:

- *Not enough fund for all*
- *Huge gape between proposed fund and allocated fund*
- *Time gape between allocation of fund and research schedule*
- *Usually no fund for long-term project for individual researcher*
- *No allocated fund for maintenance/repairing the valuable instruments*
- *Insufficient fund for good publication*

PROBLEMS AND BOTTLENECKS FACED BY RESEARCHERS OF INDIA

- ❑ Lack of central laboratory and related facilities in many institutes
- ❑ Lack of research project/cell/council in many institutes resulting in-
 - *Inadequate guidance by the institute.*
 - *No collaborative approach for research quality control*
 - *Inadequate resources and staffs for research quality control such as Plagiarism check, Thesis writing format check, Biosafety ensure, Ethical assurance etc.*

RESEARCH PROBLEM

What is a research problem?

- The term ‘problem’ means a question or issue to be examined.
- **Research Problem** refers to some difficulty /need which a researcher experiences in the context of either theoretical or practical situation and wants to obtain a solution for the same.
- **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, in theory, or in practice that points to the need for meaningful understanding and deliberate investigation.

RESEARCH PROBLEM

The purpose of a problem statement is to:

- Introduce the reader to the importance of the topic being studied. The reader is oriented to the significance of the study and the research questions or hypotheses to follow.
- Places the problem into a particular context that defines the parameters of what is to be investigated.
- Provides the framework for reporting the results and indicates what is probably necessary to conduct the study and explain how the findings will present this information.

SOURCES OF PROBLEMS

- ❖ **Reading**
- ❖ **Academic Experience**
- ❖ **Daily Experience**
- ❖ **Exposure to Field Situations**
- ❖ **Consultations**
- ❖ **Brainstorming**
- ❖ **Research**
- ❖ **Intuition**

HOW TO FIND A RESEARCH PROBLEM?

Step 1: Identify a broad problem area

- ❑ As you discuss and read about your topic, look for:
 - under-explored aspects and
 - areas of concern,
 - conflict or controversy.
- ❑ Your goal is to find a gap that your research project can fill.
- ❑ To find the **Practical** or **Theoretical** research problems the focus will be different

HOW TO FIND A RESEARCH PROBLEM?

□ Practical research problems

If you are doing practical research, you can identify a problem by reading reports, following up on previous research, and talking to people who work in the relevant field or organization.

□ Theoretical research problems

Theoretical research focuses on expanding knowledge and understanding rather than directly contributing to change.

You can identify a research problem by reading recent research, theory and debates on your topic to find a gap in what is currently known about it.

HOW TO FIND A RESEARCH PROBLEM?

Step 2: Learn more about the problem

- ❑ Next, you have to find out what is already known about the problem, and pinpoint the exact aspect that your research will address.
- ❑ It have to include
 - *the context and background of problem*
 - *specificity and relevance of problem*

HOW TO FIND A RESEARCH PROBLEM?

Context and background

- Who does the problem affect?
- Has it been an issue for a long time, or is it a newly discovered problem?
- What research has already been done?
- Have any solutions been proposed?
- What are the current debates about the problem, and what do you think is missing from them?

HOW TO FIND A RESEARCH PROBLEM?

Specificity and relevance

- What particular place, time and/or animals/ people will you focus on?
- What aspects will you not be able to tackle?
- What will be the consequences if the problem is not resolved?
- Whose will benefit from resolving the problem

SELECTION OF A RESEARCH TOPIC

The selection of one appropriate researchable topic out of the identified problems or topics requires evaluation of certain criteria. These are:

- **Internal / Personal criteria** – Researcher's Interest, Researcher's Competence, Researcher's own Resource: finance and time.
- **External Criteria or Factors** – Researchable problem, Importance and Urgency, Novelty of the Problem, Feasibility, Facilities, Usefulness and Social Relevance, Research Personnel.

CONCLUSION

It plays a vital role in research design and provides a clear, precise view of the area of study.

While performing social research, diagnostic research comes into existence mostly.

**SCIENCE IS NOT BELIEF,
BUT THE WILL TO FIND OUT.”**

THANKS