#### Scientific Method

All scientists use common methods for their enquiry. All sciences whether natural or social agree up on methods of studying phenomena. But their materials differ. A biologist studying the structure of some flowers, a chemist studying radioactive properties of an element and a sociologist studying crime situation in an urban slum. All follows similar scientific methods of inquiry. But their subjects of study are different. Therefore, they use different techniques of investigation for their study. As their materials are different, their purposes also differ. All of them will observe the phenomenon and analyze them to find out their sequences this is called scientific method. Thus scientific method is a systematic step-by-step procedure (three steps-observation, hypothesis and verification) following logical process ofreasoning.

According to **prof. Morgan “scientific method being highly elastic, can be applicable to all domain of human activity where the discovery of truth is the objective”.** So the scientific method is means for gaining knowledge of the universe. As Karl Person observed “there is no short-cut to truth, no way to gain a knowledge of the universe expect through the gate way of scientific method”. Two elements of scientific method are, a) Procedural components and b)Personal Components.

###### Procedural Components.

Observation, hypothesis and verification are the three procedural components. Observation helps to collect data and help to build hypothesis. The second step is formation of one or more hypotheses. A hypothesis is tentative conclusion. It guides collection of data. The third stage is verification of hypothesis. It is done by analytical tools.

* 1. **Personal Components.**

The researcher needs imagination, analytical ability resourcefulness, skill, capacity to find out the hearts of the problem. Researcher’s ability and attitude are more important than the method of approach. Ambitions interest and perseverance are very much required to go on successfully with research. Researcher should have an objective scientific and professional qualification and personal quality andinterest.

***Meaning and essentials of scientific method***

Scientific method is a way in which one can test opinion, impressions or guess by examining available evidences fore and against them. So it is controlling lot of things and establishing stablebelief.

Essentials of scientific method are,

* + - Scientific method aims at discovering facts.
		- It is itself corrective in nature.
		- It is itself based on systematic doubts.
		- Scientific theories are abstract in nature.

In the preceding sections, we described science as a knowledge derived by systematic procedure. Therefore science is a knowledge acquired through a scientific method. So what exactly is the “scientific method”? **Scientific method** refers to a standardized set of techniques for building scientific knowledge, such as how to make valid observations, how to interpret results, and how to generalize those results. The scientific method allows researchers to independently and impartially test preexisting theories and prior findings, and subject them to open debate, modifications, or enhancements. The scientific method must satisfy four key characteristics:

 *Logical:* Scientific inferences must be based on logical principles of reasoning.

 *Confirmable:* Inferences derived must match with observed evidence.

 *Repeatable:* Other scientists should be able to independently replicate or repeat a

                         scientific study and obtain similar, if not identical, results.

 *Scrutinizable:* The procedures used and the inferences derived must withstand critical

                                scrutiny (peer review) by other scientists.

Any branch of inquiry that does not allow the scientific method to test its basic laws or theories cannot be called “science.” For instance, theology (the study of religion) is not science because theological ideas (such as the presence of God) cannot be tested by independent observers using a logical, confirmable, repeatable, and scrutinizable. Similarly, arts, music, literature, humanities, and law are also not considered science, even though they are creative and worthwhile endeavors in their own right.

The scientific method, as applied to social sciences, includes a variety of research approaches, tools, and techniques, for collecting and analyzing qualitative or quantitative data. These methods include laboratory experiments, field surveys, case research, ethnographic research, action research, and so forth. Much of this book is devoted to learning about these different methods. However, recognize that the scientific method operates primarily at the empirical level of research, i.e., how to make observations and analyze these observations. Very little of this method is directly pertinent to the theoretical level, which is really the more challenging part of scientific research.

##### Basis of scientific method

Following are the major basis of scientific method,

1. **Reliance on empiricalevidence:-**

Scientific method involves a systematic process. The answer to a question is not decided by intuition or imagination.

Relevant data are collected through observation and experimentation. The validity and the reliability of data are checked carefully and the data are analyzed thoroughly using appropriate methods of analyses.

1. **Use of concepts:-**

We use concepts to deal with real facts. Concepts are logical constructs or abstractions created from sense impressions. They are the symbols representing the meaning that we hold.

1. **Commitment toobjectivity**:-

Objectivity is the hallmark of the scientific method. It means forming a judgment upon facts unbiased by personal impressions. The conclusion should not vary from person to person. It should be same for all persons.

1. **Ethical neutrality.**

Science does not pass normative judgment on facts. It does not say they are good or bad.

Science aims nothing but making true and adequate statements about its object.

1. **Generalization.**

Scientist tries to find out the commonality of a series of event. They aim at discovering the uniformity. Assumed a discovered uniformity a logical class and it’s observed pattern, a descriptive generalization is formulated. Generalization is an act of reasoning that involves drawing broad inferences from particular observations. It is widely-acknowledged as a quality standard in quantitative research, but is more controversial in qualitative research.

1. **Verifiability.**

The findings of a research should be verifiable. Scientist must make know to others, how he arrived at his conclusion. He should thus expose his own methods and conclusions to critical scrutiny. When others test his conclusion under the same conditions, then it is accepted as correct.

1. **Logical reasoningprocess.**

The scientist method involves the logical process of reasoning. This reasoning process is used for drawing inference from the finding of a study or for arriving at conclusion. This logical reasoning process consists of induction and deduction.

**Induction:** One of the methods of logical reasoning process. Induction is reasoning from the particular to general. The inductive method consists of studying several individual cases drawing a generalization. It involves two processes-observation and generalization. Conclusion from induction method is subjected to further conformation based on more evidence

**Deduction:** deduction is reasoning from the general to the particular. This reasoning establishes a logical relationship between a major premise (evidence, idea, principle). A minor premise and a conclusion. A major premise is a previously established generalization or assumption. A minor premise is a particular case related to the major premise. The logical relationship of these premise lead to conclusion.

E.g. major premise: - All men are mortal Minor premise: - A is a man Conclusion: - A is mortal.

The logical process of both induction and deduction are useful in research studies. Both are inseparable parts of a system of reasoning. Both processes are often used simultaneously.

Difficulties in the use of scientific methods in social science research

Some theorists argue that scientific method is more applicable to physical or natural sciences: and it can not applicable to social sciences. The following are the major difficulties.

* 1. Human behavior is different. It s very difficult to categories.
	2. When human behavior is studied and analyses by another human, there may be personal problems.
	3. Psychological nature of human behavior can not be measurable.
	4. Human behavior is not uniformed and predictable. Uncertainty is existing.
	5. Difference in choice and decision.