RESEARCH METHODOLOGY AND IPR (SHS04)

Unit-I

Research methodology objectives and motivation of research-Types of research, research approaches, research methods verses methodology, research and research methodology, scientific method, Importance of research methodology, approaches of Investigation of solutions for research problem, data collection, analysis of interpretation, necessary instrumentations, criteria of good research. Defining the research problem, definition of research problem, problem formulation, necessity of defining the problem, technique involved in defining a problem.

6-hours

Meaning of research

Research is a derivative of French word "Researche" means quest, pursuit and search for truth. The term research consists of two words;

Research = Re + Search, Re means again and again and search means to find out something.

The following is the process

Person —observes again and again→ **phenomena** —collection of data, analysis of data→ **Conclusions**

Therefore research means to observe the phenomena again and again from different dimensions, Collection of data, analysis of data and make conclusions.

- The dictionary meaning of research is "careful investigation or inquiry especially through search for new facts in branch of knowledge"
- Research can also be defined as "a Scientific and systematic search for pertinent information on a specific topic". In-fact research is an art of scientific investigation.
- The research comprises defining and redefining a problem, formulating the hypothesis or suggested solutions, collecting, organizing and evaluating data making deductions and reaching conclusions and at-last carefully testing the conclusions to determine whether they fit the formulating hypothesis.

Research is not confined to science and technology only, there are vast areas of research in other disciplines such as languages, literature, history and sociology.

Whatever might be the subject, research has to be an active, diligent and systematic process of inquiry in order to discover, interpret or revise facts, events, behaviors and theories. Applying the outcome of research for refinement of Knowledge in other subject or in enhancing the quality of human life. Also becomes a kind of research and development.

Objectives of research

The main aim of research is to find out the truth which is hidden and which has not been discovered till today. Each research study has its own specific purpose.

The following are the research objectives.

1. To gain familiarity with a phenomenon or to achieve new insight into it (studies with this object in view are termed as exploratory or formulative research studies)
2. To portray accurately the characteristics of a particular individual, situation or a group (Studies with this object in view are descriptive research studies)
3. To determine the frequency with which something occurs or with which it is associated with something else (Studies with this object in view are diagnostic - research studies)
4. To test a hypothesis of Causal relationship between variables. (such studies are hypothesis testing research studies)

Motivation in Research

What makes people to undertake research? This is a fundamental question of importance. The possible motives for doing research may be either one or more of the following.

1. Desire to get a research degree with a consequential benefits.
2. Desire to face the Challenge in solving the unsolved problems, i.e., concern over practical problems initiates research
3. Desire to get intellectual joy of doing some creative work
4. Desire to be of service to society.
5. Desire to get respectability.

In addition to above factors, many more factors such as directives of government, employment conditions, curiosity about new things, desire to understand causal relationships, social thinking may motivate researchers to perform research operations.

Importance of Research or Significance of research

“All progress is born of inquiry, Doubt is often better than overconfidence, for it leads to inquiry and inquiry leads to invention" is a famous Hudson maxim in context of which the significance of research can be well understood.

- Research inculcates scientific and inductive Thinking and promotes the development of logical habits of thinking and organization.
- The role of research in several fields of applied economies, whether it is related to business or to the economy as a whole, has greatly increased in modern times. The Increasingly complex nature of business and government has focused attention on the use of research in solving Operational problems

Research proves the basis for really all government policies in our economic system e,g government budget rest in part on an analysis of the needs and desires of the people and on the availability of revenues to meet such desires

Research has its special significance in solving Various Operational and planning problems of business and industry. (OR and market research)

Research is equally important for social scientists in studying social relationships and in seeking answers to various social problems.

In addition to the above, the significance of research

1. To those students who are to write Ph.D. thesis research may mean a way to attain high position in the social structure.
2. To professionals in research methodology, research may mean a source of lively hood.
3. To philosophers and thinkers, research may mean outlet for new ideas and insights
4. To literary men, research may mean to the development of new styles and creative work
5. To analysts and intellectual, research may mean the development of new styles and creative work.

Types of Research

The basic types of research are as follows.

- Descriptive vs Analytical
- Applied vs Fundamental
- Quantitative vs Qualitative
- Conceptual vs Empirical
- Some other types of research.

1. Descriptive vs Analytical

- Descriptive research includes surveys and fact finding enquiries of different kinds. The major purpose of the descriptive research is description of the state of affairs as it exists at present
- The main characteristic of this method is that the researcher has no control over its variables, he can only report what has happened or what is happening.
- Most ex post facto research projects are used for descriptive research in which the researcher seeks to measure items such as, for example, frequenting of shopping, preference of people etc
- The method used are survey methods of all kinds

Analytical research:-In analytical research, researcher has to use facts or information already available. The researcher attempts to analyze and explain why or how something is happening.

2. Applied vs fundamental

Applied research aims at finding a solution for on immediate problem facing a Society or an Industry/business organization. It is to identify social, economic or political trends. The Central aim of applied research is to discover a solution for some practical problem. (Used in business, medicine and education)

- **Fundamental research**: -This research is mainly concerned with generalization and with the formation of a theory. Gathering knowledge for knowledge's sake is termed as "pure or basic research".

  Example: - Research concerning some natural phenomenon or relating to pure mathematics.
- Studies concerning human behavior.

3. Quantitative vs Qualitative:

Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in term of quantity. It is more concerned with questions about how much? how many? how often? to what extent etc. It is used not only in physical sciences but also in economics, social science and biology.

Qualitative research is concerned with qualitative phenomena involving quality or kind. For instance, when we are Interested in investigating the reasons for human behavior i.e., why people think or do certain things. We talk of motivation research as an important type of Qualitative research

It is undertaken to gain in sights concerning to attitudes to behave in a particular manner.

4. Conceptual vs Empirical

Conceptual research is related to some abstract idea or theory. It is used by philosophers and thinkers to develop new concepts or to interpret existing ones. It is preferred in social sciences and philosophy. Here, the researcher tackle the problems part by part. He breaks down the concept into smaller, simpler parts to understand it better.

Empirical research: - This research relies on experience or observation alone. It is data-based research, coming up with conclusions which are capable of being verified by observations or experiment. It is also known as experimental type of research.

It is appropriate when proof is sought that certain variables affect other variables in some way. Evidence gathered through experiments are empirical studies

Some other types of research: All other types of research are variations of one or more of the above stated approaches

They are based on either the purpose of research or time required to accomplish the research.

1. One Time Research or Longitudinal Research

- Research is confined to a single time period
- In case of longitudinal research, the research is carried out on over several time periods

2. Clinical or Diagnostic Research

Such researches follow case study methods. Such studies go deep into the Causes of things or events. E.g. Small samples and deep probing

3. Formalized research: - these studies are those with substantial Structure and with specific hypothesis to be tested.

4. Historical research: It utilizes historical documents, remains etc to study events or ideas of past.

5. Conclusion oriented and decision Oriented

• While doing conclusion-oriented research, a researcher is free to pick up a problem, design the enquiry as he proceeds and is prepared to conceptualize as he wishes

• Decision oriented research is always for the need of a decision maker and the researcher in this case is not free to embark upon research according to his own inclination.

e.g. Operations Research

Research method vs methodology

Research methods there are methods/ Techniques that are used for conduction of research. The research method can put into following 3 groups

1. This group include those methods which are concerned with its collection of data. These methods will be used where the data already available are not sufficient to arrive at the required solution

2. This group includes those statistical techniques which are used for establishing relationship between the data and its unknowns

3. This group consists of those methods which are used to evaluate its accuracy of the results obtained

Research methods are various procedures, schemes and algorithm used in research. They include theoretical procedures, experimental Studies, numerical schemes, statistical approaches etc.

Research methodology

It is a systematic way to solve a problem. It has many dimensions and research methods. So research method constitutes a part of research methodology. The scope of research methodology is wider than that of research methods.

It is a science of studying now research is to be carried out

It is also defined as study of methods by which knowledge in gained. It plans to give the work plan of the research.

Research process (various stages of research) Research process consists of series of actions or steps necessary to effectively carried out research. The following are the various steps of research process;

1. Formulating the research problem
2. Extensive literature survey
3. Developing a hypothesis
4. Preparing the research design
5. Determining the sample design
6. Collecting the data
7. Execution of the project
8. Analysis of data
9. Hypothesis testing
10. Generalization and interpretation
11. Preparation of the report or presentation of the results i.e., formal write-up of the conclusions researched.

1. Formulating the research problem

- The first step in the research process is to identify a problem or develop research question. There are 2 types of research problems Viz-related to
  i) States of nature
  ii) Relationship between Variable,
- Researcher must decide the general area of interest or aspect of a subject matter to study.
- Essentially 2 steps are involved in formulating the problem is
  (i) Understanding the problem thoroughly
  (ii) Rephrasing the same into a meaningful term from an analytical point of view.
- The best way of understanding the problem is to discuss with one's own colleagues or with some expertise in the matter or guide.

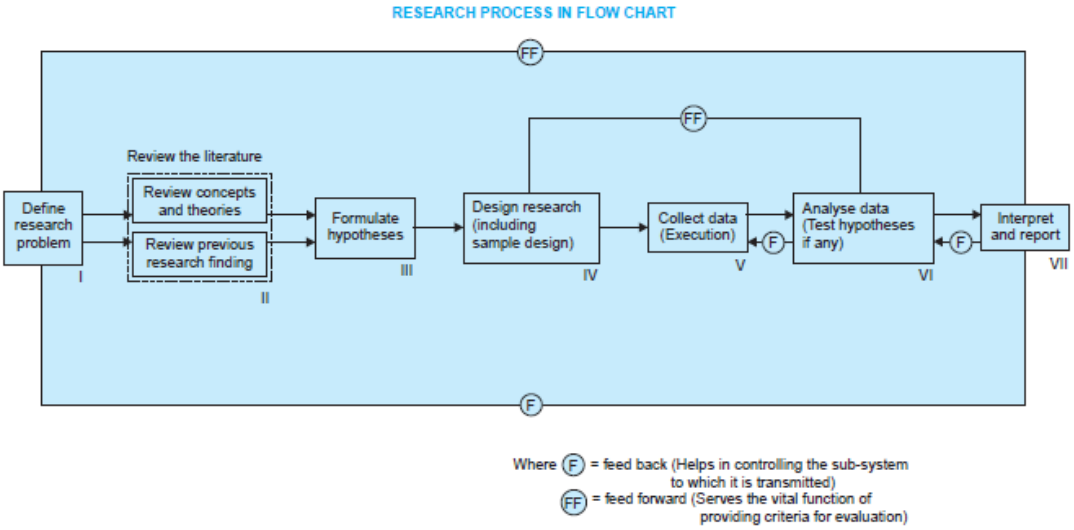

Fig. 1.1

2. Extensive literature survey

- Once the problem is formulated, a brief summary of it should be prepared. It is compulsory for a researcher writing a thesis for Ph.D. degree synopsis of the topic and submit it to the necessary committee or the research board for approval.
- To do this, the researcher must review the literature related to the problem. This step provides fundamental knowledge about the problem area.
- The review of literature also educates the researcher about what studies have been conducted in the past, how then studies were conducted and conclusion in the problem area.

3. Developing the hypothesis

After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses. It plays an important role. Working hypothesis is a tentative assumption made in order to draw out and test its logical or empirical consequences.

Working hypothesis can be developed by using the following approach.

- Discussions with colleague, and experts about the problems
- Examination of data and records, if available
- Review of Similar studies
- Exploratory personal investigation which involves original field interviews on limited scale with a View to secure greater insight into to practical aspects of the problem.

4. Preparing the research design:

The researcher is required to prepare a research design i.e., he will state the conceptual structure within which research would be conducted. There are several research designs such as experimental and non-experimental hypothesis testing.

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

- The means of obtaining information
- The availability and skills of the researcher and his staff (if any)
- Explanation of the way in which selected means of obtained Information will be organized and the reasoning leading to the solution.
- The time available for research
- Cost factor relating to research i.e., finance available for the purpose

5. Determining sample design: the way of selecting a sample is popularly known as research design. A brief mention of the important sample design is as follows.

i) Deliberate Sampling: It is also known as purposive or non-probability. This method involves purposive or deliberate Selection of particular units of the Universe.

ii) Simple random sampling this type of sampling is known as chance sampling or probability sampling. In this case each & every item in the population has an equal Chance of being inclusion in the sample.

e.g. If we have to select a sample of 300 items from a universe of 15,000 items, we can put the names or numbers for all 15,000 items on slips of paper and conduct a lottery.

(iii) Systematic sampling: In some instances the most practical way of sampling to select every 15th name on a list, every 10th house on one side of a street and so on.

iv) Stratified sampling: It is important that sample includes representative groups of study units with specific Characteristic Eg. Residents from urban and rural areas. Sampling frame must be divided into groups or states according to their characteristics. Samples of predetermined size will then will have to be obtained from each group.

v) Quota sampling: the actual selection of items for the sample is left to interviewers judgement

vi) Cluster sampling and area sampling

It involves grouping to population. Then group or clusters are selected rather than individual for inclusion in the sample.

E.g. Suppose a departmental store wishes to sample its Credit Card holders. It has issued its Cards to 15,000 customers. The sample size is say 450. Among 15,000 customer 100 clusters are formed, each cluster consists of 150 card holders. 3 clusters are selected for sample randomly.

Under area sampling the total area is to be divided into a number of smaller non- over lapping area. These are known as geographical clusters. Then a number of these smaller areas randomly selected to form a sample.

vii) Multistage sampling. In this first stage may be select large primary sampling units such as states, then districts, then town and finally certain families with in towns. If the technique of random. Sampling is applied at all stages, the sampling procedure is described as multistage random sampling.

Viii) Sequential sampling: This design is usually adopted under acceptance sampling plan in the context of statistical quality control

6) Collection of data:

There are several ways of collecting the appropriate data. They are different in context of money costs, time and other resources of research.

Primary data can be collected either through experiment or through surveys. The researcher conducts experiment and observes some quantitative measurement of data.

In case of a survey, data can be collected by one or more of the following.

- By observation
- Through personal interviews
- Through telephone interviews
- By mailing of Questionnaires

7. Execution of project: This step is very important in research process. The data to be collected would be adequate and dependable. The project should be executed in a systematic manner and in-time.

8. Analysis of data. After collection of data the next task is the analysis of data. The analysis of data requires a number of closely related Operation such as establishment of categories of raw data through Coding tabulation and then drawing statistical inferences.

Analysis work is based on the computation of various percentages, coefficients etc

9. Hypothesis testing various tests, such as chi-square test, t-test, F-test, have been developed by the statisticians for the purpose. There tests depend upon the nature and objective of research.

Hypothesis testing will result in either accepting the hypothesis or in rejecting it.

10. Generalizations and interpretation when hypothesis is tested several times, it is possible to arrive at generalizations i.e., to build a theory. When there is no hypothesis to start with, findings can be explained on the basis of same theory. It is known as interpretation.

1**1. Preparation of the report or the thesis** finally, the researcher has to prepare the report of what has been done by him. Writing report must be done with great care keeping view the following

The layout report should be as follows

1) The preliminary pages 2) Main text 3) The end matter.

In its preliminary pages to report should carry

- Title and date
- Acknowledgements and forward
- Table of contents, list of tables, and graphs etc

The main text of lo report should have the following parts

Introduction: It should contain a clear statement of the objectives research and an explanation of the methodology adopted in accomplishing to research. The scope of let's study along with various limitation should be stated in this part

Summary of findings: After introduction there would appear a statement of findings and recommendations in non-technical language.

• **Main part:** the main body of the report should be presented in logical sequence and broken down into readily identifiable sections.

• **Conclusions** towards the end of main text, researcher should again putdown the results of his research clearly and precisely. In fact, it is the final summing up.

At the end of the report, appendices should be enlisted in respect of all technical data. Bibliography is list of books, journals, reports should also be given in the end.

Research and scientific method

Research and scientific method are closely related. Research can be termed as "an inquiry into the nature of, to reasons for, and it consequences of any particular set of circumstance, where these circumstances are experimentally controlled or recorded just as they occur. Further research implies the researcher is interested in more than particular results, he is interested in the repeatability of results and in their extension to more complicated and general situations"

The scientific method is one and same in all branches (of science) and that method is the method of all logically trained minds... the unity of all sciences consists alone in its methods, not its material, the man who classifies facts of any kind whatever, who sees their mutual relations and describes their sequences, is applying the scientific method and is a man of science

Research differs from scientific method only in view point and philosophy. The scientific method is based on certain basic postulates which can be stated as under.

- It relies on empirical evidence.
- It utilizes relevant concept
- It is committed to only objective considerations
- It presupposes ethical neutrality
- It results into probabilistic predictions
- Its methodology is made known to all concerned

Scientific method encourages a rigorous Impersonal mode of procedure dictated by the demand logic and objective procedures

Research approaches

There are two basic approaches to research

1. Quantitative approach
2. Qualitative approach.

- The quantitative approach involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion. This approach can be further sub classified to inferential, experimental and simulation approaches to research.

- The purpose of inferential approach to research is to form a data base from which to inter relationship of population. Normally this is survey research where the sample of population is studied to determine its characteristics and it is then inferred that population has the same characteristics

- Experimental approach is characterized by much greater control over the research environment and in this care some variables are manipulated to observe their effect on other variables.

- Simulation approach involves the creation of an artificial environment within which the relevant information and data can be generated. This permits to an observation of dynamic behavior of a system under controlled conditions.

Qualitative approach to research is concerned with subjective assessment of attitude, opinions and behavior. Research in such a situation is function of researcher's insights and impressions. Such an approach to research generates result either in non-quantitative form or in the form of which are not subjected to rigorous quantitative analysis.

Criteria of good research

Whatever may be the type of research and studies, one thing is important is that they all meet on the common ground of scientific method employed by them.

One expects scientific research to satisfy the following criteria.

1. The purpose of research should be clearly defined and common concept be used.
2. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping in continuity of what has already been attained.
3. The procedural design of the research should be carefully planned to yield results that are as objective as possible
4. The researcher should report with complete frankness, flaws in the procedural design and estimate their effects upon the findings.
5. The analysis of data should be sufficiently adequate to reveal its significance. The methods of analysis used should be appropriate. The validity and reliability of the data should be checked carefully.
6. Conclusions should be confined to those justified by the data of the research and limited to those for which the data to provide an adequate basis
7. Greater confidences in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

In other words, we can state the quality of a good research as under.

1. **Good research is systematic:** It mean that the research is structured with specific steps to be taken in a specified sequence in accordance with the well defined set of rules.
2. **Good research is logical:** It means that research is guided by the rules of logical reasoning and the logical process of induction and deduction are a great value in carrying out research.
3. **Good research is empirical:** It implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external Validity research results

4. **Good result is replicable:** This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

Research problem

What is research problem?

Research problem refers to some difficulty which a researcher experiences in the context of either a Theoretical or Practical situation or wants to obtain solution for the same.

The components of research problem are

1) There must be an individual or group which has some difficulty or the problem
2) There must be some objective(s) to be attained at.
3) There must be alternative means or (Course of action) for obtaining the Objective(s) one wishes to attain.
4) There must remain some doubt in the mind of a researcher with regard to the selection of alternatives.
5) There must be some environment(s) to which the difficulty pertains.

Thus, a research problem is one which requires the researcher to find out the best solution for the given problem i.e., to find out which course of action the objective can be attained optimally in the context of a given environment.

Necessity of defining the problem

We all hear that a problem clearly stated is a problem half solved. This statement signifies the need for defining a research problem. The problem to be investigated must be defined clearly. This will help to discriminate relevant data from the irrelevant ones. A proper definition of the research problem will enable it researcher to be on track where are ill defined problem may create hurdles. Questions like what data are to be collected? What characteristics of data are relevant and need to be studied? What relations to be explored? What techniques are to be used for the purposes? and similar other questions crop up in the mind of a researcher who can well plan his strategy and find answers to all such questions only when to research problem has been well defined. Thus, defining research problem properly is a prerequisite for any study and is a step of

the highest importance. It is only on careful detailing to research problem that we can work out the research design and can smoothly carry on all the consequential steps involved while doing research.

Technique involved in defining a problem

The research problem should be defined in a systematic manner. The technique for the purpose involves to following steps generally one after the other;

- Statement of the problems in general way
- Understanding the nature of the problem
- Surveying the available literature
- Developing the ideas through discussion
- Rephrasing the research problem into a working proposition.

Statement of the problem in general way

The problem should be stated in broad general way Keeping in view practical concern or some scientific or intellectual interest. In case of a social research, it is advisable to do some field observations and as such the researcher may undertake some sort of preliminary survey or pilot survey.

Understanding the nature of the problem

Next step is to understand its origin and nature clearly. The way of understanding the problem is to discuss it with those who first raised it in order to find out how the problem originally came out and with what Objectives in view. If the researcher has stated to problem himself, he should consider once again all those points that induced him to make a general statement concerning the problem.

Surveying to alternative literature.

All available literature concerning the problem at hand must be surveyed and examined before a definition of a research problem is given. This means that researcher must be well conversant with relevant theories in the field, report and records. He must devote sufficient time in reviewing of research already undertaken on related problems.

Developing the ideas through discussions

Discussion concerning it problem often produces useful information. Various new ideas can develop through such exercise. Therefore, a researcher must discuss his problem with his colleagues, and others who have enough expertise or experience in the same or area. This is quite often known as experience survey.

Rephrasing the research problem

Finally, the researcher rephrases the research problem into a working proposition. The research problem is rephrased into analytical or operational terms.

In addition to the above, the following points must also be observed while defining a problem.

a. Technical terms and words
b. Basic assumptions should be clearly defined.
c. A straightforward statement of the value of the investigation should be provided
d. The suitability of the time period and the sources of data available must also be considered
e. The scope of the Investigation or limits within which the problem is to be studied.