Research Methodology

Shraddha M. Bhome
Rajiv S. Mishra
Swati Subhash Desai
Suyash Pradhan

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Dr. Shraddha Mayuresh Bhome
M.Com, M.Phil. (Gold Medalist), Professional MBA, Ph.D. in Commerce,
Pursuing D.Litt. in Commerce
Assistant Professor and Coordinator (Accounting and Finance),
Satish Pradhan Dnyanasadhana College, Thane.

Rajiv S. Mishra
M.Com., MBA, M.Phil., UGC NET,
Assistant Professor at N.E.S. Ratnam College of Arts, Science & Commerce for BBI & Coordinator for M.Com., Bhandup (W), Mumbai - 400078.
Visiting Faculty at Nitin Godiwala, Chandrabhan Sharma, S.M. Shetty College, N.G. Acharya, V.K. Menon College, Sikkim Manipal University & Vikas College for M.Com., MBA, BBI, BMS, BFM & BAF.

Prin. Dr. Swati Subhash Desai
M.Sc. (Applied Statistics),
Ph.D. (Statistics),
D.Litt. (Honoris Causa) (Statistics),
Principal,
RAV's Laxmichand Golwala College of Commerce & Economics,
Ghatkopar (East).

Adv. Suyash Pradhan
B.Com., LL.M. (UK), CS (Inter), Pursuing Ph.D.,
I/C Principal,
Anand Vishwa Gurukul College of Law, Thane.
Visiting Faculty at Satish Pradhan Dnyanasadhana College, Thane.

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Phone: 011-23270392, 23278631; Fax: 011-23256286

Nagpur : Kundanlal Chandak Industrial Estate, Ghat Road, Nagpur - 440 018.
Phone: 0712-2738731, 3296733; Telefax: 0712-2721216

Bengaluru : Plot No. 91-33, 2nd Main Road, Seshadripuram, Behind Nataraja Theatre,
Bengaluru - 560 020. Phone: 080-41138821; Mobile: 09379847017, 09379847005

Hyderabad : No. 3-4-184, Lingampally, Besides Raghavendra Swamy Matham, Kachiguda,
Hyderabad - 500 027. Phone: 040-27560041, 27550139

Chennai : New No. 48/2, Old No. 28/2, Ground Floor, Sarangapani Street, T. Nagar,
Chennai - 600 012. Mobile: 09380460419

Pune : "Laksha" Apartment, First Floor, No. 527, Mehunpura, Shaniwarpeth (Near Prabhat Theatre),
Pune - 411 030. Phone: 020-24496323, 24496333; Mobile: 09370579333

Lucknow : House No. 731, Shekhupura Colony, Near B.D. Convent School, Aliganj,
Lucknow - 226 022. Phone: 0522-4012353; Mobile: 09307501549

Ahmedabad : 114, "SHAIL", 1st Floor, Opp. Madhu Sudan House, C.G. Road, Navrang Pura,
Ahmedabad - 380 009. Phone: 079-26560126; Mobile: 09377088847

Ernakulam : 39/176 (New No. 60/251), 1st Floor, Karikkamuri Road, Ernakulam, Kochi - 682 011.
Phone: 0484-2378012, 2378016; Mobile: 09387122121

Bhubaneswar : Plot No. 214/1342, Budheswari Colony, Behind Durga Mandap, Bhubaneswar - 751 006.
Phone: 0674-2575129; Mobile: 09338746007

Kolkata : 108/4, Beliaghata Main Road, Near ID Hospital, Opp. SBI Bank, Kolkata - 700 010.
Phone: 033-32449649; Mobile: 07439040301

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PREFACE

It is a matter of great pleasure to present a book on **Research Methodology** to the students and teachers fraternity of T.Y. BBI for University of Mumbai.

The special features of this book are simple and lucid language, in-depth analysis and more explanation to topics with suitable diagrams. All chapters are properly revised and edited as per the syllabus of University of Mumbai.

We are thankful to our family members for constant support and motivation. We owe sincere gratitude to Himalaya Publishing House Pvt. Ltd. for giving us the chance to write this book. Any constructive suggestions are always welcome.

Also, we are thankful to Prof. Mrunmayi Thatte, Coordinator, BBI and BFM, Joshi Bedekar College and Dr. Afreen Eksambi, Coordinator, BBI, Satish Pradhan Dnyanasadhana College, Thane for support and motivation.

Authors

SYLLABUS

Research Methodology

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction to Research	10
2	Data Collection and Processing	15
3	Data Analysis and Interpretation	15
4	Advanced Statistical Techniques	15
5	Research Report	05
	Total	**60**

Sr. No.	Modules/Units
1	**Introduction to Research** • Meaning, Objectives and Importance of Research • Types of Research • Research Process • Characteristics of Good Research • Hypothesis – Meaning, Nature, Significance, Types and Sources • Research Design – Meaning, Definition, Need and Importance, Steps, Scope and Essentials of a Good Research Design • Sampling– (a) Meaning of Sample and Sampling (b) Methods of Sampling (i) Non-probability Sampling – Convenience, Judgment, Quota and Snowball (ii) Probability – Simple Random, Stratified, Cluster and Multi Stage
2	**Data Collection and Processing** • Types of Data and Sources – Primary and Secondary Data Sources • Methods of Collection of Primary Data (a) Observation – (i) Structured and Unstructured, (ii) Disguised and Undisguised and (iii) Mechanical Observations (Use of Gadgets) (b) Experimental – (i)Field and (ii) Laboratory (c) Interview – (i) Personal Interview, (ii) Focused Group and (iii) In-depth Interview Method (d) Survey – Telephonic Survey, Mail, E-mail, Internet Survey, Social Media and Media Listening

	(e) Survey Instrument – (i) Questionnaire Designing (I) Types of Questions – (i) Structured/Close Ended and (ii) Unstructured/ Open Ended, (iii) Dichotomous and (iv) Multiple Choice Questions (II) Scaling Techniques – (i) Likert Scale and (ii) Semantic Differential Scale
3	**Data Analysis and Interpretation** ● Processing of Data – Meaning and Essentials of: (i) Editing, (ii) Coding and (iii) Tabulation ● Analysis of Data – Meaning, Purpose, Types ● Interpretation of Data – Essentials, Importance, Significance and Descriptive Analysis ● Testing of Hypothesis – One Sample T-test, ANOVA, F-test, Chi-square and Paired Sample Test
4	**Advanced Statistical Techniques** Introduction, Characteristics and Applications of: ● Correlation and Regression Analysis ● Factor Analysis ● Cluster Analysis ● Discriminant Analysis ● Multidimensional Scaling
5	**Research Report** ● Report Writing – (i) Meaning, Importance, Structure, Types, Process and Essentials of a Good Report

PAPER PATTERN

Maximum Marks: 75

Questions to be Set: 05

Duration: 2½ Hours

All questions are compulsory carrying 15 Marks each.

Question No.	Particulars	Marks
Q.1	Objective Questions: (A) Sub-questions to be asked (10) and to be Answered (any 08) (B) Sub-questions to be asked (10) and to be Answered (any 07) (*Multiple Choice/True or False/Match the Columns/Fill in the Blanks)	15
Q.2	Full Length Question **OR** Full Length Question	15 15
Q.3	Full Length Question **OR** Full Length Question	15 15
Q.4	Full Length Question **OR** Full Length Question	15 15
Q.5 Q.5	(A) Theory Questions (B) Theory Questions **OR** Short Notes: To be Asked (05) To be Answered (03)	08 07 15

Note:

Theory question of 15 Marks may be divided into two sub-questions of 7/8 and 10/5 Marks.

CONTENTS

UNIT I

UNIT II

UNIT I

1

Chapter

INTRODUCTION TO RESEARCH

Structure

1.1 INTRODUCTION

Research is searching for and gathering information, usually to answer a particular question or problem. The word research is derived from the French word 'recherché' which means "to go about seeking". The word research consists of two syllables, "re" and "search". Research includes creative work which is undertaken on an organised basis in order to increase the bank of knowledge, including knowledge of humans, culture and society, and the use of this bank of knowledge to formulate new applications. It is used to create or confirm facts, reconfirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. A research project may also be an extension on past work in the related field. Research is a continuous process and is useful in decision-making, especially in business.

Research has been defined in a number of different ways.

According to Martyn Shuttleworth, research is any gathering of data, information and facts for the advancement of knowledge.

Creswell says that "Research is a process of steps used to collect and analyse information to increase our understanding of a topic or issue".

According to Fred Kerlinger, research is an organised enquiry designed and carried out to provide information for solving a problem.

1.2 CHARACTERISTICS

1. **Uses Scientific Methods:** Research uses scientific methods to discover facts and tries to give solutions to specified problems. Researchers follow organised procedure to carry out research. To receive better results, scientific method is used for carrying out investigation.
2. **Continuous Process:** It is a continuous process as it studies existing facts and also develops new facts. Research also tries to distinguish relationship among variables.
3. **Multipurpose Activity:** Research is a multipurpose activity as it not only includes collection of data but also includes predicting future, establishing relationship between variables, finding solutions to problems, and developing new theories, tools, and concepts.
4. **Maintains Objectivity and Eliminates Impartiality:** Research is based on suitable procedures. It collects appropriate, precise and objective data to understand research problem. After data collection, researcher process data, analyse it and arrive at appropriate solutions.
5. **Empirical Nature:** Empirical research can be undertaken to study situations where methods such as observation, experimentation or survey can be used for conducting research.
6. **Generalisation:** Research conclusions can be applied to a large population. Research can be carried on sample of respondents that represents the universe where the conclusions generated through research can be applied to the complete universe.
7. **Researchers Controlled Movement of the Research Procedure:** In social research, there are many factors that have an effect on result. Due to various factors, some of them can be considered as controlled factors while others can be tested for possible consequences. But, it is difficult to execute controlled experiments in social researches, whereas it is easy to perform controlled experiments in pure sciences.
8. **Development of Concepts and Theories:** Research helps to develop new concepts and theories where these innovations can be useful for the betterment of society at a large scale.

1.3 IMPORTANCE OF RESEARCH

Research is significant both in scientific and non-scientific fields. Research is important for the following reasons:

1. A research problem refers to a complexity which a researcher or a scientific community or an industry or a government organisation or a society experiences. It may be a theoretical or a practical situation. It calls for a systematic understanding and possible solution.
2. Research on existing theories and concepts help us recognise their range and applications.
3. It is the bank of knowledge and provides strategy for solving problems.
4. It is important in industry and business for higher profits, output, efficiency and to improve the quality of products.
5. Mathematical and logical research on business and industry reduces the problems in them.

6. It leads to the identification and categorisation of new materials, new living things, new stars, etc.
7. Inventions can be done through research
8. Social research helps find answers to social problems. They explain social phenomena and try to find solution to social problems.

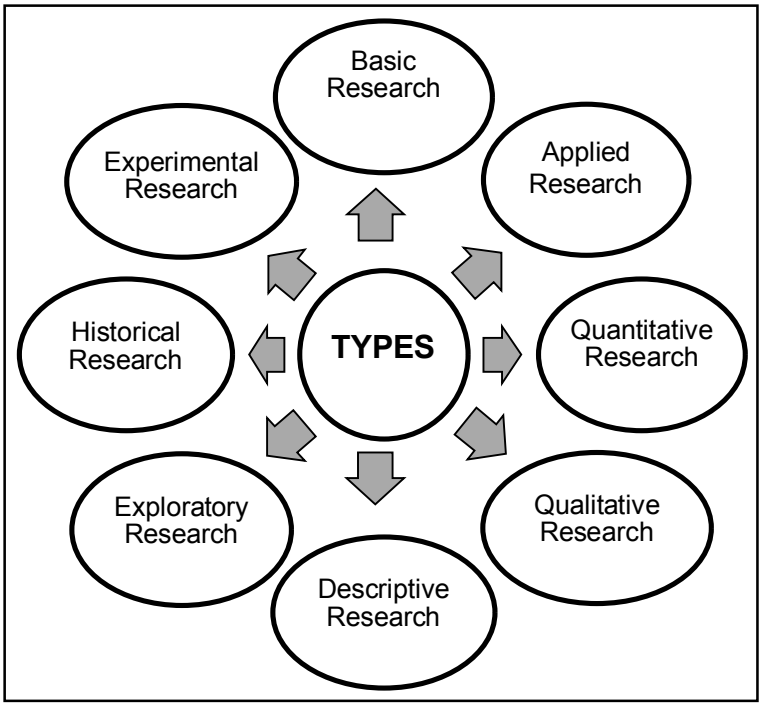
1.4 OBJECTIVES OF RESEARCH

- To understand clearly an observed phenomenon and explain its logic and reason for happening.
- To get insights about problem.
- To find solutions for a problem.
- To test existing laws or theories.
- To develop new ideas, concepts and theories.
- To test hypothesis of a casual relationship between variables.
- To identify areas where research could make the difference.
- To predict future of events.

1.5 TYPES OF RESEARCH

1. Basic Research

- It is also known as pure or fundamental research.
- This research is mainly conducted to increase knowledge base. It is driven purely by interest and a desire to expand our knowledge.
- This type of research tends not to be directly applicable to the real world in a direct way, but enhances our understanding of the world around us.
- Pure research can be exploratory, descriptive or explanatory.
- Basic research generates new ideas, principles and theories in different fields.
- Basic research concentrates on fundamental principles and testing theories.
- It is sometimes implicitly said that basic research does not have practical applications. For example, someone conducting basic research on cheating behaviour may design a study examining whether students from illiterate families cheat more often than students from literate families.
- Notice that the research is not done to reduce cheating or help people who cheat or any other "applied" aspect, but to increase the understanding of cheating behaviour.



2. Applied Research

- Applied research is mainly related with solving practical problems rather than focussing on knowledge expansion.
- It is mainly used to find solutions to problems which occur on a daily basis and develop new innovative technologies.
- The main aim of applied research is to provide better technologies for humans to enhance their standard of living.
- Example: Investigating which treatment approach is the most effective for treating cancer patients whereas Researching which strategies work best to motivate workers.

3. Quantitative Research

- Quantitative research is generally related with the positivist concept.
- It usually involves collecting and converting data into numerical form so that statistical calculations can be made and conclusions drawn.
- Objectivity is very vital in quantitative research.
- Therefore, researchers try to avoid their own presence, behaviour or attitude affecting the results (e.g., by changing the circumstances being studied or causing participants to behave differently).
- They also examine their methods and results for any possible bias.
- The aim of quantitative research is to develop mathematical models, theories related to phenomenon. Quantitative research is mainly used in social sciences.

4. Qualitative Research

- Qualitative research is the approach usually related with the social constructivist concept which emphasises the socially constructed nature of reality.
- It is about recording, analysing and attempting to reveal the in debt meaning and significance of human behaviour and experience, including conflicting beliefs, behaviours and emotions.
- The qualitative method tries to answer why and how of decision-making rather than what and when.
- The approach to data collection and analysis is logical but allows for greater flexibility than in quantitative research.
- Data is collected in textual form on the basis of observation and communication with the participants, e.g., through participant observation, in-depth interviews and focus groups.
- It is not converted into numerical form and is not statistically analysed.

5. Descriptive Research

- Descriptive research is used to describe characteristics of an observable fact being studied.
- Descriptive studies are structured in such a way that it cannot be changed frequently, so it can be said that they are rigid in nature.
- They cannot identify cause and effect relationship between variables.
- Descriptive research answers questions such as who, when, where, what and how.
- This type of research describes what exists and may help to reveal new facts and meaning.
- The purpose of descriptive research is to observe, describe and document.

6. Exploratory Research

- Exploratory research is carried out for a problem that has not been clearly defined.
- The main aim of this research is to gather initial information which helps to define problems and recommend hypothesis.
- Exploratory research helps to settle on the best research design, data collection method and selection of subjects.
- Exploratory research often relies on secondary research such as reviewing available literature, or qualitative approaches such as informal discussions with consumers, employees, management or competitors, and more formal approaches through in-depth interviews, focus groups, projective methods, case studies or pilot studies.
- Exploratory research can mainly be conducted when researchers lack clear idea of the problem.
- The results of exploratory research are not generally useful for decision-making, but they can provide major insight into a given situation.

7. Historical Research

- It is defined as the type of research that examines past events or combinations of events to arrive at an account of what has happened in the past.
- Historical research is carried out to discover the unknown; answer questions, recognise the relationship that the past has to the present; record and assess activities of individuals, agencies, or institutions; and assist in understanding the culture in which we live.
- Historical research can exhibit patterns that occurred in the past and over time which can facilitate us to see where we came from and what kinds of solutions we have used in the past.
- We usually will notice that what we do today is expressly rooted in the past. Historical research involves the process of collecting and reading the research material collected, and writing the document from the data collected.

8. Experimental Research

- It is commonly used in sciences such as sociology and psychology, physics, chemistry, biology, medicine, etc.
- It is a collection of research designs which use manipulation and controlled testing to understand fundamental processes.
- Usually, one or more variables are manipulated to establish their effect on a dependent variable.
- Experimental Research is mainly used when: there is time priority in a causal relationship (cause precedes effect) or there is uniformity in a causal relationship (a cause will always lead to the same effect) or the magnitude of the correlation is great.
- Experimental research is important to society as it helps us to improve our daily lives.

1.6 FORMULATION OF RESEARCH PROBLEM

There are two types of research problems, viz., those which relate to states of nature and those which relate to relationships between variables. At the very outset, the researcher must single out the problem he wants to study, i.e., he must decide the general area of interest or aspect of a subject matter that he would like to inquire into. Initially, the problem may be stated in a broad general way and then the ambiguities, if any, relating to the problem be resolved.

Then, the feasibility of a particular solution has to be considered before a working formulation of the problem can be set up. The formulation of a general topic into a specific research problem, thus, constitutes the first step in a scientific enquiry.

Essentially, two steps are involved in formulating the research problem, viz., understanding the problem thoroughly, and rephrasing the same into meaningful terms from an analytical point of view. The best way of understanding the problem is to discuss it with one's own colleagues or with those having some expertise in the matter. In an academic institution, the researcher can seek the help from a guide who is usually an experienced man and has several research problems in mind.

Often, the guide puts forth the problem in general terms and it is up to the researcher to narrow it down and phrase the problem in operational terms. In private business units or in governmental

organisations, the problem is usually earmarked by the administrative agencies with which the researcher can discuss as to how the problem originally came about and what considerations are involved in its possible situations.

1.7 SIGNIFICANCE OF REVIEW OF LITERATURE

Doing a careful and thorough literature review is essential when you write about research at any level. It is basic homework that is assumed to have been done vigilantly, and a given fact in all research papers. By providing one, usually offered in your introduction before you reach your thesis statement, you are telling your reader that you have not neglected the basics of research.

It not only surveys what research has been done in the past on your topic, but it also appraises, compares and contrasts, and correlates various scholarly books, research articles, and other relevant sources that are directly related to your current research. Given the fundamental nature of providing one, your research paper will be not considered seriously if it is lacking one at the beginning of your paper.

1. It Creates a Rapport with Your Audience

A literature review helps you create a sense of rapport with your audience or readers. So, they can trust that you have done your homework. As a result, they can give you credit for your due diligence: you have done your fact-finding and fact-checking mission, one of the initial steps of any research writing.

As a student, you may not be an expert in a given field; however, by listing a thorough review in your research paper, you are telling the audience, in essence, that you know what you are talking about. As a result, the more books, articles, and other sources you can list in the literature review, the more trustworthy your scholarship and expertise will be. Depending on the nature of your research paper, each entry can be long or short.

2. It Helps You Avoid Incidental Plagiarism

Imagine this scenario. You have written a research paper, an original paper in your area of specialisation, without a literature review. When you are about to publish the paper, you soon learn that someone has already published a paper on a topic very similar to yours. Of course, you have not plagiarised anything from that publication; however, if and when you publish your work, people will be suspicious of your authenticity. They will ask further about the significance of repeating similar research. In short, you could have utilised the time, money, and other resources you have wasted on your research on something else. Had you prepared a literature review at the onset of your research, you could have easily avoided such mishap. During the compilation of your review, you could have noticed how someone else has done similar research on your topic. By knowing this fact, you can tailor or tweak your own research in such a way that it is not a mere rehashing of someone else's original or old idea.

3. It Sharpens Your Research Focus

As you assemble outside sources, you will condense, evaluate, synthesise, and paraphrase the essence of outside sources in your own words. Through this process of winnowing, you will be able to

place the relevance of your research in the larger context of what other researchers have already done on your topic in the past. The literature review will help you compare and contrast what you are doing in the historical context of the research as well as how your research is different or original from what others have done, helping you rationalise why you need to do this particular research.

1.8 QUESTIONS

Q.1 State True or False

1. Research is the systematic process of collecting and analyzing information to increase the understanding of the phenomenon under study.
2. Business research is a systematic and objective process of gathering, recording and analyzing data for aid in making business decisions.
3. Product analysis is the first step of social research.
4. Research methods provide the knowledge and skills to solve the problems and meet the challenge of a fast passed decision making environment.
5. Exploratory research is problem-oriented as the research is carried out to solve a specific problem that requires a decision.
6. Literature search refers to "referring to a literature to develop a new theory".
7. Descriptive research is used to obtain information concerning the future status of the phenomena.
8. Archival research is the analysis of pre-existing data or records.
9. Ex-post facto study requires the investigator to determine the specific variables for analysis after the research has been completed.
10. Research Methodology is a scientific and systematic approach to solve business problems.

Answers: 1. True; 2. True; 3. False; 4. True; 5. False;
6. True; 7. False; 8. True; 9. True; 10. False.

Q.2 Multiple Choice Questions

1. Which research is the problem-oriented to solve a specific problem that requires a decision?
   (a) Fundamental research (b) Applied research
   (c) Exploratory research (d) Descriptive research
2. Which is a systematic method of investigation, evaluation, experimentation, interpretation and theorizing?
   (a) Survey (b) Experiment
   (c) Scientific Method (d) Meta-analysis
3. Which one is the limitation of business research?
   (a) Access to information (b) Time management
   (c) Access to resources (d) All of the above
4. Which analysis is the first step of business research?
   (a) Product analysis (b) Market analysis
   (c) Financial analysis (d) Competitor analysis

5. Which research is a well-planned, systematic process which implies that it needs planning at all the stages?
   (a) Marketing research (b) Business research
   (c) Social research (d) Scientific research
6. What is research ethics?
   (a) Safety (b) Honesty
   (c) Transparency (d) All of the above
7. Which study is similar to descriptive research study but with a different focus?
   (a) Experimental research (b) Diagnostic research
   (c) Qualitative research (d) All of the above
8. Which study is required by the investigators to determine the specific variables for analysis after the research has been completed?
   (a) Correlation study (b) Ex-post facto study
   (c) Longitudinal study (d) Meta analysis
9. Which one of the following is the criterion of good research?
   (a) Research is a systematic and critical investigation into a phenomenon.
   (b) Research is based upon observable experience.
   (c) All the assumptions for the study should be expressively mentioned.
   (d) Research is not to arrive at an answer.
10. Research methodology is a scientific approach to solve _____.
   (a) Research methods (b) Research problem
   (c) Research operations (d) All of the above

Answers: 1. (b); 2. (c); 3. (d); 4. (a); 5. (a); 6. (d); 7. (b); 8. (b); 9. (c); 10. (b).

Q.3 Short Notes on

(a) Importance of research
(b) Types of research
(c) Characteristics of research
(d) Formulation of research problem
(e) Significance of review of literature

Q.4 Long Questions

1. What is research? State the types of research with examples.
2. What are the qualities of good research?
3. State and explain why and how review of literature is important for every research to start with?

2

Chapter

RESEARCH DESIGN

Structure

2.1 INTRODUCTION

A research design is nothing but a detailed plan of action for the research. A researcher attempting to solve the research problem should necessarily prepare a plan which will help him to attain his ultimate motto. This plan is nothing but a research design. It is a plan which defines research problem, identifies data needed, decides on tool of data collection, type of study, etc. It is a tentative plan which undergoes many modifications as the research study progresses. It presents a series of guide posts to enable the researcher to progress in the right direction.

Designing of the research is done mainly to solve the problem of getting the various stages of the research under control. This control factor is very important for the researcher during any of the research operation. Preparation of the design for the research forms a very critical stage in the process of carrying out some research work or a research project.

Research Design, in general terms, can be referred to as the scheme of work to be done or performed by a researcher during the various stages of a research project. With the help of the research design, one can very easily handle and operate research work as research design acts

as a working plan, which is made by a researcher even before he starts working on his research project. By this, researcher gets a great help and guidance in achieving his aims and goals.

2.2 DEFINITIONS OF RESEARCH DESIGN

Several definitions of Research Design have been advanced by several writers on the subject of research methodology. Few of them are presented here:

- According to Claire Seltiz, "Research Design is a catalogue of the various facts relating to the formulation of a research effort. It is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure".
- According to Paul E. Green and Tull, "a Research Design is the specification of methods and procedures for acquiring the information needed. It is the overall operational pattern or framework, of the project that stipulates what information is to be collected from which sources by what procedures. If it is a good design, it will ensure that the information obtained is relevant to the research questions and that it was collected by objective and economical procedures".
- According to Fred N. Kerlingar, "Research Design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance. The plan is the overall scheme or programme of research. It includes an outline of what the investigator will do from writing the hypotheses and their operational implications to the final analysis of the data. To structure the research is to outline the scheme and paradigm of the operations of the variables strategy. It includes the methods to be used to gather and analyse the data. In other words, strategy implies how the research objectives will be reached and how the problems encountered in the research will be tackled".

2.3 ESSENTIALS OF GOOD RESEARCH DESIGN

1. **Reliability:** In general, reliability is concerned with the question of whether the results of a study are repeatable. It is an indication of the ability of a system to perform and maintain its functions consistently in routine circumstances as well as hostile or unexpected circumstances. Reliability is particularly important in quantitative research and may refer to:
   (a) The statistical reliability of a set of data.
   (b) The experimental reliability of an experiment.
   (c) Data reliability, a property of some disk arrays in computer storage.
   (d) Reliability engineering ensures a system will be reliable when operated in a specified manner.
   (e) Reliability theory, as a theoretical concept, to explain biological aging and species longevity.
   (f) Reliability (computer networking) is a category used to describe protocols.

2. **Replication:**
   (a) It is sometimes necessary for researchers to replicate (i.e., reproduce or duplicate) the findings of others; in order for this to happen, a study must be replicable.
   (b) A study must be replicable in order that the reliability of a measure or a concept can be determined.
   (c) Replications should not be confused with repeated measurements which refer literally to taking several measurements of a single occurrence of a specific phenomenon.
3. **Validity:**
   (a) Validity is concerned with the integrity of the conclusions that are generated from a piece of research.
   (b) A valid measure is one which is measuring what it is supposed to measure.
   (c) A valid measure must be reliable, but a reliable measure need not be valid.
   (d) Validity refers to obtaining results that accurately reflect the concept being measured and it implies reliability (consistency).
   (e) The main types of validity that are typically distinguished include:
   - Measurement (or construct) validity, e.g., does an IQ test really measure variations in intelligence?
   - Internal validity, e.g., if we suggest that x causes y, can we be sure that it is x that is responsible for the variation in y and not something else?
   - External validity, e.g., can the results of a study be generalised beyond the specific research content?
   - Ecological validity, e.g., are social scientific findings applicable in people's every day, natural social settings?

2.4 STEPS OF RESEARCH DESIGN

Following are the steps in research design:

1. **The Problem:** The first step involves the proper selection and then carefully defining the problem. By this, researcher will be enabled to know about what he has to search, but it should be kept in mind that the problems selected should not be unmanageable in nature and also should not be based on the desires.
2. **Objective of the Study:** The objective should be very clear in the mind of the researcher as this will lead to the clarity of the design and proper response from the respondents.
3. **Nature of the Study:** The research design should be very much in relation with the nature of the study, which is to be carried out.
4. **Data Sources:** The various sources of the data or the information should be very clearly stated by the researcher.
5. **Techniques of Data Collection:** For the collection of the required information, it sometimes becomes very necessary to use some special techniques.
6. **Social Cultural Context:** Research design based on the social cultural concept is prepared in order to avoid the various study variations.

7. **Geographical Limit:** This step becomes a necessity at this point of time as with the help of this step, research linked to the hypothesis applies only to certain number of social groups.
8. **Basis of Selection:** Selecting a proper sample acts as a very important and critical step and this is done with the help of some mechanics like drawing a random stratified, deliberate, double cluster or quota sample, etc.
9. **Data Analysis and Interpretation:** Analysis of data is a process of inspecting, cleaning, transforming, and modelling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision-making.
10. **Data Interpretation:** Data interpretation can be defined as "the application of statistical procedures to analyse specific observed or assumed facts from a particular study".
11. **Conclusions and Recommendations:** Conclusion means a position or opinion or judgement reached after consideration. On the basis of the research findings, the conclusion needs to be drawn and suitable recommendations should be made to help improve the research problem.

2.5 EVALUATION OF RESEARCH DESIGN

The research design must be good. The question of good design is related to the purpose or objective of the research problem and also with the nature of the problem to be studied.

A good design is often characterised by features like flexibility, appropriateness, economical and so on. Generally, the design which minimises bias and maximises the reliability of the data collected and analysed is considered a good design. The design which gives the smallest experimental error is supposed to be the best design in many investigations. Similarly, a design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered most appropriate and efficient design in respect of many research problems. A design may be quite suitable in one case, but may be found wanting in one respect or the other in the context of some other research problem.

The fundamental questions in evaluating a research design pertain to the precision, reliability and relevance of the data and their analysis. Before actually carrying out research, it is better if the researcher evaluates his research design. This can be achieved if he verifies the following aspects for their explicitness.

- How relevant are the objectives?
- How relevant are the hypotheses?
- How explicit are the hypotheses?
- Have the problems and hypotheses been stated in operational terms scientifically?
- Has the plan of research been presented in detail so that its logic is apparent?
- How scientific is data collection tool?
- How scientific is method of data collection?
- How precise are the observations?
- Can other investigators repeat the observations?
- Do the data actually satisfy the demands of the problem, i.e., do they actually demonstrate the conclusion?
- Does the research design ensure a comparison that is not subject to the alternate interpretations?

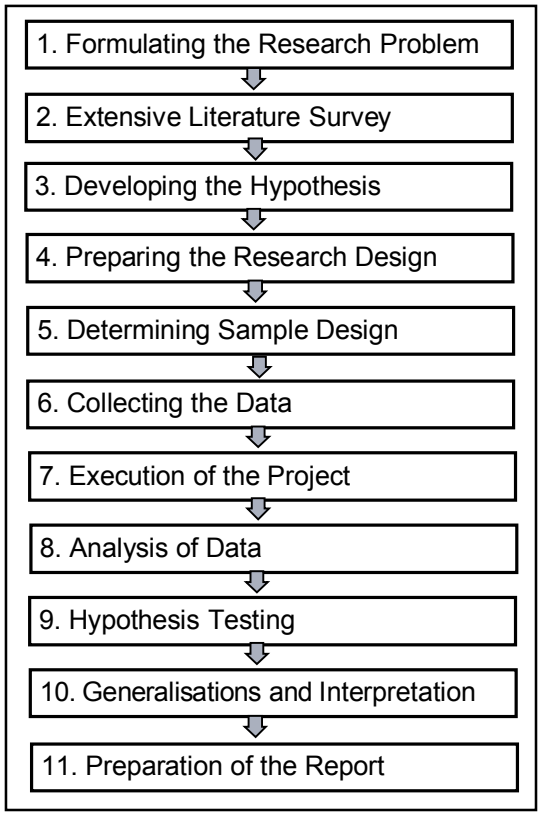
2.6 FACTORS AFFECTING RESEARCH DESIGN

The following factors affect the design of research:

1. The nature of the study
2. The scope of the study
3. The level of the study
4. Availability of sufficient data
5. Proper exposure to the sources of data, especially primary data
6. Availability of time
7. Availability of money and manpower
8. Impact of the various internal and external as well as controllable and uncontrollable variables on the research project
9. The ability, skill, knowledge and technical background of the researcher
10. Utility and applicability of the research result in practice

2.7 PROCESS OF RESEARCH

However, the following order concerning various steps provides a useful procedural guideline regarding the research process:



1. Formulating the Research Problem: There are two types of research problems, viz., those which relate to states of nature and those which relate to relationships between variables. At the very outset, the researcher must single out the problem he wants to study, i.e., he must decide the general area of interest or aspect of a subject-matter that he would like to inquire into. Initially, the problem may be stated in a broad general way and then the ambiguities, if any, relating to the problem be resolved.

Then, the feasibility of a particular solution has to be considered before a working formulation of the problem can be set up. The formulation of a general topic into a specific research problem, thus, constitutes the first step in a scientific enquiry.

Essentially, two steps are involved in formulating the research problem, viz., understanding the problem thoroughly, and rephrasing the same into meaningful terms from an analytical point of view. The best way of

understanding the problem is to discuss it with one's own colleagues or with those having some expertise in the matter. In an academic institution, the researcher can seek the help from a guide who is usually an experienced man and has several research problems in mind.

Often, the guide puts forth the problem in general terms and it is up to the researcher to narrow it down and phrase the problem in operational terms. In private business units or in governmental organisation, the problem is usually earmarked by the administrative agencies with which the researcher can discuss as to how the problem originally came about and what considerations are involved in its possible solutions.

2. Extensive Literature Survey: Once the problem is formulated, a brief summary of it should be written down. It is compulsory for a research worker writing a thesis for a Ph.D. degree to write a synopsis of the topic and submit it to the necessary Committee or the Research Board for approval.

At this juncture, the researcher should undertake extensive literature survey connected with the problem. For this purpose, the abstracting and indexing journals and published or unpublished bibliographies are the first place to go to. Academic journals, conference proceedings, government reports, books, etc. must be tapped depending on the nature of the problem. In this process, it should be remembered that one source will lead to another.

The earlier studies, if any, which are similar to the study in hand should be carefully studied. A good library will be a great help to the researcher at this stage.

3. Development of Working Hypotheses: After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses. Working hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. As such, the manner in which research hypotheses are developed is particularly important since they provide the focal point for research. They also affect the manner in which tests must be conducted in the analysis of data and indirectly the quality of data which is required for the analysis. In most types of research, the development of working hypothesis plays an important role.

Hypothesis should be very specific and limited to the piece of research in hand because it has to be tested. The role of the hypothesis is to guide the researcher by delimiting the area of research and to keep him on the right track. It sharpens his thinking and focuses attention on the more important facets of the problem. It also indicates the type of data required and the type of methods of data analysis to be used.

How does one go about developing working hypotheses? The answer is by using the following approach:

(a) Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution;

(b) Examination of data and records, if available, concerning the problem for possible trends, peculiarities and other clues;

(c) Review of similar studies in the area or of the studies on similar problems; and

(d) Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals with a view to secure greater insight into the practical aspects of the problem.

Thus, working hypotheses arise as a result of *a priori* thinking about the subject, examination of the available data and material including related studies and the counsel of experts and interested parties. Working hypotheses are more useful when stated in precise and clearly defined terms.

It may as well be remembered that occasionally we may encounter a problem where we do not need working hypotheses, especially in the case of exploratory or formulative researches which do not aim at testing the hypothesis. But as a general rule, specification of working hypotheses is another basic step of the research process in most research problems.

4. Preparing the Research Design: The research problem having been formulated in clear-cut terms, the researcher will be required to prepare a research design, i.e., he will have to state the conceptual structure within which research would be conducted. The preparation of such a design facilitates research to be as efficient as possible yielding maximal information. In other words, the function of research design is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money. But how all these can be achieved depends mainly on the research purpose. Research purposes may be grouped into four categories, viz.,

(i) Exploration,

(ii) Description,

(iii) Diagnosis, and

(iv) Experimentation.

A flexible research design which provides opportunity for considering many different aspects of a problem is considered appropriate if the purpose of the research study is that of exploration. But when the purpose happens to be an accurate description of a situation or of an association between variables, the suitable design will be one that minimises bias and maximises the reliability of the data collected and analysed.

5. Determining Sample Design: All the items under consideration in any field of inquiry constitute a 'universe' or 'population'. A complete enumeration of all the items in the 'population' is known as a census inquiry. It can be presumed that in such an inquiry when all the items are covered, no element of chance is left and highest accuracy is obtained. But in practice, this may not be true.

Even the slightest element of bias in such an inquiry will get larger and larger as the number of observations increases. Moreover, there is no way of checking the element of bias or its extent except through a resurvey or use of sample checks. Besides, this type of inquiry involves a great deal of time, money and energy. Not only this, census inquiry is not possible in practice under many circumstances.

For instance, blood testing is done only on sample basis. Hence, quite often, we select only a few items from the universe for our study purposes. The items so selected constitute what is technically called a sample. The researcher must decide the way of selecting a sample or what is popularly known as the sample design.

6. Collecting the Data: In dealing with any real-life problem, it is often found that data at hand are inadequate, and hence, it becomes necessary to collect data that are appropriate. There are several

ways of collecting the appropriate data which differ considerably in context of money costs, time and other resources at the disposal of the researcher.

Primary data can be collected either through experiment or through survey. If the researcher conducts an experiment, he observes some quantitative measurements, or the data, with the help of which he examines the truth contained in his hypothesis.

7. Execution of the Project: Execution of the project is a very important step in the research process. If the execution of the project proceeds on correct lines, the data to be collected would be adequate and dependable. The researcher should see that the project is executed in a systematic manner and in time. If the survey is to be conducted by means of structured questionnaires, data can be readily machine-processed. In such a situation, questions as well as the possible answers may be coded. If the data are to be collected through interviewers, arrangements should be made for proper selection and training of the interviewers.

The training may be given with the help of instruction manuals which clearly explains the job of the interviewers at each step. Occasional field checks should be made to ensure that the interviewers are doing their assigned job sincerely and efficiently. A careful watch should be kept for unanticipated factors in order to keep the survey as much realistic as possible. This, in other words, means that steps should be taken to ensure that the survey is under statistical control so that the collected information is in accordance with the pre-defined standard of accuracy. If some of the respondents do not cooperate, some suitable methods should be designed to tackle this problem. One method of dealing with the non-response problem is to make a list of the non-respondents and take a small sub-sample of them, and then with the help of experts, vigorous efforts can be made for securing response.

8. Analysis of Data: After the data have been collected, the researcher turns to the task of analysing them. The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding, tabulation and then drawing statistical inferences.

The unwieldy data should necessarily be condensed into a few manageable groups and tables for further analysis. Thus, researcher should classify the raw data into some purposeful and usable categories.

Coding operation is usually done at this stage through which the categories of data are transformed into symbols that may be tabulated and counted. *Editing* is the procedure that improves the quality of the data for coding. With coding, the stage is ready for tabulation.

Tabulation is a part of the technical procedure wherein the classified data are put in the form of tables. The mechanical devices can be made use of at this juncture. A great deal of data, especially in large inquiries, is tabulated by computers. Computers not only save time but also make it possible to study large number of variables affecting a problem simultaneously.

Analysis work after tabulation is generally based on the computation of various percentages, coefficients, etc. by applying various well-defined statistical formulae. In the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to tests of significance to determine with what validity data can be said to indicate any conclusion(s).

9. Hypothesis-testing: After analysing the data as stated above, the researcher is in a position to test the hypotheses, if any, he had formulated earlier. Do the facts support the hypotheses or they happen to be contrary? This is the usual question which should be answered while testing hypotheses.

Various tests, such as Chi-square test, t-test, F-test, etc. 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 it. If the researcher had no hypotheses to start with, generalisations established on the basis of data may be stated as hypotheses to be tested by subsequent researches in times to come.

10. Generalisations and Interpretation: If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalisation, i.e., to build a theory. As a matter of fact, the real value of research lies in its ability to arrive at certain generalisations. If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as interpretation. The process of interpretation may quite often trigger off new questions which in turn may lead to further researches.

11. Preparation of the Report or the Thesis: Finally, the researcher has to prepare the report of what has been done by him. Writing of report must be done with great care keeping in view the following:

- **The layout of the report should be as follows:**
  (i) The preliminary pages,
  (ii) The main text, and
  (iii) The end matter.

  In its preliminary pages, the report should carry title and date followed by acknowledgements and foreword. Then there should be a table of contents followed by a list of tables and list of graphs and charts, if any, given in the report.

  The main text of the report should have the following parts:

  (a) Introduction: It should contain a clear statement of the objective of the research and an explanation of the methodology adopted in accomplishing the research. The scope of the study along with various limitations should as well be stated in this part.

  (b) Summary of Findings: After introduction, there would appear a statement of findings and recommendations in non-technical language. If the findings are extensive, they should be summarised.

  (c) Main Report: The main body of the report should be presented in logical sequence and broken down into readily identifiable sections.

  (d) Conclusion: Towards the end of the main text, the researcher should again put down 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, i.e., list of books, journals, reports, etc. consulted, should also be given in the end. Index should also be given specially in a published research report.
- **Report should be written in a concise and objective style** in simple language avoiding vague expressions such as 'it seems,' 'there may be', and the like.
- **Charts and illustrations in the main report should be used** only if they present the information more clearly and forcibly.
- **Calculated 'confidence limits' must be mentioned** and the various constraints experienced in conducting research operations may as well be stated.

2.8 QUESTIONS

Q.1 State True or False

1. Research design specifies the objectives of the study, the methodology and techniques to be adopted for achieving the objectives.
2. A good research design is a blueprint specifying the methods to be adopted for gathering and analyzing the data.
3. A research design prescribes the boundaries of research activities and enables the researcher to channel his energies.
4. Independent variables that are not related to the purpose of the study, but may affect the dependent variable are termed as extraneous variables.
5. The different conditions under which experimental and control groups are put are usually referred to as experiment.
6. Qualitative research design is an excellent way of finalizing results and proving or disproving a hypothesis.
7. Quantitative experiments can be difficult and expensive and require a lot of time to perform.
8. Objective of the exploratory research is to manage the broad problem into specific problem statement and generate possible hypothesis.
9. The principal of randomization provides protections, when we conduct an experiment, against the effects of extraneous factors by randomization.
10. Completely Randomize design involves the principal of replication and the principal of randomization of experimental designs.

Answers: 1. True; 2. True; 3. False; 4. True; 5. False;
6. False; 7. True; 8. True; 9. True; 10. True.

Q.2 Multiple Choice Questions

1. Which is the program that guides the investigator in the process of collecting, analyzing and interpreting observation?
   (a) Research process (b) Research problem
   (c) Research design (d) All of the above
2. Research in which the independent variable is manipulated is called _____.
   (a) Experimental hypothesis testing research
   (b) Experimental and control group
   (c) Treatment
   (d) Experiment
3. Which is the advantage of the qualitative research design?
   (a) Can be difficult and expensive
   (b) An excellent way of finalizing results and proving hypothesis
   (c) Require extensive statistical analysis which is difficult
   (d) None of the above

4. Exploratory research studies are mainly used for _____.
   (a) Providing information (b) Establishing research priorities
   (c) Data collecting information (d) All of the above
5. Which of the following group refers to another group assigned to the experiment?
   (a) Treatment group (b) Control group
   (c) Experimental group (d) Random group
6. Which one of the following is a principle of experimental design?
   (a) Principle of randomization (b) Principle of replication
   (c) Principle of local control (d) All of the above
7. Which one of the following is an information experimental design?
   (a) Latin square design (b) Factorial design
   (c) Ex-post facto design (d) Randomized block design
8. Which one of the following is formal experimental design?
   (a) After with control (b) Before without control
   (c) Ex-post facto design (d) Completely randomized block design
9. Which one of the following is the advantage of randomized block design?
   (a) Missing plot are easily estimated
   (b) No restriction on the number of treatment
   (c) Both (a) and (b)
   (d) None of the above
10. Which one of the following are the advantages of Latin Square design?
   (a) You can control variation in two direction.
   (b) The number of treatment must equal the number of replicates.
   (c) The experimental error is likely to increase with the size of the square.
   (d) All of the above

Answers: 1. (c); 2. (a); 3. (b); 4. (d); 5. (b); 6. (d); 7. (c); 8. (d); 9. (e); 10. (a).

Q.3 Short Notes on

1. Essentials of good research design
2. Evaluation of research design

Q.4 Long Questions

1. Define research design. State the steps in research design.
2. What are the factors affecting research design?
3. Describe the process of research.