

Business Research Methods



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PREFACE

Business Research Methods is a course of study in several Master level programs like M.B.A., M.Com., M.S.W., etc and also for Ph.D., M.Phil., in all type of social sciences courses. It is a course of study in several Under Graduation level like B.Com., B.B.A., B.S.W., B.A., in all type of social sciences courses. And it is also a course of all professional diploma courses offered by Universities.

The course of Business Research Methods is often a theory course to both the students and the faculties. There are, of course, a few good publications on methodology of research, but they are mostly discipline-specific and do not cover all aspects of methodology and statistical analysis. The contents of the book are completely covered with theoretical part. It has grown out of our vast and rich experiences in guiding and evaluating research project students in Doctoral, M.Phil., Masters, Under Graduate and Diploma levels.

We are immensely thankful to the Skyfox Publishing Group for publishing this book on their official website. Suggestions for the improvement of the book are always welcome.

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Dr. J. MEXON, M.Com., M.Phil., B.Ed., Ph.D., (NET), currently is working as a Senior lecturer in the department of Commerce and Management at DMI St.Eugene University, Zambia, Central Africa. He has 9 years of teaching experience at the college and university level and published more than 10 research papers in the field of Commerce and Management. He has experience in handling subjects related to Commerce (Accounts and Finance) and Management. His area of specialization is Accounts. Currently he is guiding a number of Post Graduate and Ph.D students in research. As an experienced faculty, he would like to practice the unique methodology of teaching that creates interest among the students.

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Basically, he completed his Ph.D., (Management) in Bharathiar University in the year of 2015. Previously, his master degree that he has done MBA in Vel Tech Engineering College, Chennai. And he started his graduate degree from B.Com.Ed., in Pope John Paul College of Education – II which is located in Pondicherry. Moreover, he has done an additional degree of MHRM., & M.Com., in different Universities. If you want any further communication, kindly drop your message to my email address: searchanandu@gmail.com

BUSINESS RESEARCH METHODS

UNIT-I

Introduction to Research: An Overview – Nature, Scope, Objectives and Motivation of research. Types of Research, Research Process – Defining the problem, formulating the objectives and research hypothesis, research design, sample design, data collection, analysis and presentation. Research Design – Concepts and steps in research design. Types of research design, features of good research design.

UNIT-II

Sampling and Data Collection – Sampling – Meaning, Types of sampling – Probability and non-probability sampling techniques, Steps involved in sampling. Data Collection – Primary and Secondary data – Sources, Advantages and Limitations. Methods of data collection: Observations, survey, Interview and Questionnaire, Qualitative Techniques of data collection. Questionnaire design – Meaning – process of designing questionnaire.

UNIT-III

Measurement & Scaling Techniques – Meaning, Importance of scaling, and Types of scale: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Criteria for good measurement, attitude measurement - Attitude measurement scale – Likert's Scale, Semantic Differential Scale, Thurston scale, Multi-Dimensional Scaling.

UNIT-IV

Data Processing, Analysis and Interpretation – Preparing the data for analysis - Editing, Coding, Classification, Tabulation. Hypothesis testing – procedure, Type I and Type II Errors. Parametric and Non

Parametric tests, T test, Z Test, Analysis of Variance – One- Way and Two-way classification, Chi-Square test.

UNIT-V

Preparation and presentation of research report- Report writing. Types of reports, a broad sweep of research applications. Role of computers in research.

UNIT – 1

INTRODUCTION TO RESEARCH

RESEARCH

Research in simple terms refers to search for knowledge. It is a scientific and systematic search for information on a particular topic or issue. It is also known as the art of scientific investigation. Several social scientists have defined research in different ways.

In the *Encyclopedia of Social Sciences*, **D. Slesinger and M. Stephenson** (1930) defined research as “the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in the construction of theory or in the practice of an art”.

According to **Redman and Mory** (1923), research is a “systematized effort to gain new knowledge”. It is an academic activity and therefore the term should be used in a technical sense. According to Clifford Woody (Kothari, 1988), research comprises “defining and redefining problems, formulating hypotheses or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and finally, carefully testing the conclusions to determine whether they fit the formulated hypotheses”.

Thus, research is an original addition to the available knowledge, which contributes to its further advancement. It is an attempt to pursue truth through the methods of study, observation, comparison and experiment. In sum, research is the search for knowledge, using objective and systematic methods to find a solution to a problem.

MEANING OF RESEARCH

Research refers to a search for knowledge. Research is an art of scientific investigation.

The Advanced Learner's Dictionary of Current English lays down the meaning of research as, "a careful investigation or inquiry specially through search for new facts in any branch of knowledge".

SOME DEFINITIONS

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

According to **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.

According to **Redman and Mory** define research as a," Systematized effort to gain new knowledge". Some people consider research as a movement, a movement from the known to the unknown.

According to **Clifford woody**, research comprises defining and redefining problems,formulating hypothesis or suggested solutions collecting, organising and evaluating data,making deductions and reaching conclusions; to determine whether they fit the formulatinghypothesis.

PURPOSE / AIMS / OBJECTIVES OF RESEARCH

- To understand clearly an observed phenomenon and explain its logic and reason forhappening.
- To get insights about the 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.

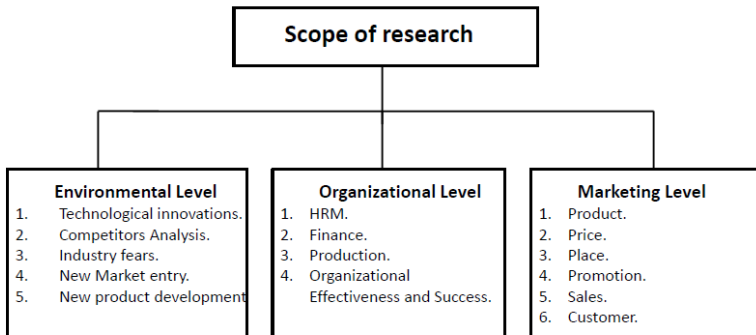
NATURE OF RESEARCH

- It strives to be objective and logical.
- It is based on observable experience or empirical evidence.
- It is characterised by patient and unhurried activity.
- It demands accurate observations, reservations and descriptions.
- It is directed towards the solution of the problem.
- It is carefully recorded and reported.
- It requires expertise.
- It involves gathering new data from primary or first hand sources or using existing data for new purpose.

FEATURES OF RESEARCH

- It means the discovery of new knowledge
- Is essentially an investigation
- Is related with the solution of a problem
- It is based on observation or experimental evidences.
- It demands accurate observation or experimentation.
- In research, the researchers try to find out answers for unsolved questions
- It should be carefully recorded and reported

SCOPE OF RESEARCH



QUALITIES OF A GOOD RESEARCH

A research is a wide task and it requires great efforts for a researcher. A good research should have the following qualities:

1. Method of Approach: The researcher should adopt the correct course of action for identifying a problem and then for working on it, to find a solution for that problem.

2. Knowledge: The researcher should have complete knowledge and information about the field of investigation so that he can go in for correct planning and then application of the correct and efficient methods for selection of the problem and then for solving it.

3. Qualification: The researcher should have a good background of study, which will facilitate the researcher to have a better knowledge and understanding of the subject.

4. Motivation: The researcher must be motivated to perform his work. For that, he should have a proper attitude, vision of his own, and an aim with some objectives to achieve something.

5. Perseverance: Perseverance means to carry on work strongly even though there are certain problems and difficulties in carrying

out the work. As a result researcher should be stable and must have consistent thinking.

6. Communication Skills: Good Communication skills are required by researcher as he can interact with respondents efficiently and understand their opinions.

7. Organisational Skills: Researcher should use time management techniques so that work can be completed on time. Whereas maintaining budget, keeping records, filing necessary documents, keeping paper cuttings is needed to carry on work successfully.

BUSINESS RESEARCH

Business research refers to systematic collection and analysis of data with the purpose of finding answers to problems facing management. It can be carried out with the objective to explore, to describe or to diagnose a phenomenon. It involves establishing objectives and gathering relevant information to obtain the answer to a business issue and it can be conducted to answer a business related question, such as: What is the target market of my product? Business research can also be used to solve a business-related problem, such as determining how to decrease the amount of excess inventory on hand.

When deciding whether business research is to be conducted or not, the firm keeps in mind factors like the availability of data, time constraints and the value of the research information to the company. Adequate planning and information-gathering are essential to derive results for business.

SOCIAL RESEARCH

Social research refers to research conducted by social scientists. It is the scientific investigation conducted in the field of social sciences and also in the behavioral sciences. Social research methods can generally vary along a quantitative/qualitative dimension. While

various methods may sometimes be classified as quantitative or qualitative, most methods contain elements of both. Social scientists employ a range of methods in order to analyse a vast breadth of social phenomena; from census survey data derived from millions of individuals, to the in-depth analysis of a single agent's social experiences; from monitoring what is happening on contemporary streets, to the investigation of ancient historical documents.

The social science research is a systematic method of exploring, analyzing and conceptualizing social life in order to expand, correct or verify knowledge whether that knowledge aids in the construction of theory or in the practice of an art.

EDUCATIONAL RESEARCH

Educational Research is that activity which is directed towards development of a science of behaviour in educational situations. The ultimate aim of this research is to provide knowledge that will permit the educator to achieve his goals by most effective methods. Educational research refers to a variety of methods, in which individuals evaluate different aspects of education including: "student learning, teaching methods, teacher training, and classroom dynamics".

Educational researchers have come to the consensus that, educational research must be conducted in a rigorous and systematic way although what this implies is often debated. There are a variety of disciplines which are each present to some degree in educational research. These include psychology, sociology, anthropology, and philosophy. The overlap in disciplines creates a broad range from which methodology can be drawn. The findings of educational research also need to be interpreted within the context in which they were discovered as they may not be applicable in every time or place.

RESEARCH METHODS VERSUS METHODOLOGY

Research methods include all those techniques/methods that are adopted for conducting research. Thus, research techniques or methods are the methods that the researchers adopt for conducting the research studies.

On the other hand, research methodology is the way in which research problems are solved systematically. It is a science of studying how research is conducted scientifically. Under it, the researcher acquaints himself/herself with the various steps generally adopted to study a research problem, along with the underlying logic behind them. Hence, it is not only important for the researcher to know the research techniques/methods, but also the scientific approach called methodology.

RESEARCH APPROACHES

There are two main approaches to research, namely quantitative approach and qualitative approach. The quantitative approach involves the collection of quantitative data, which are put to rigorous quantitative analysis in a formal and rigid manner. This approach further includes experimental, inferential, and simulation approaches to research. Meanwhile, the qualitative approach uses the method of subjective assessment of opinions, behaviour and attitudes. Research in such a situation is a function of the researcher's impressions and insights. The results generated by this type of research are either in non-quantitative form or in the form which cannot be put to rigorous quantitative analysis. Usually, this approach uses techniques like indepth interviews, focus group interviews, and projective techniques.

TYPES OF RESEARCH

Research may be broadly classified as (1) Fundamental and Applied Research (2) Descriptive and Analytical Research or (3) Quantitative and Qualitative Research or (4) Conceptual and Empirical Research

1. Fundamental (or Basic) and Applied Research

Fundamental research is mainly concerned with generalization with the formulation of a theory. It is a research concerning principles or laws or rules. It aims at the achievement of knowledge and truth. Research studies concentrating on some natural phenomenon or relating to pure mathematics are examples of fundamental research. It aims at some theoretical conclusions. It may verify the old theory or establish a new one. It tries to explain the cause and effect relationship in social phenomena. It is essentially positive and not normative. That is, it explains the phenomena as they are and not as they should be.

Applied research is concerned with the solution of particular problems. It aims at finding a solution for an immediate problem facing a society or an industrial organization. It is empirical and practical. It is concerned with applied aspects of life. Research to identify social, economic or political trends that may affect a particular institution or the marketing research are examples of applied research.

2. Descriptive Research and Analytical Research

Descriptive research includes survey and fact finding enquiries of different kinds. It describes the state of affairs as it exists at present. The researcher has no control over the variables. He can only report what has happened or what is happening.

In Analytical research one has to use facts or information already available and analyse these to make a critical evaluation of the material.

3. Quantitative Research and Qualitative Research

Quantitative research is applicable to phenomena that are measurable so that they can be expressed in terms of quantity.

Qualitative research is concerned with qualitative phenomenon. Research designed to find out how people feel or what they think about a particular subject is a qualitative research. Qualitative research is especially important in the behavioural sciences where the aim is to discover underlying motives of human behaviour.

4. Conceptual Research and Empirical Research

Conceptual research is that related to some abstract ideas or theory. It is generally used by philosophers and thinkers to develop new concepts or to interpret existing ones.

Empirical research relies on experience or observation alone. It is data based research coming up with conclusions capable of being verified by observation or experiment. It can be experiment research. In empirical research, the researcher has to first set up a hypothesis or guess as to the probable results. He then works out to get enough facts to prove or disprove his hypothesis.

Empirical studies have a great potential for they lead to inductions and deductions. Thus research enables one to develop theories and principles and to arrive at generalizations. As research is based on observations and empirical evidences it improves knowledge and understanding as well as decision making skill and ability.

PROCESS OF RESEARCH

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

1. Formulating the research problem
2. Extensive literature survey
3. Development of working hypothesis
4. Preparing the research design
5. Determining sample design
6. Collecting the data
7. Execution of the project

8. Analysis of data
9. Hypothesis testing
10. Generalizations and interpretation
11. Preparation of the report or presentation of the results, i.e., formal write-up of conclusions reached.

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 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 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 the extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses. The working hypothesis is a 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.

The 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 a 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 the 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 explain 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, the researcher should classify the raw data into some purposeful and usable categories.

a. 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.

b. 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 a large number of variables affecting a problem simultaneously.

c. 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. Generalizations and Interpretation

If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalizations, i.e., to build a theory. As a matter of fact, the real value of research lies in its ability to arrive at certain generalizations. 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:

A. 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.

B. 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.

C. Charts and illustrations in the main report should be used only if they present the information more clearly and forcibly.

D. Calculated 'confidence limits' must be mentioned and the various constraints experienced in conducting research operations may as well be stated.

RESEARCH DESIGN

A research design 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. In fact the research design is the conceptual structure within which research is conducted. It constitutes the blueprint for the collection, measurement and analysis of data. In keeping with the above stated design decisions one may split the overall research design into the following parts;

1. **The sampling design:** Which deals with the method of selecting items to be observed for the given study.
2. **The above observational design:** which relates to the conditions under which the observation is to be made?
3. **The statistical Design:** which concerns with the question of how many items are to be observed and how the information and data gathered are to be analysed.

4. **The operational design:** which deals with the techniques by which the procedures specified in the sampling , statistical and observational design can be carried out.

FEATURES OF THE RESEARCH DESIGN:

1. It is a plan that specifies the source and types of information relevant to the research problem.
2. It is an outline that specifies the objectives of the study and the hypothesis
Relevant to the research questions.
 - It is a blueprint specifying his methods to be adopted for gathering and analyzing data.
3. It is a scheme defining the domain of generalisability.

SIGNIFICANCE OF RESEARCH DESIGN:

- It may lead in the desired type of study with useful conclusions
- It may lead to more accurate results or help to reduce inaccuracy.
- It may lead to optimum efficiency and reliability.
- It may minimize the wastage of time and beating about the bush.
- It may minimize the uncertainty, confusing and practical hazards associated with research problem.
- It may be helpful for the collection of research material and testing of hypothesis.
- A research design is a guidepost for research direction.

TYPES OF RESEARCH DESIGN

There are different types of research designs. They may be broadly categorized as:

- (1) Exploratory Research Design;
- (2) Descriptive and Diagnostic Research Design; and

(3) Hypothesis-Testing Research Design.

1. Exploratory Research Design:

The Exploratory Research Design is known as formulative research design. The main objective of using such a research design is to formulate a research problem for an in-depth or more precise investigation, or for developing a working hypothesis from an operational aspect. The major purpose of such studies is the discovery of ideas and insights. Therefore, such a research design suitable for such a study should be flexible enough to provide opportunity for considering different dimensions of the problem under study. The in-built flexibility in research design is required as the initial research problem would be transformed into a more precise one in the exploratory study, which in turn may necessitate changes in the research procedure for collecting relevant data. Usually, the following three methods are considered in the context of a research design for such studies. They are (a) a survey of related literature; (b) experience survey; and (c) analysis of 'insight-stimulating' instances.

2. Descriptive And Diagnostic Research Design:

A Descriptive Research Design is concerned with describing the characteristics of a particular individual or a group. Meanwhile, a diagnostic research design determines the frequency with which a variable occurs or its relationship with another variable. In other words, the study analyzing whether a certain variable is associated with another comprises a diagnostic research study.

On the other hand, a study that is concerned with specific predictions or with the narration of facts and characteristics related to an individual, group or situation, are instances of descriptive research studies.

Generally, most of the social research design falls under this category. As a research design, both the descriptive and diagnostic

studies share common requirements, hence they are grouped together. However, the procedure to be used and the research design need to be planned carefully. The research design must also make appropriate provision for protection against bias and thus maximize reliability, with due regard to the completion of the research study in an economical manner. The research design in such studies should be rigid and not flexible. Besides, it must also focus attention on the following:

- a) Formulation of the objectives of the study,
- b) Proper designing of the methods of data collection,
- c) Sample selection,
- d) Data collection,
- e) Processing and analysis of the collected data, and
- f) Reporting the findings.

3. Hypothesis-Testing Research Design:

Hypothesis-Testing Research Designs are those in which the researcher tests the hypothesis of causal relationship between two or more variables. These studies require procedures that would not only decrease bias and enhance reliability, but also facilitate deriving inferences about the causality. Generally, experiments satisfy such requirements. Hence, when research design is discussed in such studies, it often refers to the design of experiments.

CHARACTERISTICS OF A GOOD RESEARCH DESIGN

A good research design often possesses the qualities of being flexible, suitable, efficient, economical and so on. Generally, a research design which minimizes bias and maximizes the reliability of the data collected and analysed is considered a good design (Kothari 1988). A research design which does not allow even the smallest experimental error is said to be the best design for investigation. Further, a research design that yields maximum information and provides an opportunity of viewing the various dimensions of a

research problem is considered to be the most appropriate and efficient design.

Thus, the question of a good design relates to the purpose or objective and nature of the research problem studied. While a research design may be good, it may not be equally suitable to all studies. In other words, it may be lacking in one aspect or the other in the case of some other research problems. Therefore, no single research design can be applied to all types of research problems.

A research design suitable for a specific research problem would usually involve the following considerations:

- i. The methods of gathering the information;
- ii. The skills and availability of the researcher and his/her staff, if any;
- iii. The objectives of the research problem being studied;
- iv. The nature of the research problem being studied; and
- v. The available monetary support and duration of time for the research work.

UNIT – 2

SAMPLING AND DATA COLLECTION

SAMPLING

Though sampling is not new, the sampling theory has been developed recently. People knew or not but they have been using the sampling technique in their day to day life. For example a house wife tests a small quantity of rice to see whether it has been well-cooked and gives the generalized result about the whole rice boiling in the vessel. The result arrived at is most of the times 100% correct. In another example, when a doctor wants to examine the blood for any deficiency, takes only a few drops of blood of the patient and examines. The result arrived at is most of the times correct and represent the whole amount of blood available in the body of the patient. In all these cases, by inspecting a few, they simply believe that the samples give a correct idea about the population. Most of our decision are based on the examination of a few items only i.e. Sample studies. In the words of Croxton and Cowdon, "It may be too expensive or too time consuming to attempt either a complete or a nearly complete coverage in a statistical study. Further to arrive at valid conclusions, it may not be necessary to enumerate all or nearly all of a population. We may study a sample drawn from the large population and if that sample is adequately representative of the population, we should be able to arrive at valid conclusions."

DEFINITION

According to **Gerald Hursh** "a Sample Design is the theoretical basis and the practical means by which we infer the characteristics of some population by generalizing from the characteristics of relatively few of the units comprising the population".

According to **Rosander**, "The sample has many advantages over a census or complete enumeration. If carefully designed, the sample is

not only considerably cheaper but may give results which are just accurate and sometimes more accurate than those of a census. Hence a carefully designed sample may actually be better than a poorly planned and executed census.”

MEANING

Sampling is concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population. Two advantages of sampling are that the cost is lower and data collection is faster than measuring the entire population. A Sample design is a definite plan for obtaining a sample from a given population

Population	The population is a group that is studied by researcher
Sampling	The process of selecting a part of population
Sample	The selected part of the population
Sample Size	The number of people in the selected sample
Sample Frame	The list of individual or people included in the sample
Sample Technique	It refers to the technique or procedure used to select members of the sample

MERITS OF SAMPLING

1. It saves time:

Sampling method of data collection saves time because fewer items are collected and processed. When the results are urgently required, this method is very helpful.

2. It reduces cost:

Since only a few and selected items are studied in sampling, there is a reduction in cost of money and reduction in terms of man hours.

3. More reliable results can be obtained:

Through sampling, more reliable results can be obtained because (a) there are fewer chances of sampling statistical errors. If there is sampling error, it is possible to estimate and control the results.(b) Highly experienced and trained persons can be employed for scientific processing and analyzing of relatively limited data and they can use their high technical knowledge and get more accurate and reliable results.

4. It provides more detailed information:

As it saves time, money and labor, more detail information can be collected in a sample survey.

5. Sometimes only a sampling method to depend upon:

Some times it so happens that one has to depend upon the sampling method alone because if the population under study is finite, sampling method is the only method to be used. For example, if someone's blood has to be examined, it will become fatal to take all the blood out from the body and study depending upon the total enumeration method.

6. Administrative convenience:

The organization and administration of sample survey are easy for the reasons which have been discussed earlier.

7. More scientific:

Since the methods used to collect data are based on scientific theory and results obtained can be tested, sampling is a more scientific method of collecting data.

It is not that sampling is free from demerits or shortcomings. There are certain **shortcomings of this method** which are discussed below:

1. Illusory Conclusion:

If a sample enquiry is not carefully planned and executed, the conclusions may be inaccurate and misleading.

2. Sample Not Representative:

To make the sample representative is a difficult task. If a representative sample is taken from the universe, the result is applicable to the whole population. If the sample is not representative of the universe the result may be false and misleading.

3. Lack of Experts:

As there are lack of experts to plan and conduct a sample survey, its execution and analysis, and its results would be Unsatisfactory and not trustworthy.

4. Sometimes More Difficult than Census Method:

Sometimes the sampling plan may be complicated and requires more money, labor and time than a census method.

5. Personal Bias:

There may be personal biases and prejudices with regard to the choice of technique and drawing of sampling units.

6. Choice of Sample Size:

If the size of the sample is not appropriate then it may lead to untrue characteristics of the population.

7. Conditions of Complete Coverage:

If the information is required for each and every item of the universe, then a complete enumeration survey is better.

ESSENTIALS OF SAMPLING

In order to reach a clear conclusion, the sampling should possess the following essentials:

1. It must be representative:

The sample selected should possess the similar characteristics of the original universe from which it has been drawn.

2. Homogeneity:

Selected samples from the universe should have similar nature and should not have any difference when compared with the universe.

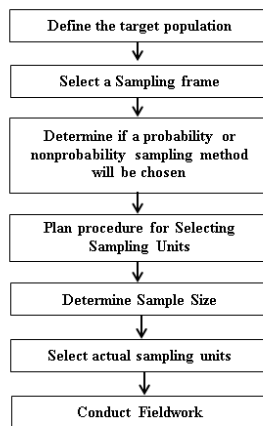
3. Adequate samples:

In order to have a more reliable and representative result, a good number of items are to be included in the sample.

4. Optimization:

All efforts should be made to get maximum results both in terms of cost as well as efficiency. If the size of the sample is larger, there is better efficiency and at the same time the cost is more. A proper size of sample is maintained in order to have optimized results in terms of cost and efficiency.

STEPS IN SAMPLING DESIGN



TYPES OF SAMPLING: SAMPLING METHODS

Sampling in market research is of two types – probability sampling and non-probability sampling. Let's take a closer look at these two methods of sampling.

1. Probability Sampling
2. Non-Probability Sampling

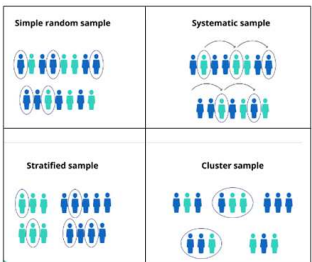
1. Probability sampling

Probability sampling is a sampling technique where a researcher sets a selection of a few criteria and chooses members of a population randomly. All the members have an equal opportunity to be a part of the sample with this selection parameter.

Probability sampling is a sampling technique in which researchers choose samples from a larger population using a method based on the theory of probability. This sampling method considers every member of the population and forms samples based on a fixed process.

For example, in a population of 1000 members, every member will have a $1/1000$ chance of being selected to be a part of a sample. Probability sampling eliminates bias in the population and gives all members a fair chance to be included in the sample.

Probability Sampling



A. Simple random sampling

In a simple random sample, every member of the population has an equal chance of being selected. Your sampling frame should include the whole population.

To conduct this type of sampling, you can use tools like random number generators or other techniques that are based entirely on chance.

Example

You want to select a simple random sample of 100 employees of Company X. You assign a number to every employee in the company database from 1 to 1000, and use a random number generator to select 100 numbers.

2. Systematic sampling

Systematic sampling is similar to simple random sampling, but it is usually slightly easier to conduct. Every member of the population is listed with a number, but instead of randomly generating numbers, individuals are chosen at regular intervals.

Example

All employees of the company are listed in alphabetical order. From the first 10 numbers, you randomly select a starting point: number 6. From number 6 onwards, every 10th person on the list is selected (6, 16, 26, 36, and so on), and you end up with a sample of 100 people.

If you use this technique, it is important to make sure that there is no hidden pattern in the list that might skew the sample. For example, if the HR database groups employees by team, and team members are listed in order of seniority, there is a risk that your interval might skip over people in junior roles, resulting in a sample that is skewed towards senior employees.

3. Stratified sampling

This sampling method is appropriate when the population has mixed characteristics, and you want to ensure that every characteristic is proportionally represented in the sample.

You divide the population into subgroups (called strata) based on the relevant characteristic (e.g. gender, age range, income bracket, job role).

From the overall proportions of the population, you calculate how many people should be sampled from each subgroup. Then you use random or systematic sampling to select a sample from each subgroup.

Example

The company has 800 female employees and 200 male employees. You want to ensure that the sample reflects the gender balance of the company, so you sort the population into two strata based on gender. Then you use random sampling on each group, selecting 80 women and 20 men, which gives you a representative sample of 100 people.

4. Cluster sampling

Cluster sampling also involves dividing the population into subgroups, but each subgroup should have similar characteristics to the whole sample. Instead of sampling individuals from each subgroup, you randomly select entire subgroups.

If it is practically possible, you might include every individual from each sampled cluster. If the clusters themselves are large, you can also sample individuals from within each cluster using one of the techniques above.

This method is good for dealing with large and dispersed populations, but there is more risk of error in the sample, as there could be substantial differences between clusters. It's difficult to guarantee that the sampled clusters are really representative of the whole population.

Example

The company has offices in 10 cities across the country (all with roughly the same number of employees in similar roles). You don't have the capacity to travel to every office to collect your data, so you use random sampling to select 3 offices – these are your clusters.

2. Non-probability sampling

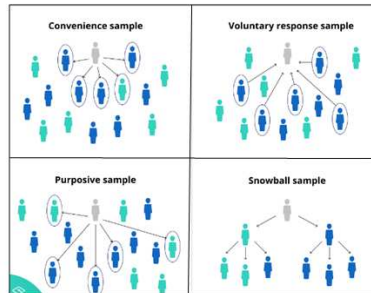
In non-probability sampling, the researcher chooses members for research at random. This sampling method is not a fixed or predefined selection process. This makes it difficult for all elements of a population to have equal opportunities to be included in a sample.

In a non-probability sample, individuals are selected based on non-random criteria, and not every individual has a chance of being included.

This type of sample is easier and cheaper to access, but it has a higher risk of sampling bias, and you can't use it to make valid statistical inferences about the whole population.

Non-probability sampling techniques are often appropriate for exploratory and qualitative research. In these types of research, the aim is not to test a hypothesis about a broad population, but to develop an initial understanding of a small or under-researched population.

Non-Probability Sampling



A. Convenience sampling

A convenience sample simply includes the individuals who happen to be most accessible to the researcher.

This is an easy and inexpensive way to gather initial data, but there is no way to tell if the sample is representative of the population, so it can't produce generalizable results.

Example

You are researching opinions about student support services in your university, so after each of your classes, you ask your fellow students to complete a survey on the topic. This is a convenient way to gather data, but as you only surveyed students taking the same classes as you at the same level, the sample is not representative of all the students at your university.

B. Voluntary response sampling

Similar to a convenience sample, a voluntary response sample is mainly based on ease of access. Instead of the researcher choosing participants and directly contacting them, people volunteer themselves (e.g. by responding to a public online survey).

Voluntary response samples are always at least somewhat biased, as some people will inherently be more likely to volunteer than others.

Example

You send out the survey to all students at your university and a lot of students decide to complete it. This can certainly give you some insight into the topic, but the people who responded are more likely to be those who have strong opinions about the student support services, so you can't be sure that their opinions are representative of all students.

C. Purposive sampling

This type of sampling involves the researcher using their judgement to select a sample that is most useful to the purposes of the research.

It is often used in qualitative research, where the researcher wants to gain detailed knowledge about a specific phenomenon rather than make statistical inferences. An effective purposive sample must have clear criteria and rationale for inclusion.

Example

You want to know more about the opinions and experiences of disabled students at your university, so you purposefully select a number of students with different support needs in order to gather a varied range of data on their experiences with student services.

D. Snowball sampling

If the population is hard to access, snowball sampling can be used to recruit participants via other participants. The number of people you have access to "snowballs" as you get in contact with more people.

Example

You are researching experiences of homelessness in your city. Since there is no list of all homeless people in the city, probability sampling isn't possible. You meet one person who agrees to participate in the research, and she puts you in contact with other homeless people that she knows in the area.

DATA COLLECTION

Data refers to information or facts. Often researcher understands by data only numerical figure. It also includes descriptive facts, non-numerical information, qualitative and quantitative information. Data could be broadly classified as:

1. Primary Data
2. Secondary Data

1. Primary Data

It is known as the data collected for the first time through field survey. Such data are collected with specific set of objectives to assess the current status of any variable studied. Primary data are generally information gathered or generated by the researcher for the purpose of the project immediately at hand. When the data are collected for the first time, the responsibility for their processing also rests with the original investigator.

2. Secondary data

It refers to the information or facts already collected. Such data are collected with the objective of understanding the past status of any variable. Secondary data can be obtained internally ie within the firm or external from one or more outside agencies.

Secondary data are those which have been collected by some other persons for his purpose and published. They are usually in the shape of finished products.

ADVANTAGES OF PRIMARY DATA

1. It provide a first hand account of the situation. We can observe the phenomenon as it takes place.
2. The information is more reliable as the investigator collects the data himself, he can take all precautions to ensure their reliability
3. These are the logical starting point for research in several disciplines.
4. Primary data are the only way of finding out opinions, personal qualities, attitudes etc.

DISADVANTAGES OF PRIMARY DATA

1. Collecting primay data is expensive in terms of both time & money.
2. There is greater scope for researcher bias creeping in unless the research investigator is fair to the respondent and methods of data collection the result of the study will not be reliable.
3. Sample selection is yet another problem.

METHODS OF COLLECTING PRIMARY DATA

1. Questionnaire

In this method to pre-printed list of questions arranged in sequence is used to elicit response from the informant.

2. Interview

This is a method in which the investigator and the respondent meet and questions raised are answered and recorded. This method is

adopted when personal opinion or view point are to be gathered as a part of data.

3. Observation

A method which requires familiarity and experience, in this method the observer applies his sense organs to note down whatever that he could observe in the field and relate these data to explain some phenomena.

4. Feedback

In the case of some of the consumer goods, the supplier or the manufacturer send the product along with a pre-paid reply cover in which questions on the product and its usage are raised and the customer is required to fill it up and send.

5. Sales force opinion

The sales representatives visit the distributor or the retailers shop to note down the detail of stock movement, availability of items etc which give valuable information.

6. Schedule

This method of data collection is very much like the questionnaire with little difference which lies in the fact that schedules are being filled in by the enumerators who are specially appointed for the purpose.

7. Warranty Card

Warranty Card are usually postal sized card which are used by dealers of consumer durables to collect information regarding their products. The information sought is printed in the form of question on the warranty cards which is placed insided the package along

with the product with a request to the consumer to fill in the card and post it back to the dealer.

8. Distributor or store Audit

Distributors get the retail stores audited through salesman and use such information to estimate market size, market share, seasonal purchasing pattern & so on.

TYPES OF PRIMARY DATA

1. Structured Observation

When observation takes place strictly in accordance with a plan or a design prepared in advance, it is called structured observation. In such a type the observer decided what to observe what to focus on, who are all to be observed etc.

2. Unstructured Observation

In this type of observation there is no advance designing of what, how, when, who etc of observation. The observer is given the freedom to decide on the spot, to observe everything that is relevant.

3. Participant Observation

In this, the observer is very much present in the midst of what is observed. He is physically present on the spot to observe and not influencing the activities. It will help him to continuously observe and not everything that is happening around him.

4. Non Participant Observation

In this observer remains detached from whatever is happening around and does not involve himself in any activities taking place. He is present only to observe and not to take part in the activities.

5. Controlled Observation

In this case, the observer performs his work in the environment or situation, which is very much planned or designed or set.

6. Uncontrolled Observation

The observer is at freedom to observe whatever is taking place around him in the natural set up.

ADVANTAGES OF SECONDARY DATA

1. The information can be collected by incurring the least cost.
2. The time required for obtaining the information is very less.
3. Most of the secondary data are those published by big institutions. So they contain large quantity of information..

DISADVANTAGES OF SECONDARY DATA

1. Since the secondary data is a result of some other person's attempt, it need not be suitable for a researcher, who makes use of it.
2. It may be inaccurate and unreliable.
3. It may contain certain errors.

SOURCES OF SECONDARY DATA

There are varieties of published sources from which one can get information for his research work. The important such sources are;

1. Official report of the central, state and local government.
2. Official publications of the foreign governments and international bodies like UNO and its subordinate bodies.
3. Reports and publications of Trade Associations, Banks, Cooperative Societies and Similar Semi Government and Autonomous Organizations.
4. Technical journals, News papers, Books, Periodicals, etc

5. Publications of research Organizations, Centers, Institutes, and reports submitted by Economists, Research scholars etc.

DATA COLLECTION METHODS

In this section, the researcher should describe the major methods for collecting data from the subjects. The major methods for obtaining data in a study may include:

1. Personal Interviews
2. Questionnaires
3. Observation techniques
4. Focus Groups
5. Surveys

1. Personal Interview

An interview is a direct face-to-face attempt to obtain reliable and valid measures in the form of verbal responses from one or more respondents. It is a conversation in which the roles of the interviewer and the respondent change continually.

Advantages

- Allows the interviewer to clarify questions.
- Can be used with young children and illiterates.
- Allow the informants to respond in any manner they see fit.
- Allows the interviewers to observe verbal and non-verbal behavior of the respondents.
- Means of obtaining personal information, attitudes, perceptions, and beliefs.
- Reduces anxiety so that potentially threatening topics can be studied.

Disadvantages

- Unstructured interviews often yield data too difficult to summarize or evaluate.
- Training interviewers, sending them to meet and interview their informants, and evaluating their effectiveness all add to the cost of the study.

2. Questionnaire

A questionnaire is a means of eliciting the feelings, beliefs, experiences, perceptions, or attitudes of some sample of individuals. As a data collecting instrument, it could be structured or unstructured.

The questionnaire is most frequently a very concise, preplanned set of questions designed to yield specific information to meet a particular need for research information about a pertinent topic. The research information is attained from respondents normally from a related interest area. The dictionary definition gives a clearer definition: A questionnaire is a written or printed form used ingathering information on some subject or subjects consisting of a list of questions to be submitted to one or more persons.

Advantages

- **Economy** - Expense and time involved in training interviewers and sending them to interview are reduced by using questionnaires.
- **Uniformity of questions** - Each respondent receives the same set of questions phrased in exactly the same way. Questionnaires may, therefore, yield data more comparable than information obtained through an interview.
- **Standardization** - If the questions are highly structured and the conditions under which they are answered are

controlled, then the questionnaire could become standardized.

Disadvantages

- Respondent's motivation is difficult to assess, affecting the validity of response.
- Unless a random sampling of returns is obtained, those returned completed may represent biased samples.

3. Direct Observation

Direct observation is a measuring instrument used to measure such traits as self-control, cooperativeness, truthfulness, and honesty. In many cases, systematic direct observation of behavior is the most desirable measurement method. An investigator identified the behavior of interest and devises a systematic procedure for identifying, categorizing, and recording the behavior in either a natural or "staged" situation.

Advantages

- It allows planners to get the views in a broad perspective rather than from an isolated point of view.
- Delphi in combination with other tools is a very potent device for teaching people to think about the future of education in much more complex ways than they ordinarily would.
- It is a useful instrument even for a general teaching strategy.
- It is a planning tool, which may aid in probing priorities held by members and constituencies of an organization.
- Delphi saves time and travel, which are required to bring people together for a conference.
- Delphi prevents personality biases from affecting the results.

Disadvantages

- Interpretation of the participants' responses and the meaning of the importance of the factors in planning are difficult.
- It is unknown how the findings can be generalized to Delphis which cover a 30 year extension into the future.
- Delphi at present can render no rigorous distinction between reasonable judgment and mere guessing.
- It is difficult to determine the amount of bias injected into the results by the person administering the Delphi.

4. Focus Groups Discussion (FGD)

A focus group is an organized discussion session. A panel of people meets for a short duration to exchange ideas, feelings, and experiences on a specific topic. A trained facilitator, using group dynamics principles, guides participants through the meeting. Increasingly used in social and business research, focus group meetings enable a researcher to gain much information in a relatively short period of time (Morgan & Kruger 1993).

Focus groups have been a mainstay in private sector marketing research for the past three decades. More recently, public sector organizations are beginning to discover the potential of these procedures. Educational and nonprofit organizations have traditionally used face-to-face interviews and questionnaires to get information. Unfortunately, these popular techniques are sometimes inadequate in meeting information needs of decision makers. The focus group is unique from these other procedures; it allows for group interaction and greater insight into why certain opinions are held. Focus groups can improve the planning and design of new programs, provide means of evaluating existing programs, and produce insights for developing marketing strategies.

Advantages

- It is a socially oriented research procedure.
- The format allows the moderator to probe.
- Discussions have high face validity.
- Discussions can be relatively low cost.
- The format can provide speedy results.
- Focus groups enable the researcher to increase the sample size of qualitative studies.

Limitations

- The researcher has less control in the group interview as compared to the individual interview.
- Data are more difficult to analyze.
- The technique requires carefully trained interviewers.
- Groups can vary considerably.
- Groups are difficult to assemble
- The discussion must be conducted in an environment conducive to conversation.

5. Telephone Surveys - surveying by telephone is the most popular interviewing method.

Advantages

- People can usually be contacted faster over the telephone than with other methods. If the Interviewers are using CATI (computer-assisted telephone interviewing), the results can be available minutes after completing the last interview.
- You can dial random telephone numbers when you do not have the actual telephone numbers of potential respondents.
- CATI software, such as The Survey System, makes complex questionnaires practical by offering many logic options. It can automatically skip questions, perform calculations and

modify questions based on the answers to earlier questions. It can check the logical consistency of answers and can present questions or answers choices in a random order (the last two are sometimes important for reasons described later).

- Skilled interviewers can often elicit longer or more complete answers than people will give on their own to mail, email surveys (though some people will give longer answers to Web page surveys). Interviewers can also ask for clarification of unclear responses.
- Some software, such as The Survey System, can combine survey answers with preexisting information you have about the people being interviewed.

Disadvantages

- Many telemarketers have given legitimate research a bad name by claiming to be doing research when they start a sales call. Consequently, many people are reluctant to answer phone interviews and use their answering machines to screen calls.
- The growing number of working- women often means that no one is at home during the day.
- You cannot show or sample products by phone.

6. Mail Surveys

Advantages

- Mail surveys are among the least expensive.
- This is the only kind of survey you can do if you have the names and addresses of the target population, but not their telephone numbers.
- The questionnaire can include pictures - something that is not possible over the phone.

- Mail surveys allow the respondent to answer at their leisure, rather than at the often inconvenient moment they are contacted for a phone or personal interview. For this reason, they are not considered as intrusive as other kinds of interviews.

Disadvantages

- Time, mail surveys take longer than other kinds. You will need to wait several weeks after mailing out questionnaires before you can be sure that you have gotten most of the responses.
- In populations of lower educational and literacy levels, response rates to mail surveys are often too small to be useful.

7. Computer Direct Interviews

These are interviews in which the Interviewees enter their own answers directly into a computer. They can be used at malls, trade shows, offices, and so on. The Survey System's optional Interviewing Module and Interview Stations can easily create computer-direct interviews. Some researchers set up a Web page survey for this purpose.

Advantages

- The virtual elimination of data entry and editing costs.
- You will get more accurate answers to sensitive questions.
- The elimination of interviewer bias. Different interviewers can ask questions in different ways, leading to different results. The computer asks the questions the same way every time.
- Response rates are usually higher. Computer-aided interviewing is still novel enough that some people will

answer a computer interview when they would not have completed another kind of interview.

Disadvantages

- The Interviewees must have access to a computer or one must be provided for them.
- As with mail surveys, computers direct interviews may have serious response rate problems in populations of lower educational and literacy levels. This method may grow in importance as computer use increases.

8. Email Surveys

Email surveys are both very economical and very fast. More people have email than have full Internet access. This makes email a better choice than a Web page survey for some populations. On the other hand, email surveys are limited to simple questionnaires, whereas Web page surveys can include complex logic.

Advantages

- Speed. An email questionnaire can gather several thousand responses within a day or two.
- There is practically no cost involved once the set up has been completed.
- You can attach pictures and sound files.
- The novelty element of an email survey often stimulates higher response levels than ordinary “snail” mail surveys.

Disadvantages

- You must possess (or purchase) a list of email addresses.
- Some people will respond several times or pass questionnaires along to friends to answer. Many programs have no check to eliminate people responding multiple times to bias the results.

- Many people dislike unsolicited email even more than unsolicited regular mail. You may want to send email questionnaires only to people who expect to get email from you.
- You cannot use email surveys to generalize findings to the whole populations. People who have email are different from those who do not, even when matched on demographic characteristics, such as age and gender.
- Email surveys cannot automatically skip questions or randomize question or answer choice order or use other automatic techniques that can enhance surveys the way Web page surveys can.

QUALITATIVE vs. QUANTITATIVE RESEARCH

When collecting and analyzing data, quantitative research deals with numbers and statistics, while qualitative research deals with words and meanings. Both are important for gaining different kinds of knowledge.

1. Quantitative Research

Quantitative research is expressed in numbers and graphs. It is used to test or confirm theories and assumptions. This type of research can be used to establish generalizable facts about a topic.

Common quantitative methods include experiments, observations recorded as numbers, and surveys with closed-ended questions.

2. Qualitative Research

Qualitative research is expressed in words. It is used to understand concepts, thoughts or experiences. This type of research enables you to gather in-depth insights on topics that are not well understood.

Common qualitative methods include interviews with open-ended questions, observations described in words, and literature reviews that explore concepts and theories.

The differences between Quantitative and Qualitative Research

Quantitative and qualitative research use different research methods to collect and analyze data, and they allow you to answer different kinds of research questions.

Quantitative research	Qualitative Research
Focuses on testing theories and hypotheses	Focuses on exploring ideas and formulating a theory or hypothesis
Analyzed through math and statistical analysis	Analyzed by summarizing, categorizing and interpreting
Mainly expressed in numbers, graphs and tables	Mainly expressed in words
Requires many respondents	Requires few respondents
Closed (multiple choice) questions	Open-ended questions
<u>Key terms</u> : testing, measurement, objectivity, replicability	<u>Key terms</u> : understanding, context, complexity, subjectivity

DATA COLLECTION METHODS

Quantitative and qualitative data can be collected using various methods. It is important to use a data collection method that will help answer your research question(s).

Many data collection methods can be either qualitative or quantitative. For example, in surveys, observations or case studies, your data can be represented as numbers (e.g. using rating scales or

counting frequencies) or as words (e.g. with open-ended questions or descriptions of what you observe).

However, some methods are more commonly used in one type or the other.

Quantitative data collection methods

- **Surveys:** List of closed or multiple choice questions that is distributed to a sample (online, in person, or over the phone).
- **Experiments:** Situation in which variables are controlled and manipulated to establish cause-and-effect relationships.
- **Observations:** Observing subjects in a natural environment where variables can't be controlled.

Qualitative data collection methods

- **Interviews:** Asking open-ended questions verbally to respondents.
- **Focus groups:** Discussion among a group of people about a topic to gather opinions that can be used for further research.
- **Ethnography:** Participating in a community or organization for an extended period of time to closely observe culture and behavior.
- **Literature review:** Survey of published works by other authors.

QUESTIONNAIRE

A set of Questions designed to generate the statistical information from a specific demographic needed to accomplish the research objectives.

The questionnaire is a set of questions, focused on specific objectives of a topic of interest, used to gather information from target responders.

The questionnaire is probably most used and most abused of the data gathering devices. It is easy to prepare and to administer. The questionnaire is a form prepared and distributed to secure responses to certain questions. It is a device for securing answers to questions by using a form which the respondent will fill by himself. It is a systematic compilation of questions. It is an important instrument being used to gather information from widely scattered sources. Normally used where one cannot see personally all of the people from whom he desires responses or where there is no particular reason to see them personally.

CHARACTERISTICS OF GOOD QUESTIONNAIRE

1. It deals with an important or significant topic.
2. Its significance is carefully stated on the questionnaire or on its covering letter.
3. It seeks only that data which cannot be obtained from the resources like books, reports and records.
4. It is as short as possible, only long enough to get the essential data.
5. It is attractive in appearance, neatly arranged and clearly stated or printed.
6. Directions are clear and complete, important terms are clarified.
7. The questions are objective, with no clues, hints or suggestions.
8. Questions are presented in a order from simple to complex.

9. Double barrelled questions or putting two questions in one question are also avoided.

TYPES OF QUESTIONNAIRE

Following are the types or forms of the questionnaire.

1. Structured Questionnaire (Closed End Questions)

A structured questionnaire is that one which has pre-determined questions with answers. The respondents only tick the correct answer in the short term “yes” or “No”. It is also called pre-coded, closed restricted and categorical questionnaire.

Advantages

1. It is easy and less time consuming.
2. It keeps the respondents in limits.
3. It has objectivity.

Disadvantages

1. Confusion and difficulty in selection.
2. It bounds the respondents.
3. Less possibility of return.
4. Difficulty in reliability.

2. Un-Structured Questionnaire (Open End Questions)

Un-structured questionnaire is that in which pre-determined questions are given but have no answers. These answers are to be structured by the respondents. Open questions are given for the respondents to give answers. In such type of questionnaire, interview b/w the researcher and respondents or face to face conversation takes place. Such types is also called open-ended, unrestricted or non-categorical questionnaire.

Please mention two natural resources of folic acid:

A.

B.

For Example

1. Do you know about poverty
2. What are the types of poverty
3. What the factors influence poverty
4. What are the remedies for its solution

Advantages

1. It is more reliable.
2. It is more explanatory.
3. It gives depth of response.

Disadvantages

1. It requires greater efforts.
2. It is more expansible.
3. It risky for an investigator.
4. Less returns by the respondents.

3. Hand Delivered Questionnaire

This is a type of questionnaire in which the investigator himself go to the field and hand over the pre written questions to the respondents. They only tick mark, the correct answers in front of the investigator. It is also called direct questionnaire because the researcher directly distributes the questionnaire among the respondents.

Advantages

1. The researcher have close contact with respondents.

2. Difficult questions are explained by the researcher to the respondents.
3. He explains the purpose of the study.

Disadvantages

1. It is more expensive and costly.
2. It more time consuming.

4. Mailed Questionnaire

Most of the researcher uses that type of questionnaire. In that type the respondents are living in far-flung areas at a distance and the questionnaire is sent to them by post, they fill it and return back to the researcher or concerned department. A particular guide line or instructions list is attached to the questionnaire for the respondents guidance.

Advantages

1. It is commonly used.
2. It is useful for the researcher.
3. It is very easy and simple.
4. It saves time and money.

Disadvantages

1. Lack of returns.
2. Research take time due to careless and laziness of the respondents.
3. Lack of skilled respondents.
4. Errors may occur due to misunderstanding of respondents.

UNIT – 3

MEASUREMENT & SCALING TECHNIQUES

INTRODUCTION

A common feature of marketing research is the attempt to have respondents communicate their feelings, attitudes, opinions, and evaluations in some measurable form. To this end, marketing researchers have developed a range of scales. Each of these has unique properties. What is important for the marketing analyst to realise is that they have widely differing measurement properties. Some scales are at very best, limited in their mathematical properties to the extent that they can only establish an association between variables. Other scales have more extensive mathematical properties and some, hold out the possibility of establishing cause and effect relationships between variables.

MEASUREMENT

Measurement is the process of observing and recording the observations that are collected as part of research. The recording of the observations may be in terms of numbers or other symbols or characteristics of objects according to certain prescribed rules. The respondents's characteristics are feelings, attitudes, opinions etc.

The most important aspect of measurement is the specification of rules for assigning numbers to characteristics. The rules for assigning numbers should be standardized and applied uniformly. This must not change over time or objects.

DEFINITIONS

Measurement is defined as process of associating numbers or symbols to observations obtained in a research study.

These observation could be qualitative or quantitative. It is difficult to measure abstract or qualitative characteristics than quantitative characteristics. It is easy to measure properties like weight, height etc. by some standard unit of measurement.

SCALING TECHNIQUES

Scaling is the procedure of measuring and assigning the objects to the numbers according to the specified rules. In other words, the process of locating the measured objects on the continuum, a continuous sequence of numbers to which the objects are assigned is called as scaling.

Scaling technique is a method of placing respondents in continuation of gradual change in the pre-assigned values, symbols or numbers based on the features of a particular object as per the defined rules. All the scaling techniques are based on four pillars, i.e., order, description, distance and origin.

The marketing research is highly dependable upon the scaling techniques, without which no market analysis can be performed.

CHARACTERITICS OF SCALES

1. Distance

The characteristic of distance means that absolute differences between the scale descriptors are known and may be expressed in units.

2. Origin

The origin characteristic means that the scale has a unique or fixed beginning or true zero point.

3. Description

By description we mean the unique labels or descriptors that are used to designate each value of the scale. All scales possess description.

4. Order

By order we mean the relative sizes or positions of the descriptors. Order is denoted by descriptors such as greater than, less than, and equal to.

LEVELS OF MEASUREMENT SCALES

The level of measurement refers to the relationship among the values that are assigned to the attributes, feelings or opinions for a variable.

Typically, there are four levels of measurement scales or methods of assigning numbers:

Primary Scaling Techniques

- a) Nominal or Categorical Scale
- b) Ordinal Scale
- c) Interval Scale
- d) Ratio Scale

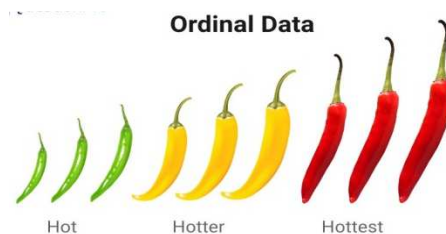
a. Nominal or categorical Scale

- Simplest level of measurement when data values fit into categories.
- Observations are dichotomous or binary in that the outcome can take on only one of two values: yes or no.
- Mutually exclusive.
- E.g sex of patient(M/F), nationality

<p>What is your gender?</p> <p><input checked="" type="radio"/> M - Male</p> <p><input type="radio"/> F - Female</p>	<p>What is your hair color?</p> <p><input checked="" type="radio"/> 1 - Brown</p> <p><input type="radio"/> 2 - Black</p> <p><input type="radio"/> 3 - Blonde</p> <p><input type="radio"/> 4 - Gray</p> <p><input type="radio"/> 5 - Other</p>	<p>Where do you live?</p> <p><input checked="" type="radio"/> A - North of the equator</p> <p><input type="radio"/> B - South of the equator</p> <p><input type="radio"/> C - Neither: In the international space station</p>
<p>How do you feel today?</p> <p><input checked="" type="radio"/> 1 - Very Unhappy</p> <p><input type="radio"/> 2 - Unhappy</p> <p><input type="radio"/> 3 - OK</p> <p><input type="radio"/> 4 - Happy</p> <p><input type="radio"/> 5 - Very Happy</p>	<p>How satisfied are you with our service?</p> <p><input checked="" type="radio"/> 1 - Very Unsatisfied</p> <p><input type="radio"/> 2 - Somewhat Unsatisfied</p> <p><input type="radio"/> 3 - Neutral</p> <p><input type="radio"/> 4 - Somewhat Satisfied</p> <p><input type="radio"/> 5 - Very Satisfied</p>	

b. Ordinal scale

- When an inherent order occurs among the categories, the observations are said to be measured on an ordinal scale.
- Clinicians often use ordinal scales to determine a patient's amount of risk or the appropriate type of therapy.
- E.g socio-economic class, rank order of a class(1st,2nd, 3rd) VAS(visual analog scale) for pain



c. Interval Scale

- Data classified by ranking.
- Quantitative classification .
- Zero point of scale is arbitrary (differences are meaningful).
- Fahrenheit temp. scale , Time

d. Ratio Scale

- Data classified as the ratio of two numbers.
- Quantitative classification .
- Zero point of scale is absolute (data can be added, subtracted, multiplied, and divided).
- E. g- Kelvin temp. scale, Weight, Height

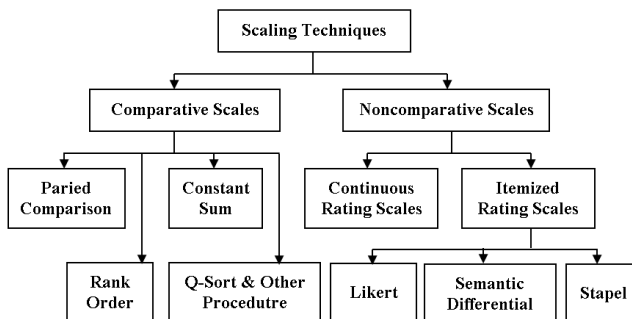
a. Comparative scale

Comparative scales involve the direct comparison of stimulus objects. Most often, the respondent is asked to compare one brand, product or feature against another. Comparative scale data must be interpreted in relative terms and have only ordinal or rank order properties.

b. Non-Comparative scale

In market research, data is collected and measured on either a comparative scale or a non-comparative scale. A comparative scale asks customers to evaluate one product in direct comparison to others. A non-comparative scale evaluates a single product by itself.

TYPES OF SCALING TECHNIQUES



1. Comparative Scales

In comparative scaling, the respondent is asked to compare one object with another.

The comparative scales can further be divided into the following four types of scaling techniques:

- a. Paired Comparison Scale
- b. Rank Order Scale
- c. Constant Sum Scale, and
- d. Q-Sort Scale

a. Paired Comparison Scale

This is a comparative scaling technique in which a respondent is presented with two objects at a time and asked to select one object according to some criterion. The data obtained are ordinal in nature.

For Example



b. Rank Order Scale

This is another type of comparative scaling technique in which respondents are presented with several items simultaneously and asked to rank them in the order of priority.

This is an ordinal scale that describes the favored and unfavored objects but does not reveal the distance between the objects

The resultant data in rank order is ordinal data. This yields better results when direct comparison are required between the given objects. The major disadvantage of this technique is that only ordinal data can be generated.

c. Constant Sum Scale:

In this scale, the respondents are asked to allocate a constant sum of units such as points, rupees among a set of stimulus objects with respect to some criterion. For example, you may wish to determine how important the attributes of price, fragrance, packaging, cleaning power, and lather of a detergent are to consumers. Respondents might be asked to divide a constant sum to indicate the relative importance of the attributes.

The advantage of this technique is saving time.

However, main disadvantages are the respondents may allocate more or fewer points than those specified. The second problem is respondents might be confused.

d. Q-Sort Scale

This is a comparative Scale that uses a rank order procedure to sort objects based on similarity with respect to some criterion. The important characteristic of this methodology is that it is more important to make comparisons among different responses of a respondent than the responses between different respondents. Therefore, it is a comparative method of scaling rather than an absolute rating scale. In this method the respondent is given statements in a large number for describing the characteristics of a product or a large number of brands of a product.

2. Non-Comparative Scales:

In non-comparative scaling respondents need only evaluate a single object. Their evaluation is independent of the other object which the researcher is studying.

The non-comparative scaling techniques can be further divided into:

- a. Continuous Rating Scale and
- b. Itemized Rating Scale

a. Continuous Rating Scale

It is very simple and highly useful. In continuous rating scale, the respondent's rate the objects by placing a mark at the appropriate position on a continuous line that runs from one extreme of the criterion variable to the other.

b. Itemized Rating Scales:

Itemized rating scale is a scale having numbers of brief descriptions associated with each category. The categories are ordered in terms of scale position and the respondents are required to select one of the limited number of categories that best describes the product, brand, company, or product attribute being rated. Itemized rating scales are widely used in marketing research.

Itemised rating scales is further divided into three parts, namely

- i. Likert Scale
- ii. Semantic Differential Scale and
- iii. Stapel Scale

i. Likert Scale:

Likert, is extremely popular for measuring attitudes, because, the method is simple to administer. With the Likert Scale, the

respondents indicate their own attitudes by checking how strongly they agree or disagree with carefully worded statements that range from very positive to very negative towards the attitudinal object. Respondents generally choose from five alternatives (say strongly agree, agree, neither agree nor disagree, disagree, strongly disagree).

A Likert scale may include a number of items or statements.

Disadvantage of Likert Scale is that it takes longer time to complete than other itemized rating scales because respondents have to read each statement. Despite the above disadvantages, this scale has several advantages. It is easy to construct, administer and use.

ii. Semantic Differential Scale:

This is a seven point rating scale with end points associated with bipolar labels (such as good and bad, complex and simple) that have semantic meaning. It can be used to find whether a respondent has a positive or negative attitude towards an object. It has been widely used in comparing brands, products and company images. It has also been used to develop advertising and promotion strategies and in a new product development study.

iii. Stapel Scale:

The Stapel scale was originally developed to measure the direction and intensity of an attitude simultaneously. Modern versions of the Stapel scale place a single adjective as a substitute for the Semantic differential when it is difficult to create pairs of bipolar adjectives. The modified Stapel scale places a single adjective in the centre of an even number of numerical values.

CRITERIA FOR GOOD MEASUREMENTS

The use of better instrument will ensure more accuracy in results, which in turn, will enhance the scientific quality of the research

There are three measurement of the characteristics for evaluating a measurement tool.

1. Validity
2. Reliability
3. Sensitivity

1. Validity

It is the ability of an instrument to measure what it is supposed to measure. That is, when we ask a questions with the hope that we are tapping the concept, how can we be reasonably certain that we are indeed measuring the concept we set to do and not something else?

2. Reliability

The reliability of a measure indicates the extent to which it is without bias (error free) and hence ensures consistent measurement across time and across the various items in the instrument.

In other words, the reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the “goodness” of measure.

3. Stability

The ability of the measure to remain the same over time despite uncontrollable testing conditions or the state of the respondents themselves is indicative of its stability and low vulnerability to changes in the situation.

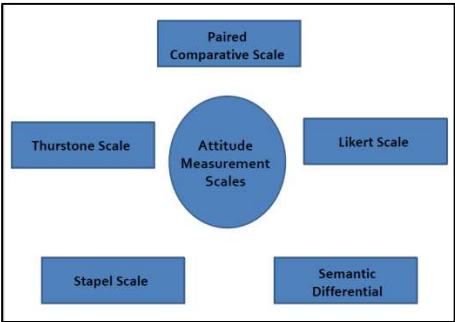
This attests to its “goodness” because the concept is stably measured, no matter when it is done.

ATTITUDE MEASUREMENT

Attitude is defined as a way of thinking about something that is expressed through a person's behavior. Attitudes about certain

events, experiences, or other people are also made up of our perspective, stance, and opinions.

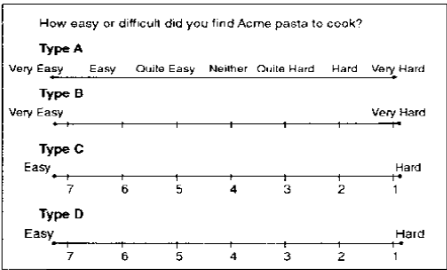
ATTITUDE MEASUREMENT SCALES



THURSTONE SCALE

It is the method of equal appearing intervals. It is made up of statements about a particular issue, and each statement has a numerical value indicating how favourable or unfavourable it is judged to be. People check each of the statements to which they agree, and a mean score is computed, indicating their attitude.

Example



MULTIDIMENSIONAL SCALING [MDS]

In earlier scales researchers knew in advance what attitude dimensions are relevant. In MDS computer based techniques are used to present an object in multidimensional space based on one or more respondent's perceptions towards the object.

Here neither the respondent nor researcher can accurately identify the number or nature of dimensions a respondent utilises in the evaluation. MDS uses simple data - similarity or preference for brands, Companies etc and attempts to disclose dimensions that underlie these judgements.

MDS helps to answer following questions:

1. What are major attributes of a product class (e.g. soft drinks) which consumers perceive viewing the product and by which they compare different brands.
2. Which brands compete most / least with each other.
3. Would consumers accept a new brand with a combination of characteristic not found in the market.
4. What is consumers ideal (point) combination of attributes
5. What sales / advertising messages are compatible with brand perceptions.

Car No.	1	2	3	4	5	6	7	8	9	10	11
1	—	8	50	31	12	48	36	2	5	39	10
2		—	38	9	33	37	22	6	4	14	32
3			—	11	55	1	23	46	41	17	52
4				—	44	13	16	19	25	18	42
5					—	54	53	30	28	45	7
6						—	26	47	40	24	51
7							—	29	35	34	49
8								—	3	27	15
9									—	20	21
10										—	43
11											—

*Read as follows: Cars 3 and 6 are most similar, 3 and 5 least similar.

Source: Paul E. Green and Frank J. Carmone, *Multidimensional Scaling* (Boston: Allyn & Bacon, 1970), p. 33.

In MDS since a no. of attributes are being analysed simultaneously it is difficult to diagram the relationships but we can understand the concept from a 2-D comparison of 11 cars based on two attributes.

Note: MDS techniques do not provide names of dimensions. The Researcher has to identify them using experience, nature of data, additional information etc. Data from many consumers in sample are collected and efforts are made to find groupings that tend to give similar configurations suggesting market segments that deserve attention.

OTHER USES OF MULTIDIMENSIONAL SCALING

1. Market segmentation.
2. Perception at different stages of product life cycle.
3. Advertisement media selection.
4. Supplier evaluation of purchase managers.

LIMITATIONS OF MULTIDIMENSIONAL SCALING

1. Definition of 'similarity and preference' imperfect - conceptual problems.
2. Empirical problems in subjective identification of relevant dimensions or bias in data collection
3. Computational problems - Most Computational programs assume linear distance because what is the best distance function is not known.

UNIT – 4

DATA PROCESSING

INTRODUCTION

Data continues to be in raw form, unless and until they are processed and analyzed. Processing is a statistical method by which the collected data is so organized the further analysis and interpretation of data become easy. It is an intermediary stage between the collection of data and their analysis and interpretation.

PROCESSING STAGES

There are four important stages in the processing of data. They are;

1. Editing
2. Coding
3. Classification
4. Tabulation

1. Editing

As soon as the researcher receives the data, he should screen it for accuracy. Editing is the process of examining the data collected through various methods to detect errors and omissions and correct them for further analysis. Though editing, it is ensured that the collected data are accurate, consistent with other facts gathered, uniformly entered and well arranged so that further analysis is made easier

Practical guidelines for editing

1. While editing care has to be taken to see that the data are as accurate and complete as possible. The following points are to be noted;

2. The editor should familiarize with the copy of instructions given to the interviewers.
3. The original entry, if found incorrect, should not be destroyed or erased. On the other hand, it should be crossed out in such a manner that it is still eligible.
4. Any, modification to the original entry by the editor must be specifically indicated.
5. All completed schedules must bear signature of the editor and the date.
6. Incorrect answer to the questions can be corrected only if the editor is absolutely sure of the answer, otherwise leave it as such.
7. Inconsistent, incomplete or missing answers should not be used.
8. Sere that all numerical answers are converted to same units.

2. Coding

Coding is the process by which r response categories are summarized by numerals or other symbols to carry out subsequent operations of data analysis. This process of assigning numerals or symbols to the responses is called coding. It facilitates efficient analysis of the collected data and helps in reducing several replies to a small number of classes which contain the critical information required for analysis. In general it reduces the huge amount of information collected in to a form that is amenable to analysis.

Steps in coding

1. Study the answers carefully.
2. Develop a coding frame by listing the answers and by aligning codes to each of them.
3. Prepare a coding manual with the detail of variable names, codes and instructions.
4. If the coding manual has already been prepared before the collection of the data, make the required additions for the open ended and partially coded questions.

Coding rules

1. Give each respondent a code number for identification.
2. Provide code number for each question.
3. All responses including 'don't know', 'no opinion'. Etc is to be coded.
4. Assign additional codes to partially coded questions.

3. Classification

Classification is the process of reducing large mass of data in to homogeneous groups for meaningful analysis. It converts data from complex to understandable and unintelligible to intelligible forms. It divides data in to different groups or classes according to their similarities and dissimilarities. When the data are classified, they give summary of whole information.

Objectives of classification

1. To organize data in to concise, logical and intelligible form.
2. To take the similarities and dissimilarities s between various classes clear.
3. To facilitate comparison between various classes of data.
4. To help the researcher in understanding the significance of various classes of data.
5. To facilitate analysis and formulate generalizations.

4. Tabulation

Tabulation is the next step to classification. It is an orderly arrangement of data in rows and columns. It is defined as the "measurement of data in columns and rows". Data presented in tabular form is much easier to read and understand than the data presented in the text the main purpose of tabulation is to prepare the data for final analysis. It is a stage between classification of data and final analysis.

Objectives of Tabulation

1. To clarify the purpose of inquiry
2. To make the significance of data clear.
3. To express the data in least possible space.
4. To enable comparative study.
5. To eliminate unnecessary data
6. To help in further analysis of the data.

ANALYSIS OF DATA

Analysis of data is considered to be highly skilled and technical job which should be carried out. Only by the researcher himself or under his close supervision. Analysis of data means a critical examination of the data for studying the characteristics of the object under study and for determining the patterns of relationship among the variables relating to it's using both quantitative and qualitative methods.

PURPOSE OF ANALYSIS

Statistical analysis of data serves several major purposes.

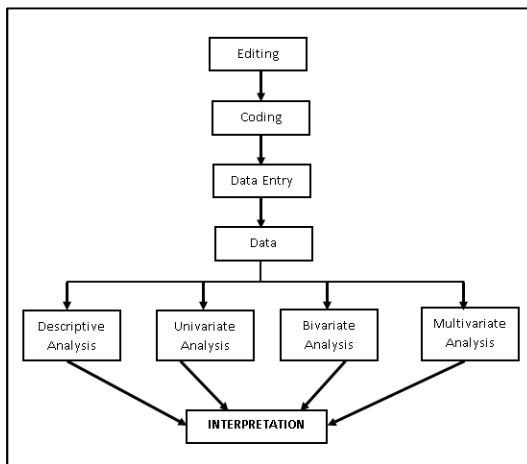
- It summarizes large mass of data into understandable and meaningful form.
- It makes descriptions to be exact.
- It aids the drawing of reliable inferences from observational data.
- It facilitates the identification of the causal factors underlying complex phenomena
- It helps making estimations or generalizations from the results of sample surveys.
- Inferential analysis is useful for assessing the significance of specific sample results under assumed population conditions.

STEPS IN ANALYSIS

- Different steps in research analysis consist of the following.
- The first step involves construction of statistical distributions and calculation of simple measures like averages, percentages, etc.
- The second step is to compare two or more distributions or two or more subgroups within a distribution.
- Third step is to study the nature of relationships among variables.
- Next step is to find out the factors which affect the relationship between a set of variables
- Testing the validity of inferences drawn from sample survey by using parametric tests of significance.

AN OVERVIEW OF THE STAGES OF DATA ANALYSIS

The process of analysis begins with after the data have been collected. During the analysis stage several interrelated procedures are performed to summarize and rearrange data. The research step relating to processing and analysis are presented in following exhibit.



DATA ANALYSIS:

A prime responsibility of the educational researcher is that of being able to make either a probability or logical inference covering the tenability of his testable hypothesis. The acceptance or rejection of these hypotheses will ultimately determine what contribution the study makes to the scientific development of a particular area. This is especially tried in the analysis for interpretation of data. The analysis and interpretation of data represent the application of deductive and inductive logic to the research process. The data are often classified by division into, subgroups, and are then analyzed and synthesized in such a way that hypothesis may be verified or rejected. The final result may be a new principle or generalization.

Data are examined in terms of comparison between the more homogeneous segments within the group any by comparison with some outside criteria. Analysis of data includes comparison of the outcomes of the various treatments upon the several groups and the making of a decision as to the achievement of the goals of research. Data relevant to each hypothesis must be assembled in quantitative form and tested to determine whether or not there is a significant difference in the results obtained from the controlled groups. Usually the analysis develops as a comparison between groups however, sometimes the type of data obtainable tends itself better to the existing differences by contrast or by summing up.

It is virtually impossible to complete a scientific analysis without using some form of statistical processing. This may involve depicting differences by complicated inferential statistics such as the analysis of variance, and analysis of covariance technique. Each statistical method is based upon its own or specific assumptions regarding the sample, population and research conditions. Unless these factors are considered in advance the researcher may find that it is impossible to make valid comparison for purpose of inferences.

INTERPRETATION

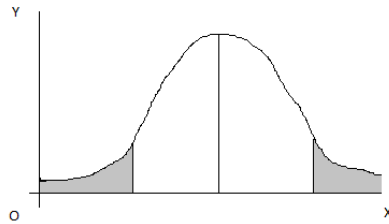
After collecting and analyzing the data, the researcher has to accomplish the task of drawing inferences followed by report writing. This has to be done very carefully, otherwise misleading conclusions may be drawn and the whole purpose of doing research may get vitiated. It is only through interpretation that the researcher can expose relations and processes that underlie his findings. In case of hypotheses testing studies, if hypotheses are tested and upheld several times, the researcher may arrive at generalizations. But in case the researcher had no hypothesis to start with, he would try to explain his findings on the basis of some theory. This may at times result in new questions, leading to further researches. All this analytical information and consequential inference(s) may well be communicated, preferably through research report, to the consumers of research results who may be either an individual or a group of individuals or some public/private organisation.

ONE-TAILED TEST AND TWO-TAILED TEST:

One-tailed or two-tailed test is the use of normal distribution curve while testing hypothesis. In a normal distribution curve or simply, the normal curve, equal area lies to the right and left of the mean ordinate (that is the line drawn from the peak of the curve to the base of the curve). This mean ordinate bifurcates the area under the bell-shaped curve. The two ends of the normal curve are called two tails. Statisticians have used normal curve to indicate the area of acceptance or rejection of a hypothesis. To understand this let us consider the figure given below.

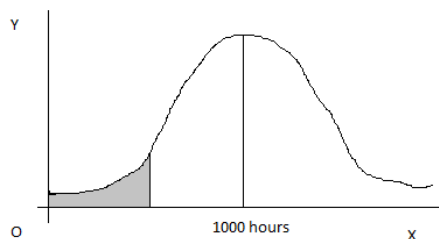
While testing hypothesized population means, one tailed and two tailed tests are applied. **A two tailed test of a hypothesis will reject the null hypothesis if the sample mean is significantly higher than or lower than the hypothesized population mean. Thus, in a two-tailed test there are two rejection regions.**

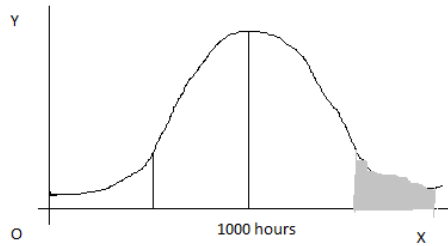
Example for two-tailed test:



Suppose a manufacturer of tube bulbs estimates the mean life of a bulb to be 1000 hours. If the life of a bulb actually is less than 1000 hours, then the sale of tube bulb will be affected. If the life of a bulb has to be more than 1000 hours, then the cost of production is bound to be higher as thicker filament has to be used. So, the manufacturer would prefer to test whether his manufacturing process is consistently producing bulbs with a mean life of 1000 hours. If not, he will study how many falls short of this mean life of 1000 hours and how many survive even after a mean life of 1000 hours. In such a situation, the manufacturer would use two tailed test of hypothesis. His null hypothesis is $H_0 = 1000$ hours. Since he would not want to deviate from this mean life of 1000 hours, his alternative hypothesis is $H_a \neq 1000$ hours. That is, by using two-tailed test, he rejects the null hypothesis if the mean life of bulbs in the sample is either too far above 1000 hours or too far below 1000 hours.

Example for one-tailed test:





There are occasions when one-tailed test is used while testing hypothesis. That is, the rejection region will lie on the left or the right hand side of the mean ordinate only.

To understand this, let us continue with the example given for two-tailed test. Suppose a wholesaler buys in bulk the tube bulbs from the manufacturer. He conducts sample test of the lot to ascertain the number of bulbs, which specified number of bulbs fail within 1000 hours. That is, only when the sample reveals that a specified number of bulbs fail within 1000 hours, that the wholesaler would reject the lot from the manufacturers. The wholesaler would not reject the lot even if some sample bulbs continue to survive after the mean life of 1000 hours. This is because; the longer life of the bulb comes without any extra cost and the end-user would be satisfied with the performance of the bulb. So he need not worry about the lot if the average life exceeds 1000 hours. So in this instance, the wholesaler would adopt only one-tail test. It should be noted that in this example left-tailed test is used.

HYPOTHESIS TESTING

Basic analysis of the data involves testing of hypothesis. Lot of confusion prevails in developing a hypothesis. In simple terms, hypothesis refers to assumption of a relationship between two variables or difference between two or more groups. Hypothesis also contains the direction of relationship between the variables concerned.

Examples for hypothesis is given below:

- a) The purchasing power of the consumers is positively related to the availability of surplus income.
- b) Customers belonging to the Northern states in India have a different taste preference than those from Northern States.

There are two types of statistical hypotheses:

Null Hypothesis (H_0) – a statistical hypothesis that states that there is no difference between a parameter and a specific value, or that there is no difference between two parameters.

Alternative Hypothesis (H_1) – a statistical hypothesis that states the existence of a difference between a parameter and a specific value, or states that there is a difference between two parameters.

We tend to want to reject the null hypothesis so we assume it is true and look for enough evidence to conclude it is incorrect. We tend to want to accept the alternative hypothesis. If the null hypothesis is rejected then we must accept that the alternative hypothesis is true.

A simple rule may be followed to develop a hypothesis:

- 1. What we hope or expect to be able to conclude as a result of the test usually should be placed in alternative hypothesis.
- 2. The null hypothesis should contain a statement of equality (=) and an alternative hypothesis contains a > or < than sign.
- 3. The null is the hypothesis that is tested.
- 4. The null and alternate hypothesis are complementary.

PARAMETRIC TEST AND NON-PARAMETRIC TESTS OF HYPOTHESIS

Hypothesis testing determines the validity of the assumption (technically described as null hypothesis) with a view to choose between two conflicting hypothesis about the value of a population

parameter. Hypothesis testing helps to decide on the basis of a sample data, whether a hypothesis about the population is likely to be true or false. Statisticians have developed several tests of hypotheses (also known as the tests of significance) for the purpose of testing of hypotheses which can be classified as

- (a) Parametric tests or standard tests of hypotheses; and
- (b) Non-parametric tests or distribution-free test of hypothesis.

Parametric tests usually assume certain properties of the parent population from which we draw samples.

Assumptions like observations come from a normal population, sample size is large assumptions about the population parameters like mean, variance, etc., must hold good before parametric tests can be used.

There are situations when the researcher cannot or does not want to make assumptions. In such situations we use statistical methods for testing hypothesis which are called **non-parametric tests** because such tests do not depend on any assumption about the parameters of the parent population.

Besides, most non-parametric tests assume only nominal or ordinal data, whereas parametric tests require measurement equivalent to at least an interval scale. As a result, non- parametric tests need more observations than parametric tests to achieve the same size of Type I and Type II errors.

Important Parametric tests:

The important parametric tests are:

1. z - Test
2. t – Test
3. χ^2 Test (Chi-square test)*

4. F – Test (Analysis of Variance)

* Chi-square is also used as a test of goodness of fit and also as a test of independence in which case it is a non-parametric test.

T - Test:

'T' Test was developed by Gossett around 1900. He published his theoretical ideas about this test in the pen name of 'Student' and so this test is also called Student Test.

This is a test applied for testing hypothesis using sample data. Sample is normally classified as Small sample and Large sample. The small sample refers to any sample, which contains 30 or less than 30 items on the otherhand, the large sample refers to samples with more than 30 items. While the choice between these two types is purely the researcher's option, it is always said that conclusions based on large sample enjoy more reliability.

This test is applied for:

1. 't' Test is applicable only for small samples when population variance is not known.
2. This test is applied for determining the significance of difference between the means of two samples.
3. If two samples are related, then for determining the significance of means of the two related samples.
4. Determining significance of coefficient of correlation and partial correlation.

T – TABLE:

This table contains the range of values of 't' at different degrees of freedom and level of significance. The researcher has to locate the

table value by using the degree of freedom and the level of significance. Then he has to compare this table value with the computed value of t' and conclude as specified as standard practice above.

CHI-SQUARE TEST (χ^2):

It is used for comparing a sample variance to a theoretical population variance. A statistical method of assessing the goodness of fit between a set of observed values and theoretically expected values.

Conditions to be fulfilled for applying Chi-square test:

The following conditions should be satisfied before chi-square can be applied:

1. Observations recorded and used are collected on a random basis.
2. All the items in the sample must be independent.
3. No group should contain very few items, say less than 10. In case where the frequencies are less than 10, regrouping is done by combining the frequencies of adjoining groups so that the new frequencies become greater than 10. Some statisticians take this number as 5 but 10 is regarded as better by most of the statisticians.
4. The overall number of items must also be reasonably large. It should normally be at least 50, however small the number of groups may be.

Goodness of Fit in Chi-square test:

Goodness of fit implies perfect tallying of the observed and estimated values. In chi-square, if the observed data and the

estimated data do not have significant difference, then the estimate is said to be a good fit.

ANALYSIS OF VARIANCE (ANOVA) (F-Test)

This test was developed by R.A. Fisher. This test is used to compare the variance of the two independent samples. When it is used as analysis of variance, it helps to judge the significance of more than two sample means at one and the same time.

An **ANOVA** test is a way to find out if survey or experiment results are significant. In other words, they help you to figure out if you need to reject the null hypothesis or accept the alternate hypothesis.

What Does “One-Way” or “Two-Way Mean?”

One-way or **two-way** refers to the number of independent variables (IVs) in your Analysis of Variance test.

- **One-way** has one independent variable (with 2 levels). For example: *brand of cereal*,
- **Two-way** has two independent variables (it can have multiple levels). For example: *brand of cereal, calories*.

1. One Way ANOVA

A one way ANOVA is used to compare two means from two independent (unrelated) groups using the F-distribution. The null hypothesis for the test is that the two means are equal. Therefore, a significant result means that the two means are unequal.

Examples of when to use a one way ANOVA

Situation 1: You have a group of individuals randomly split into smaller groups and completing different tasks. For example, you

might be studying the effects of tea on weight loss and form three groups: green tea, black tea, and no tea.

Situation 2: Similar to situation 1, but in this case the individuals are split into groups based on an attribute they possess. For example, you might be studying leg strength of people according to weight. You could split participants into weight categories (obese, overweight and normal) and measure their leg strength on a weight machine.

Limitations of the One Way ANOVA

A one way ANOVA will tell you that at least two groups were different from each other. But **it won't tell you which groups were different**. If your test returns a significant f-statistic, you may need to run an ad hoc test (like the Least Significant Difference test) to tell you exactly which groups had a difference in means.

2. Two Way ANOVA

A Two Way ANOVA is an extension of the One Way ANOVA. With a One Way, you have one independent variable affecting a dependent variable. With a Two Way ANOVA, there are two independents. Use a two way ANOVA when you have one measurement variable (i.e. a quantitative variable) and two nominal variables. In other words, if your experiment has a quantitative outcome and you have two categorical explanatory variables, a two way ANOVA is appropriate.

For example, you might want to find out if there is an interaction between income and gender for anxiety level at job interviews. The anxiety level is the outcome, or the variable that can be measured. Gender and Income are the two categorical variables. These categorical variables are also the independent variables, which are called **factors** in a Two Way ANOVA.

The factors can be split into **levels**. In the above example, income level could be split into three levels: low, middle and high income.

Gender could be split into three levels: male, female, and transgender. Treatment groups are all possible combinations of the factors. In this example there would be $3 \times 3 = 9$ treatment groups.

Assumptions for Two Way ANOVA

- The population must be close to a normal distribution.
- Samples must be independent.
- Population variances must be equal.
- Groups must have equal sample sizes.

UNIT – 5

PREPARATION AND PRESENTATION OF RESEARCH REPORT

RESEARCH REPORT

A research report is a formal statement of the details of the research process and its results. It gives an account of the problem(s) studied, objectives, methodology, findings and conclusion of the research study.

A research is said to be incomplete unless it is presented in a report format. Any research will be appreciated only when it is made known to others through research report. The exotic dishes in a dinner are appreciated by the guests when the host lays the table neatly, explains the dishes and serves in a meticulous way. Similarly, the efforts of the research and the fruits of the research will be appreciated only when it is presented as a report in a logical sequence incorporating all the relevant details.

PURPOSE OF A RESEARCH REPORT

1. To communicate the methodology and results of the study to the targeted audience.
2. To enable the person(s) concerned to determine the validity of the results/conclusion and judge the quality of the research project as well and as the ability and competence of the researcher to do research.
3. To provide as base for formulating policies and strategies in the relevant areas.
4. To provide additional knowledge to tackle certain problems/issues.
5. To serve as a basic reference for future study.

CHARACTERISTICS OF A GOOD RESEARCH REPORT

1. Not only must the report be narrative, must also be an authoritative document on the outcome. There should be no ambiguity.
2. It must be specific and accurate and there is no question of beating around the bush.
3. It should be written with the targeted audience in mind.
4. It must be non-persuasive. That is, extra caution is needed while advocating a particular course of action based on the finding.
5. It must be simple, logical and understandable.

INTERPRETATION

Interpretation refers to the task of drawing inferences from the collected facts after an analytical and /or experimental study. The task of interpretation has two major aspects viz., (1) the effort to establish continuity in research through linking the results of a given study with those of another and, (ii) the establishment of some explanatory concepts. Thus interpretation is the device through which the factors that seem to explain what has been observed by researcher in the course of the study can be better understood and it also provides a theoretical conception which can serve as a guide for further researches.

IMPORTANCE OF INTERPRETATION

Interpretation is essential for the simple reason that the usefulness and utility of research findings lie in proper interpretation. It is being considered a basis component of research process because of the following reasons:

- i. It is through interpretation that the researcher can well understand the abstract principle that works beneath his findings. Through this he can link up his findings with those of other studies, having the same abstract

principle, and thereby can predict about the concrete world of events. Fresh inquiries can test these predictions later on. This way the continuity in research can be maintained.

- ii. Interpretation leads to the establishment of explanatory concepts that can serve as a guide for future research studies; it opens new avenues of intellectual adventure and stimulates the quest for more knowledge.
- iii. Researcher can better appreciate only through interpretation why his findings are what they are and can make others to understand the real significance of his research findings.
- iv. The interpretation of the findings of exploratory research study often results into hypotheses for experimental research and as such interpretation is involved in the transition from exploratory to experimental research.

PRECAUTIONS IN INTERPRETATION

The researcher must pay attention to the following points for correct interpretation:

- i. At the outset, the researcher must invariably satisfy himself that (a) the data are appropriate, trustworthy and adequate for drawing inferences; (b) the data reflect good homogeneity and that (c) proper analysis has been done through statistical methods.
- ii. The researcher must remain cautious about the errors that can possibly arise in the process of interpreting results.

- iii. Precautions to be taken by the researcher concerning the reliability of data, computation checks, validation and comparison of results.
- iv. The researcher must never lose sight of the fact that his task is not only to make sensitive observations of relevant occurrences, but also to identify and disengage the factors that are initially hidden to the eye.
- v. The researcher must remember that 'ideally' in the course of a research study, there should be constant interaction between initial hypothesis, empirical observation and theoretical conceptions.
- vi. He must pay special attention to this aspect while engaged in the task of interpretation.

GENERAL FORMAT OF A RESEARCH REPORT

A written format of a research work is known as thesis or research report. All such works may differ considerably in scope of treatment and details of presentation. Even then all types of research reports are expected to follow a general uniform, common pattern of format, style and structure. The general format of research report is evolved and it has become a tradition in academic area. A research report or thesis is an organized format of research work done. It is viewed in three major categories:

- A. Preliminaries,
- B. Textual Body, and
- C. References.

Each category has been outlined further as follows:

A. Preliminary Section

- 1. Title page
- 2. Preface or acknowledgements
- 3. Table of content

4. List of tables (if any)
5. List of figures (if any).

B. Main Body of Report or Textual Body

1. Introduction:

- (a) Statement of the problem
- (b) Objectives of the study
- (c) Hypotheses to be tested
- (d) Significance of the problem
- (e) Assumptions and delimitations.
- (f) Definitions of Important terms used.

2. Review of related literature.

3. Design of the study

- (a) Method and procedure used
- (b) Tools of research or sources of data
- (c) Techniques of data collection
- (d) Description of techniques used.

4. Analysis and presentation of data

- (a) Analysis of data
- (b) Tables and interpretation
- (c) Figures and interpretation.

5. Conclusions

- (a) Discussion of results
- (b) Main Findings and inferences
- (c) Implication of the findings and limitations
- (d) Suggestions for further studies.

C. Reference Section

1. Bibliography
2. Appendices (if any)
3. Index or glossary (if any).

The detailed explanation of each aspect is given here

A. PRELIMINARY SECTION

As the preliminaries form a significant part of the whole thesis report, due care should be taken in preparing them. If the specifications are already laid down by some colleges or universities they should be observed. However, a general standard pattern suggested here in each case will be helpful for a researcher.

1. Title Page

This is the first page of a thesis or a dissertation. It includes:

- (a) Title of thesis.
- (b) Name of the candidate.
- (c) Purpose or relationship of the thesis to the course or degree requirement.
- (d) College and/or department in which the candidate has been admitted for the degree.
- (e) Name of the university to which it is submitted.
- (f) Month and year of submission or acceptance.

The title should be accurate, concise and clearly printed in capital letters. It should convey the main theme of the problem investigated and if possible one should give a clue about the method or type of research involved. A specimen of title page has been presented here.

2. Preface or Acknowledgement

A preface is different from introduction. It is a brief account of the purport or the origin and the utility of the study for which the thesis is presented. It also

includes the acknowledgement to the persons and sources that have been helpful to the investigator. If the researcher does not want to mention anything about the study on this page except to acknowledging debt to others, it will be desirable to use the title simple and restrained without flattery and effusive recognition for help by the family members and others. The preface should not be too long with too many details about the research work or its organization, which can appear in the introduction. The word PREFACE or ACKNOWLEDGEMENT should be typed in capital letters. It should be written in an impressive way.

3. Table of Contents

This section lists all the main chapter headings and the essential sub-heading in each with the appropriate page numbers against each. The listing of main chapters is generally preceded by some preliminaries like preface or acknowledgement, list of tables, list of figures, abstract or synopsis and their respective pages in small Roman numbers and followed at the end by appendices, and Indexes. Contents should neither be too detailed nor too sketchy the table of contents should serve an important purpose in providing an outline of the contents of the report. The capitalized title 'Contents' should be the central heading of the page and the capitalized word 'CHAPTER' and 'PAGE' should lead to the numbers of chapters and those of pages respectively on the left and right margins. An example has been given in the tabular of form.

4. List of Tables

The table of contents is followed by the list of tables on a separate page. This list of tables consists of the titles or captions of the tables included "in the thesis along with the page number where these can be located. It has been illustrated here.

The capitalized title 'LIST OF TABLES' should be the central heading of the page and the capital words 'TABLE' and 'PAGE' should lead to the numbers and those of pages respectively at left and right margins.

5. List of Figures and Illustrations

If any charts graphs or any other illustrations are used in the thesis, a list of figures on a separate page is prepared in the same form as the list of tables except that they are numbered with Arabic numbers. An example has been given here for this -purpose.

Table of Contents

CONTENTS
Preface
List of Tables
List of Figures

I. INTRODUCTION
(a) Statement of Problem
(b) Objectives
(c) Hypotheses
(d) Assumptions and Limitations

II. REVIEW OF LITERATURE

III. DESIGN OF RESEARCH
(a) Method of Sample
(b) Procedure and Technique
(c) Statistical Technique

IV. ANALYSIS OF DATA

V. CONCLUSIONS
Bibliography
Appendix

LIST OF TABLES

Table	Page
1. Sample Structure.....	20
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4. Regression Weights	28

Similarly list-of figures is prepared. The page number of figures is given facing the page number of the report.

(B) MAIN BODY OF REPORT OR TEXTUAL BODY

The text of the thesis is the most important section in the organization of the research report. The quality of worth of thesis is mainly examined. It is the original production of the researcher. The report of the main body serves the function of demonstrating the competence of the researcher. If any sentence, paragraph, concept fails to serve the single function within a given section or chapter, it is irrelevant. The subject matter of any chapter should be relevant to that point. Generally the main body of the research reports consists of five or six chapters.

Chapter

I. Introduction or Theoretical Frame Work

II. Review of Related Literature

III. Design or Methodology

IV. Data Collection or Administration of Tools and Scoring.

V. Analysis and Interpretation of Data.

VI. Conclusions and Suggestions for the Further Researches.

CHAPTER 1: Introduction or Theoretical Frame Work

The main purpose of this chapter is to indicate the need and scope of the study. It consists essentially of the statement of research inquiry. It is reported in past tense form of work completed. The problem objectives, hypotheses, assumptions and delimitations of the study are reported precisely.

If an introduction is required, the researcher should make certain that it is an introduction that generates an interest and appropriate mental set which introductions are regarded as capable of producing. It must be long enough to do its jobs and nothing more.

CHAPTER 2: Review of Related Literature

This chapter is essential in most of the research studies. It presents the comprehensive development of the problem background. It indicates what has already been studied by others, which has a bearing upon the present study.

The review of literature stresses two aspects: the first is the consideration of the subject-matter and it is likely more important than the other. The second is related to methodology and design. The review chapter is devoted to the development of the problem statement or the object of the inquiry. The review is utilized to retain a direct relevancy to the study in hand. It is the balancing chapter of the research report.

CHAPTER 3: Design or Methodology of Research

This chapter indicates the line of approach of the study. The first aspect deals with the method, population and sample of the study and the second part provides the tools and techniques employed in the research. It also presents the procedure of the study. The whole plan of the study is discussed in detail under this chapter.

Administration of tools and scoring procedure are reported systematically. The data organization and presentation should be given in this section. It may be reported in a separate chapter of the report.

CHAPTER 4: Analysis and Interpretation of the Data

In this chapter analysis and results are reported so as to draw the inferences of the study. The analysis of data is presented in tabular form and in figures or pictorial presentation. The results are interpreted at length. This chapter provides the original work or contribution by the researcher. The communicative accuracy is required in this chapter. The text must be developed to ensure an effective ordering of the evidences.

CHAPTER 5: Conclusions and Suggestions

This is the most important chapter of the report. It requires the creative and reflective aspect of the researcher. The results are discussed to make them more meaningful comparison of the results with the evidence in the review section should be woven into the text whenever such a discussion can serve to clarify the points being reported. This is the final chapter of a report, thus findings of the study are summarized and suggestions for the further studies are also given. The implications and delimitations of the findings are also mentioned in this section. The main thrust in the section is the answer of the question or solution of the problem. The validity of the findings should be mentioned.

(C) REFERENCE SECTION

This is the third section of a research report. It consists of generally the bibliography and appendices. It is also essential to include glossary and index for the convenience of the readers. The bibliography, appendix, glossary and index all these are written on a separate page - in the centre with capital letters.

1. Bibliography

The bibliography is a list of the printed sources utilized in the research work. The publications used for information-yield but not quoted in the report may also be included in the bibliography. The format of the bibliography depend on the footnote style. If the foot-notes reference in the text are numbered to refer to the source in the bibliography, the entries must be numerically listed in the order of appearance in the text. The various format manuals include information on form for the bibliography. If the list of sources is too large the bibliography should be categorized in the following sections: Books, monographs, documents and reports, periodicals and journals, essay and articles, unpublished thesis and material and newspapers.

If selected sources are reported the words 'Selected Bibliography' should be written. In writing bibliography the surname is written first than initials, year

of publication, title of the book, publisher's name, place and total number of pages.

The following are the examples of writing bibliography: (i) Example for single author: Best, John. W (1977) 'Research in Education', 3rd ed., New Jersey: Prentice-Hall Inc. Englewood Cliffs, 403 pp.

(ii) Example for two authors: The only difference is that second author's name is written differently i.e. initial first and surname at the end in a usual manner.

McGrath, J.H. and D. Gene Watts on (1970) 'Research Methods and Designs for Education' Pennsylvania: International Text-Book Company, 222 pp.

(iii) Example for three or more authors: Selltitz, Claire et al. (1959) "Research Method in Social Relations", New York: Holt, Rinehart and Winston, 424 pp.

(iv) Example for editor as author: Buros, Oscar K. ed. (1965) 'The Sixth Mental Measurement', Yearbook: Highland Park, N.J. : Gryphon Press 1163 pp.

(v) Example for author not given: Author's Guide (1955) Englewood Cliffs, N.J. Prentice Hall, 121 pp.

(vi) Example for publication of an association, Agency or Society: National Society for the study of Education (1955), 'Modern Philosophies of Education' 54th Yearbook, Part-I, The University of Chicago Press, Chicago 37 pp. Or 'Modern Philosophies of Education' (1955), National Society for the Study of Education, 54th Yearbook Part-I, Chicago: The Chicago University Press 374 pp.

(vii) Example for unpublished thesis: Sharma, R.A. (1972), 'Some Predictors of Teacher Effectiveness' Unpublished" Ph.D. Thesis Submitted to Meerut University, 320 pp.

(viii) Article in an Encyclopaedia and Hand Book. Barr, A.S. (1944), 'Criteria of Teacher-Effectiveness' Ebel's Encyclopaedia of Educational Research, 742 pp.

Smith, B.O. (1964), 'Relationship of Teaching and Learning', Gage, Hand Book of Research in Teaching, 426 pp.

(ix) Example for Journals and Periodicals: Bar, A.S. (1940), 'The Measurement and Prediction of Teaching Efficiency,' Review of Educational Research, Vol. 10, No. 4, pp. 185-190. Leeds, C.H. (1969), Predictive Validity of MTAIL', The Journal of Teacher Education, Vol. 20 NO.1.

(x) A chapter written by an author other than the editor: Maccoby E.E. (1954), 'The Interview: A Tool of Social Science', Chapter 12, in the Hand Book of Social Psychology, Addison, Wesley Cambridge Mass.

(xi) Quotations primary source cannot be located: Kelley, E.P. (1950), 'Education for what is Real', As cited by Edward A. Krug, 'Curriculum Planning', New York: Harper and Row Publishers, 55 pp. The place of publication may be written before the name of publishers e.g. New York: Harper and Row Publishers, 55 pp.

A bibliography reference is written in the following manner and arranged alphabetically to facilitate the readers:

- Name of the author with the last name first and initials afterwards.
- The year of publication is given in bracket after the name of the author and authors.
- Title of the book or the work is written, underlined and followed by a full stop (.).
- Place of Publication followed by a colon (:).
- Name of the publishing agency and publishers and followed by a comma (,).
- Total pages of the book are given.

The above sequence is employed in preparing bibliographical references. It is also used for giving a footnotes reference with a little deviation. In a footnote the name of the author with the Initials first followed by surname or last name is given. The specific page number of the work or the book is given not the total pages. Other things remain the same as mentioned in the

bibliography. The bibliography pages are also written in Arabic figure in the sequence of main body of the report.

2. Appendix

An appendix is the important reference materials category. It includes the material which cannot be logically included in the main body or textual body of the research report or the relevant materials too unwieldy to include in the main body. The appendix usually includes: tools of research, statistical tables and sometime raw-data (when data were processed through computer). Even the material of minor importance e.g. forms, letters, reminders, interview sheets, blank questionnaires, charts, tables, lengthy questions, report of cases (if follow-up or case studies have been conducted). The tools and other material should be placed first and tables at the end and page numbers should be assigned in Roman Numbers (i, ii, xxi). The appendix serves the function of providing greater clarity and authenticity for the readers or consumers of the thesis. The items of the appendix are very essential for a good research report.

3. Index and Glossary

When a research report is published in index, must be given. The index includes authors and subjects and topics or words in alphabetical order. In the report glossary should be provided. It includes the meanings or definitions of some words and terms 'used in the research report. Some notations symbols or abbreviations should be explained what actually they mean or indicate in the study.

MECHANICS OF REPORT WRITING

A research report writing is a highly technical activity. It includes various mechanics for a smooth flow of the thesis. The mechanical aspect has been standardized which must be followed by researcher in preparing a thesis. Such mechanics involve the following issues:

- (a) Footnotes and references,
- (b) Style of writing,

- (c) Headings,
- (d) Tables,
- (e) Figures,
- (f) Pagination,
- (g) Proof reading, and
- (h) Binding and submission.

(a) Footnotes

Sometimes it is desirable to quote some authoritative views or statements from the written works of others in the research report. It may be necessary from various purposes viz. to review the related literature, to support to give the rationale for one's viewpoint.

Each quotation must have a footnote or reference indicating the sources from which it is borrowed. All these sources and authority be acknowledged both for intellectual honesty and for validity of one's research.

Footnotes serve a number of purposes. They enable the researcher to substantiate his presentation by quotations or citations of other authorities, to give credit to sources of material that he has reported and to provide the reader with specific sources that he may use to verify the authenticity and accuracy of material quoted.

The footnotes are placed at the bottom of the page" and are separated from the text by a three cms horizontal line drawn from the left margin. Footnotes are numbered consecutively within a chapter.

b) Style of Preparing Thesis

The research report should be written in a style that it is creative, clear and concise. Therefore the following considerations should be kept in view in writing a research report.

- The research must be reported in full and its results are subjected to criticism and verification.

- A research report is always written in third person i.e. he, she or the investigator. I, we, you, my, our and us should not be used.
- It is prepared and written in past tense and present-perfect tense because it is reported usually after completion of the work.
- The scientific language is used rather than literary language. The British-English pattern is followed in writing a research report. The spellings of the words are employed of the British English.
- It is typed printed/cyclostyled on 11"9" size (thesis size) sunlit bond papers. There should be left a margin of 1-1/2" right margin one inch top and bottom margin should be 1-1/4" in each. The same machine of typing must be used for typing research report.

c) Headings

- Generally a research report is divided into chapters, each chapter begins from a new page. The title of a chapter is called the chapter heading. The word 'CHAPTER' is written in capital letters, in the centre of the page and title is placed three spaces of the chapter. The following is the example:
- **CHAPTER IV. IDENTIFICATION OF TEACHING SKILLS (Chapter Heading)**

Major Heading: A chapter of the report is divided into major heads. The major heading is written in capital letters at the centre of the page. An example is as follows:

- **STIMULUS VARIATION SKILL**

(Major Heading)

- **Major Heading:** A major heading is sometimes divided into sub headings which are known as minor heading. It starts with left margin of a page in lower-upper letters. A paragraph starts two spaces below. An example is given below:
- **Components of Stimulus Variation Skill:** (Minor Heading)

Paragraph Heading: If the minor heading is further divided, the paragraph is used. It must be indented five spaces and underlined. A full stop and dash is marked after such a heading. The written matter starts on the same line. The following is an example:

- **Change in Voice:** There is a modulation in the voice of effective teachers. (Paragraph heading). These headings are also specified by using the numbers. For the Main headings 1, 2, 3, 4...so on are assigned in a chapter. The minor headings or sub-heading are shown in decimal numbers e.g. 2.1, 2.2, 2.3, it indicates that 1, 2, 3 are the minor headings of second main heading. Similarly paragraph headings are indicated in further decimal numbers e.g. 2.1.1, 2.1.2, 2.1.3 last numbers, 1, 2, 3 are paragraph headings of first minor heading of second major heading.

(d) Tables

A table is used for presenting statistical data. It enables the readers to comprehend and interpret data quickly and to understand significant aspects at a glance.

The word 'TABLE' is followed by the serial Roman number which is placed in the centre two spaces above the title of the table. The title of the table is written in capital letters at the centre of the page. The statistical data are presented in vertical columns and horizontal row, according to some classification of subject matter.

(e) Figures

A figure is a device that presents statistical data in pictorial or visual form. The figure is used to a variety of graphs, charts, maps, sketches, diagrams and drawings. It helps to understand the aspects of data clearly and easily. One idea or fact should be present in each figure. The description of the figure must be given in the textual body. 'FIGURE' should be written in the centre of the page at the top of the figure.

(f) Pagination

Assigning page numbers of the report is very essential. The title page or initial page of any section does not have a page number typed on it, but a number is allotted to it in the series of pages. Page numbers are typed in the upper right hand corner, one inch below the top edge of the page. The small or lower Roman numerals (i, ii, iii, iv,) are assigned for the pages of preliminary section. The serial Arabic nos. 1, 2, 3, 4.....so on are assigned for the pages of textual body or main body of the report i.e. Chapter I to last and Bibliography.

(g) Proof Reading

A research report should not have errors. It requires that final typed copies must be checked carefully. All types of errors should be deleted before submission. Thus, proof reading of final typed copies should be done two or three times.

(h) Binding and Submission

It is the last activity for preparing research report. Before giving to the binder it should be arranged properly and systematically and the serial number of pages are checked carefully. It should be given to an expert binder who has the experience of binding research thesis.

After binding the thesis it should be submitted to the University for Evaluation Purpose. Researcher should ascertain the date of submission and other requirement e.g. certificate of the supervisor, evaluation fees etc. for the post-graduate dissertation. Student should plan that he would be able to submit to the university in time. He must obtain the receipt of the submission of his thesis.

IMPORTANT STEPS INVOLVED IN WRITING A RESEARCH REPORT:

Research reports are the product of slow, painstaking, accurate, inductive work. The usual steps involved in writing reports are the following:

a. Logical analysis of the subject matter:

It is the first step which is primarily concerned with the development of a subject. There are two ways in which to develop a subject (a) logically and (b) chronologically. The logical development is made on the basis of mental connections and associations between the one thing and another by means of analysis. Logical treatment often consists in developing the material from the simple possible to the most complex structures. Chronological development is based on a connection or sequence in time or occurrence. The directions for doing or making something usually follow the chronological order.

b. Preparation of the final outline:

It is the next step in writing the research report "Outlines are the framework upon which long written works are constructed. They are an aid to the logical organization of the material and a reminder of the points to be stressed in the report."

c. Preparation of the rough draft:

This follows the logical analysis of the subject and the preparation of the final outline. Such a step is of utmost importance for the researcher now sits to write down what he has done in the context of his research study. He will write down the procedure adopted by him in collecting the material for his study along with various limitations faced by him, the technique of analysis adopted by him, the broad findings and generalizations and the various suggestions he wants to offer regarding the problem concerned.

d. Rewriting and polishing of the rough draft:

This step happens to be the most difficult part of all formal writing. Usually this step requires more time than the writing of the rough draft. The careful revision makes the difference between a mediocre and a good piece of writing. While rewriting and polishing, one

should check the report for weaknesses in logical development or presentation. The researcher should also “see whether or not the material, as it is presented, has unity and cohesion; does the report stand upright and firm and exhibit a definite pattern, like a marble arch? Or does it resemble an old wall of moldering cement and loose brick.”⁴ In addition the researcher should give due attention to the fact that in his rough draft he has been consistent or not. He should check the mechanics of writing – grammar, spelling and usage.

e. Preparation of the final bibliography:

Next in order comes the task of the preparation of the final bibliography. The bibliography, which is generally appended to the research report, is a list of books in some way pertinent to the research which has been done. It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts; the first part may contain the names of books and pamphlets, and the second part may contain the names of magazine and newspaper articles. Generally, this pattern of the bibliography is considered convenient and satisfactory from the point of view of the reader, though it is not the only way of presenting a bibliography. The entries in the bibliography should be made adopting the following order:

For books and pamphlets the order may be as under:

1. Name of author, last name first.
2. Title, underlined to indicate italics.
3. Place, publisher, and date of publication.
4. Number of volumes.

Example

Kothari, C.R., *Quantitative Techniques*, New Delhi, Vikas Publishing House Pvt. Ltd., 1978.

For magazines and newspapers the order may be as under:

1. Name of the author, last name first.
2. Title of article, in quotation marks.
3. Name of periodical, underlined to indicate italics.
4. The volume or volume and number.
5. The date of the issue.
6. The pagination.

Example

Robert V. Roosa, "Coping with Short-term International Money Flows", *The Banker*, London, September, 1971, p. 995.

The above examples are just the samples for bibliography entries and may be used, but one should also remember that they are not the only acceptable forms. The only thing important is that, whatever method one selects, it must remain consistent

a. Writing the final draft:

This constitutes the last step. The final draft should be written in a concise and objective style and in simple language, avoiding vague expressions such as "it seems", "there may be", and the like ones. While writing the final draft, the researcher must avoid abstract terminology and technical jargon. Illustrations and examples based on common experiences must be incorporated in the final draft as they happen to be most effective in communicating the research findings to others. A research report should not be dull, but must enthuse people and maintain interest and must show originality. It must be remembered that every report should be an attempt to solve some intellectual problem and must contribute to the solution of a problem and must add to the knowledge of both the researcher and the reader.

TYPES OF REPORTS:

1. Technical report
2. Popular report

1. TECHNICAL REPORT:

A *technical report* is used whenever a full written report of the study is required whether for recordkeeping or for public dissemination.

GENERAL OUTLINE OF A TECHNICAL REPORT:

a. Summary of results: A brief review of the main findings just in two or three pages.

b. Nature of the study: Description of the general objectives of study, formulation of the problem in operational terms, the working hypothesis, the type of analysis and data required, etc.

c. Methods employed: Specific methods used in the study and their limitations. For instance, in sampling studies we should give details of sample design viz., sample size, sample selection, etc.

d. Data: Discussion of data collected, their sources, characteristics and limitations. If secondary data are used, their suitability to the problem at hand be fully assessed. In case of a survey, the manner in which data were collected should be fully described.

e. Analysis of data and presentation of findings: The analysis of data and presentation of the findings of the study with supporting data in the form of tables and charts be fully narrated. This, in fact, happens to be the main body of the report usually extending over several chapters.

f. Conclusions: A detailed summary of the findings and the policy implications drawn from the results be explained.

g. Bibliography: Bibliography of various sources consulted be prepared and attached.

h. Technical appendices: Appendices be given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular technique of analysis and the like ones.

i. Index: Index must be prepared and be given invariably in the report at the end.

The order presented above only gives a general idea of the nature of a technical report; the order of presentation may not necessarily be the same in all the technical reports. This, in other words, means that the presentation may vary in different reports; even the different sections outlined above will not always be the same, nor will all these sections appear in any particular report.

2. POPULAR REPORT: A *popular report* is used if the research results have policy implications.

GENERAL OUTLINE OF A POPULAR REPORT:

The findings and their implications: Emphasis in the report is given on the findings of most practical interest and on the implications of these findings.

Recommendations for action: Recommendations for action on the basis of the findings of the study is made in this section of the report.

Objective of the study: A general review of how the problem arise is presented along with the specific objectives of the project under study.

4. Methods employed: A brief and non-technical description of the methods and techniques used, including a short review of the data on which the study is based, is given in this part of the report.

Results: This section constitutes the main body of the report wherein the results of the study are presented in clear and non-technical

terms with liberal use of all sorts of illustrations such as charts, diagrams and the like ones.

Technical appendices: More detailed information on methods used, forms, etc. is presented in the form of appendices. But the appendices are often not detailed if the report is entirely meant for general public.

Plagiarism:

Unauthorized use or close imitation of the language and thoughts of another author and the representation of them in one's own work is called plagiarism.

PRECAUTIONS FOR WRITING RESEARCH REPORTS:

Research report is a channel of communicating the research findings to the readers of the report. A good research report is one which does this task efficiently and effectively. As such it must be prepared keeping the following precautions in view:

- While determining the length of the report (since research reports vary greatly in length), one should keep in view the fact that it should be long enough to cover the subject but short enough to maintain interest. In fact, report-writing should not be a means to learning more and more about less and less.
- A research report should not, if this can be avoided, be dull; it should be such as to sustain reader's interest.
- Abstract terminology and technical jargon should be avoided in a research report. The report should be able to convey the matter as simply as possible. This, in other words, means that report should be written in an objective style in simple language, avoiding expressions such as "it seems," "there may be" and the like.
- Readers are often interested in acquiring a quick knowledge of the main findings and as such the report must provide a

ready availability of the findings. For this purpose, charts, graphs and the statistical tables may be used for the various results in the main report in addition to the summary of important findings.

- The layout of the report should be well thought out and must be appropriate and in accordance with the objective of the research problem.
- The reports should be free from grammatical mistakes and must be prepared strictly in accordance with the techniques of composition of report-writing such as the use of quotations, footnotes, documentation, proper punctuation and use of abbreviations in footnotes and the like.
- The report must present the logical analysis of the subject matter. It must reflect a structure wherein the different pieces of analysis relating to the research problem fit well.
- A research report should show originality and should necessarily be an attempt to solve some intellectual problem. It must contribute to the solution of a problem and must add to the store of knowledge.
- Towards the end, the report must also state the policy implications relating to the problem under consideration. It is usually considered desirable if the report makes a forecast of the probable future of the subject concerned and indicates the kinds of research still needs to be done in that particular field.
- Appendices should be enlisted in respect of all the technical data in the report.
- Bibliography of sources consulted is a must for a good report and must necessarily be given.
- Index is also considered an essential part of a good report and as such must be prepared and appended at the end.
- Report must be attractive in appearance, neat and clean, whether typed or printed.
- Calculated confidence limits must be mentioned and the various constraints experienced in conducting the research study may also be stated in the report.

- Objective of the study, the nature of the problem, the methods employed and the analysis techniques adopted must all be clearly stated in the beginning of the report in the form of introduction.

COMPUTERS

Computers have always assisted to solve the problems faced by the mankind.

Since the time of invention, the size of the computers has drastically reduced from that of a room to that can be accommodated in a human palm. The word computer means “something which computes or a machine for performing calculations automatically”. But, today computer means not merely a “calculator”. It does vast variety of jobs with tremendous speed and efficiency. Today people use computers in almost every walk of life. Computers have become a subject of study at schools. Electronic computers have now become an indispensable part of every profession: do research.

A computer has three basic components. They are:

- 1) An input device (keyboard and mouse)
- 2) A central processing unit (CPU) and
- 3) An output device (monitor and/or printer)

IMPORTANT CHARACTERISTICS OF A COMPUTER

1. Speed: computers can perform calculations in just a few seconds that a human beings would need weeks to do.

2. Storage: end number of data can be stored in the computer and retrieved when needed. Whereas a human mind can remember limited information and unimportant data can be forgot sometimes.

3. Accuracy: the computer’s accuracy is consistently high. Almost without exception, the errors in computing are due to human rather

than to technological weakness. i.e. due to imprecise thinking by the programmer or due to inaccurate data or due to poorly designed system.

4. Automation: the computer programmes are automatic in nature. Individual instructions to perform which programme is needed sometimes.

5. Diligence: being a machine computer does not suffer from human traits of tiredness and lack of concentration. A computer can perform a number of calculations continuously with the same accuracy and speed.

COMPUTERS IN RESEARCH

The computers are indispensable throughout the research process. The role of computer becomes more important when the research is on a large sample. Data can be stored in computers for immediate use or can be stored in auxiliary memories like floppy discs, compact discs, universal serial buses (pen drives) or memory cards, so that the same can be retrieved later. The computers assist the researcher throughout different phases of research process.

PHASES OF RESEARCH PROCESS

There are five major phases of the research process. They are:

- 1) Conceptual phase
- 2) Design and planning phase
- 3) Empirical phase
- 4) Analytic phase and
- 5) Dissemination phase

1) Role of Computer in Conceptual Phase

The conceptual phase consists of formulation of a research problem, review of literature, theoretical framework and formulation of hypothesis.

Role of Computers in Literature Review: Computers help for searching the literatures (for review of the literature) and bibliographic references stored in the electronic databases of the world wide webs. It can thus be used for storing relevant published articles to be retrieved whenever needed. This has the advantage over searching the literatures in the form of books, journals and other newsletters at the libraries which consume considerable amount of time and effort.

2) Role of Computers in Design and planning phase

Design and planning phase consist of research design, population, research variables, sampling plan, reviewing the research plan and pilot study.

Role of Computers for Sample Size Calculation: Several softwares are available to calculate the sample size required for a proposed study. NCSS-PASSGESS is such software. The standard deviation of the data from the pilot study is required for the sample size calculation.

3) Role of Computers in Empirical phase

Empirical phase consist of collecting and preparing the data for analysis.

Data Storage: The data obtained from the subjects are stored in computers as wordfiles or excel spreadsheets. This has the advantage of making necessary corrections or editing the whole layout of the tables if needed, which is impossible or time consuming in case of writing in papers. Thus, computers help in data entry,

data editing, data management including follow up actions etc. Computers also allow for greater flexibility in recording the data while they are collected as well as greater ease during the analysis of these data.

In research studies, the preparation and inputting data are the most labor intensive and time consuming aspect of the work. Typically the data will be initially recorded on a questionnaire or record form suitable for its acceptance by the computer. To do this the researcher in conjunction with the statistician and the programmer, will convert the data into Microsoft word file or excel spreadsheet. These spreadsheets can be directly opened with statistical softwares for analysis.

4) Role of Computers in Data Analysis

This phase consists of statistical analysis of the data and interpretation of results.

Data Analysis: Many softwares are now available to perform the 'mathematical part' of the research process i.e. the calculations using various statistical methods. Softwares like SPSS, NCSS-PASS, STATA and Sysat are some of the most widely used. They can be like calculating the sample size for a proposed study, hypothesis testing and calculating the power of the study. Familiarity with any one package will suffice to carry out the most intricate statistical analyses.

Computers are useful not only for statistical analyses, but also to monitor the accuracy and completeness of the data as they are collected.

5) Role of Computers in Research Dissemination

This phase is the publication of the research study.

Research publishing: The research article is typed in word format and converted to a portable data format (PDF) and stored and/or published on the World Wide Web.