M.B.A IInd Semester

Course - 207

Research Methodology

LESSONS 1 TO 12

By. Dr. Atul Dhingra

INTERNATIONAL CENTRE FOR DISTANCE EDUCATION AND OPEN LEARNING HIMACHAL PRADESH UNIVERSITY, GYAN PATH, SUMMERHILL, SHIMLA-171005

Contents

Old Syllabus
Master of Business Administration (M.B.A.) 2nd Semester
207 Research Methodology

Objective

To equip the students with the basic understanding of the research methodology and to provide an insight into the application of modern analytical tools and techniques for the purpose of management decision-making.

Unit I

Nature and Scope of Research Methodology: Problem Formulation and Statement of Research Process.

Unit II

Research Designs-Exploratory, Descriptive and experimental Research designs;

Unit-III

Methods of Data Collection - Observational, Survey Case Method; Questionnaire Design; Attitude Measurement Techniques; Motivational research techniques.

Unit-IV

Sample Design; selecting an Appropriate Statistical Technique; Field Work and Tabulation of Data.

Unit-V

Analysis of Data; Techniques for Data Analysis - ANOVA, Discriminate Analysis, Factor Analysis, Conjoint Analysis, Multidimensional Scaling and Clustering Methods; Research Application.

SUGESTED READINGS

1. Andrews, F.M. and S.B. Withey Social Indicators of will Being Plenum Press, NY, 1976.
2. Bennet, Roger: Management Research, ILO, 1983.
3. Fowler, Floyd J.Jr., Survey Methods, 2nd ed., Sage Pub., 1993.
4. Fox, J.A. and P.Ei Tracy : Randomized Response : A Method of Sensitive Surveys, Sage Pub., 1986.
5. Goswami, P.R. Statistical Information System and Librries, New Delhi, Anmol Pub., 1996.
6. Gupta, S.P. Statistical Methids, 30th ed., Sultan Chand, New Delhi, 2001.
7. Salkind, Neil J., Exploring Research, erd ed., Predtice Hall, NJ, 1997.

The list of cases and specific reference including recent articles will be announced in the class at the time of launching of the course.

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Lesson-1
Introduction to Research Methodology

Structure

1.0 Introduction

Research takes us from the situation of unknown to known. It is a systematic, scientific and exhaustive process of finding some answers to our queries. What we are doing? Why we are doing? And how we are doing? These three important questions from the pillars of research. Understanding the concepts of research, research methodology, and research methods help in exploring these questions in details. This lesson a though is focused on research methodology but talks about research and research methods for proper understanding.

1.1 Leaning Objectives

Research in simplest terms, may be defined as search for knowledge. One can also define research as a scientific and systematic search for pertinent information on a specific topic. Advance Learner's Dictionary lays down the meaning of research as a careful investigation or enquiry especially through search for new facts in any branch of knowledge. Some people consider research as a movement, a movement from the unknown to the known. It is actually a voyage of discovery.

Actually, we all possess the vital instinct of inquisitiveness for, when the unknown confronts us, we wonder and our inquisitiveness makes us probe and attain full and fuller understanding of the unknown. This inquisitiveness is the mother of all knowledge and the method, which man employs for obtaining the knowledge of whatever the unknown, can be termed as research.

1.2 Presentation of Contents

1.2.1 Research and Scientific Method

1.2.2 Concept of Business Research

1.2.3 Research method v/s research methodology

1.2.4 Types of research methodologies

1.2.5 Importance of research methodology

1.2.1 Research and Scientific Method

For a clear perception of the term research, one should know the meaning of scientific method. The two terms, research and scientific method are closely related. Research, as we have already stated, can be termed as "an inquiry into the nature, of the reasons for, and the consequences of any particular set of circumstances, whether these circumstances are experimentally controlled or recorded just as they occur.

Further, research implies the researcher is interested m more than particular results; he is interested in the repeatability of the results and in their extension to more complicated and general situations."

As such the term *research* refers to the systematic method consisting of defining and formulating the problem, formulating hypotheses, collecting the data, analyzing the data, and reaching ascertain conclusions.

On the other hand, the philosophy common to all research methods and techniques, although they may vary considerably from one science to another, is usually given the name of scientific method. In this context it is stated that "The scientific method is one and same in the branches (of science) and that method is the method of all logically trained minds.... The unity of all sciences consists alone in its methods, not its material; the man who classifies facts of any kind whatever, who sees their mutual relation and describes their sequences, is applying the Scientific Method and is a man of science".

(a) Scientific method is the pursuit of truth as determined by logical considerations.

The ideal of science is to achieve a systematic interrelation of facts. Scientific method attempts to achieve this ideal by experimentation, observation, logical arguments from accepted postulates and a combination of these three in varying proportions. In scientific method, logic aids in formulating propositions explicitly and accurately so that their possible alternatives become clear. Further, logic develops the consequences of such alternatives, and when these are compared with observable phenomena, it becomes possible for the researcher or the scientist to state which alternative is most in harmony with the observed facts. All this is done through experimentation and survey investigation which constitute the integral parts of scientific method.

Experimentation is done to test hypotheses and to discover new relationship, if any, among variables. But the conclusions drawn on the basis of experimental data are generally criticized for either faulty assumption, poorly designed experiments, badly executed experiments or faulty interpretations As such the researcher must pay all possible attention while developing the experimental design and must state only probable inferences. The purpose of survey investigations may also be to provide scientifically gathered information to work as a basis for the researchers for their conclusions.

The scientific method is, thus based on certain basic postulates which can be stated as under: ‘

(i) It relies on empirical evidence;

(ii) It utilizes relevant concepts;

(iii) It is committed to only objective considerations;

(iv) It presupposes ethical neutrality i.e. it aims at nothing but making only adequate and correct statements about population objects; ,

(v) It results into probabilistic predictions;

(vi) Its methodology is made known to all concerned for critical scrutiny and for use in testing the conclusions through replication;

(vii) It aims at formulating most general axioms or what can be termed as scientific theories.

Thus, the scientific method encourages a rigorous, impersonal mode or procedure dictated by the demands of logic and objective procedure. Scientific method, therefore, is an objective, logical and systematic method, i.e. a method free from personal bias or prejudice, a method to ascertain demonstrable qualities of a phenomenon capable of being verified, a method wherein the researcher is guided by the rules of logical reasoning a method wherein the investigation proceeds in an orderly manner and a method that implies internal consistency.

1.2.2 Concept of Business Research

Business Research is the systematic and objective identification, collection, analysis, dissemination, and use of information for the purpose of improving decision making related to the identification and solution of problems and opportunities in business world.

Several aspects of this definition are noteworthy. First business researches are systematic. Thus, systematic planning is required at all stages of the business research process. The procedures followed at each stage are methodologically sound, well documented, and, as much as possible, planned in advance. Business researches attempt to provide accurate information. It involves the identification, collection, analysis, and dissemination of information.

We identify or define the research problem or opportunity and then determine what information is needed to investigate it. Next, the relevant information sources are identified and a range of data collection methods varying in sophistication and complexity are evaluated for their usefulness. The data are collected using the most appropriate method, they are analysed and interpreted, and inferences are drawn. Finally, the findings, implications, and recommendations are provided in a format that allows the information to be used for decision making and to be acted upon directly.

1.2.3 Research Methods versus Research Methodology

It seems appropriate at this juncture to explain the difference between research methods and research methodology. ***Research methods*** may be understood as all those methods/techniques the researchers use in performing research operations. In other words, all those methods which are used by the researcher during the course of studying his research problem are termed as research methods.

At times, a distinction is also made between research techniques and research methods. ***Research techniques*** refer to the behaviour and instruments we use in performing research, operations such as making observations, recording data, techniques of processing data and the like. Research methods refer to the behaviour and instruments used in selecting and constructing research technique. As such we can say that methods are more general, it is the methods that generate techniques. However, in practice, the two terms are taken as interchangeable and when we talk of research methods we do include research techniques within their compass.

Since the objective of research, particularly the applied research is to arrive at a solution for a given problem the available data and the unknown aspects of the problem have to be related to each other to make a solution possible. Keeping this in view, research methods can be put into the following three groups:

(i) In the first group we include those methods which are concerned with the collection of data. These methods will be used where the data already available are not sufficient to arrive at the required solution;

(ii) The second group consists of those statistical techniques which are used for establishing relationships between the data and the unknown;

(iii) The third group consists of those methods which are used to evaluate the accuracy of the results obtained.

Research methodology, on the other hand, is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them. It is necessary for the researcher to know not only the research methods/techniques but also the methodology. Researcher not only need to know how to develop certain indices or tests, how to calculate the mean, the mode, the median or the standard deviation or chi-square, how to apply particular research techniques, but they also need to know which of these methods or techniques, are relevant and which are not, and what would they mean and indicate and why.

The researchers also need to understand the assumptions underlying various techniques and they need to know the criteria by which they can decide that certain techniques and procedures will be applicable to certain problems and others will not. All this means that it is necessary for the researcher to design his methodology for his problem as the same may differ from problem to problem. For example, an architect, who designs *a* building, has to consciously evaluate the basis of his decision, i.e. he has to consciously evaluate why and on what basis he selects particular size, number and location of doors, windows and ventilators, uses particular materials and not others and the like. Similarly, in research the scientist has to expose the research decisions to evaluation before they are implemented. He has to specify very clearly and precisely what decisions he takes and why he takes them so that they can be evaluated by others also.

From what has been stated above, we can say that research methodology has many dimensions and research methods do constitute a part of the research methodology. The scope of research methodology is wider than that of research methods. Thus, when we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods we use in the context of our research study and explain why *we* are using a particular method or technique and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others.

Why a research study has been undertaken, how the research problem has been defined; in what way and why the hypothesis has been formulated, what data have been collected and what particular method has been adopted, why particular technique of analyzing data has been used and a host of similar other questions are usually answered when we talk of research methodology concerning a research problem or study.

Research methodology, therefore, refers to overall approach to the research process, from the theoretical underpinning to the collection and analysis of data. Like theories, methodologies cannot be true or false. They can only be more or less useful.

1.2.4 Types of research methodologies

We can classify research methodologies into two categories on the basis of research paradigm. These are positivistic methodologies and phenomenological methodologies. The type of methodology a

researcher chooses reflects the assumptions of his research paradigm. For example, an experiment conducted in the laboratory to measure the productivity of workers where the temperature of the room is deliberately varied would be positivistic. Whereas, case study, which is an extensive examination of a single instance of a phenomenon of interest, is an example of phenomenological methodology.

(a) Positivistic methodologies - Positivistic methodologies in social sciences are based on the approaches used in natural sciences such as physics, chemistry, botany etc. The research approaches used by natural scientists are highly successful and it is, therefore, not surprising that social scientists may also use them. Positivism is founded on the belief that the study of human behaviour should be conducted in the same way as the studies conducted in natural sciences.

According to positivists, law's provide the basis of explanation, permit the anticipation of phenomena, predict the occurrence and therefore allow them to be controlled. Explanation consists of establishing causal relationships between the variables by establishing causal laws and linking them to a deductive or integrated theory.

The examples of the use of positivistic methodologies include cross-sectional studies, experimental studies, longitudinal studies, and surveys.

(b) Phenomenological methodologies - Social scientists point out that physical sciences deal with objects which are outside us, whereas social sciences deal with action and behaviour which are generated from within the human mind. Moreover, they argued that the interrelationship of the investigator and what was being investigated was impossible to separate. Therefore, phenomenological methodologies are concerned with understanding human behaviour from the participant's own frame of reference.

Phenomenology actually is the science of phenomena and phenomenon is a fact or occurrence that appears or is perceived. To varying degrees, phenomenologist's believe that social reality is dependent on the mind. There is no reality independent of the mind; therefore, what is researched cannot be unaffected by the process of the research. The research methods used under this approach are an array of interpretative techniques which seek to describe not the frequency of certain more or less naturally occurring phenomena in social world.

The examples of the use of phenomenological methodologies include action researches, case studies, participative enquiry, and ethnography etc.

1.2.5 Importance of Research Methodology

The knowledge of research methodology gives the researcher the necessary training in gathering materials and arranging or card indexing them, participation in the field work when required, and also training in techniques for the collection of data appropriate to particular problems, in the use of statistics, questionnaires and controlled experimentation and in recording evidence, sorting it out and interpreting it. In fact, importance of knowing the methodology of research or how research is done stems from the following consideration:

i. For one who is preparing himself for a career of carrying out research the importance of knowing research methodology and research techniques is obvious since the same constitute the tools of his trade. The knowledge of methodology provides good training especially to the new research worker and enables him to do better research. It helps him to develop disciplined thinking or a bent of mind to observe the field objectively. Hence, those aspiring for career in research must develop the skill of using research techniques and must thoroughly understand the logic behind them.

ii. Knowledge of how to do research will inculcate the ability to evaluate and use research results with reasonable confidence. In other words, we can state that the knowledge of research methodology Is helpful in various fields such as government or business administration, community development and social work where persons are increasingly called upon to evaluate and use research results for action.

iii. When one knows how research is done then one may have the satisfaction of acquiring a new intellectual tool which can become a way of looking at the world and of judging every day experience. Accordingly, it enables us to make intelligent decisions concerning problems facing us in practical life at different points of time. Thus, the knowledge of research methodology provides tools to look-at things in life objectively.

iv. In this scientific age, all of us are in many ways consumers of research results and we can use them intelligently provided we are able to judge the adequacy of the methods by which they have been obtained. The knowledge of methodology helps the consumer of research results to evaluate them and enables him to take rational decisions.

1.3 Self-Assessment Questions:

Q1: What do meant by the concept of business research?

Q2: Explain scientific method?

Q3: Discuss the types of research methodology?

Q4: What is the importance of research methodology?

Q5:Briefly explain phenomenological methodologies?

1.4 Summary

Research is a careful investigation or enquiry especially through search for new facts in any branch of knowledge. It is a movement, a movement from the unknown to the known. It is actually a voyage of discovery.

Scientific method is the pursuit of truth as determined by logical considerations. The ideal of science is to achieve a systematic interrelation of facts. Scientific method attempts to achieve this ideal by experimentation, observation, logical arguments from accepted postulates and a combination of these three in varying proportions. In scientific method, logic aids in formulating propositions explicitly and accurately so that their possible alternatives become clear.

Research methods may be understood as all those methods/techniques the researchers use in performing research operations. In other words, all those methods which are used by the researcher during the course of studying his research problem are termed as research methods.

Research methodology, on the other hand, is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them. It is necessary for the researcher to know not only the research methods/techniques but also the methodology. Researcher not only need to know how to develop certain indices or tests, how to calculate the mean, the mode, the median or the standard deviation or chi-square, how to apply particular research techniques, but they also need to know which of these methods or techniques, are relevant and which are not, and what would they mean and indicate and why.

1.5 Glossary:

Research: It is creative and systematic work undertaken to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications.

Methodology: It is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge.

Scientific: Based on or characterized by the methods and principles of science.

Business: A person's regular occupation, profession, or trade.

Empirical: Based on, concerned with, or verifiable by observation or experience rather than theory or pure logic.

Phenomenological: It is the philosophical study of the structures of experience and consciousness.

1.6 Answer to self-check questions:

Q1: Refer to 1.2.2

Q2: Refer to 1.2.1

Q3: Refer to 1.2.4

Q4: Refer to 1.2.5

Q5: Refer to 1.2.4

1.7. Terminal Questions

1. What do you understand by research, method? Explain with suitable examples.
2. Compare and contrast research methods and research methodology.
3. Clarify the concept of research and scientific method.
4. All researchers must have scientific bent of mind. Do you agree with this statement? Elaborate your view point with the help of suitable examples.
5. Why is it important to have knowledge of research methodology?
6. Discuss different type of research methodologies.

1.8 Suggested Readings

1. T.S. Wilkinson, and P.L. Bhandankar, "Methodology and techniques of Social Research", Himalaya Publishing House, New Delhi
2. S.P. Gupta, "*Statistical methods'* Sultan Chand & Sons publication, New Delhi
3. Donald S. Tull and Del S. Hawkins, "*Marketing Research - Measurement and Method*, Prentice Hall of India Pvt. Ltd., New Delhi.
4. William G. Zikmund, "*Exploring Marketing Research*", Thomson South-Western Publication, Singapore.
5. Kothari, C.R., "*Research Methodology - Methods and Techniques',* Wiley Eastern Limited, Delhi.

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Lesson-2
Research Process & Organization

Structure

2.0 Introduction

Research is a systematic and careful examination of problem under study or an effort to find out facts. Research process describes the steps a researcher uses in conducting research. This lesson discusses the steps involved in carrying out the research. It also describes how the research activities are organized in the organization. The objectives of the lesson are:

2.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- The research process
- Organization of research

2.2 Presentation of contents

2.2.1 The Research Process

Research process consists of series of steps necessary to effectively carry out research. Some of these steps overlap continuously rather than following a strictly prescribed sequence. These steps are not mutually exclusive and are not separate and distinct. However, the order discussed below provides a useful procedural guideline. The steps of research process are:

a) **Define and formulate the research problem:** Problem definition is the most critical part of the research process. Research problem definition involves specifying the information needed by management. Unless the problem is properly defined, the information produced by the research process is unlikely to have any value.

The management problem can be understood only within the context of the decision situation. In order to formulate the problem, the researcher must give careful attention to company records; appropriate secondary sources such as census data, industry sales figures, economic indicators, and so on. He may also discuss with his colleagues, decision makers, and experts both external and internal.

b) **Set the Objectives of research -** After the problem has been defined the manager and researcher must set the research objectives. Most, of the objectives are derived from the problem itself. However, objectives may be of three types, depending upon the research proposed:

(a) The objective of exploratory research is to gather preliminary information that will help in understanding the problem and formulation of hypotheses.

(b) The objective of descriptive research is to describe things such as market potential for a product or the demographics and attitudes of consumers who buy the product.

(c) The objective of causal research is to find out cause and effect relationships.

c) Development of Hypothesis: Hypotheses are tentative solutions for the problem in hand and are tested with the help of research. We, however, do not frame hypotheses in every kind of research. There are two types of hypotheses namely: null hypothesis and alternative hypothesis. These hypotheses are so framed that acceptance of one leads to rejection of other and vice-versa. Normally, null hypotheses are framed and tested with suitable techniques and tests.

d) Deciding the research Design: Research design is actually the blue print of the research project and when implemented must bring out the information required for solving the identified problem.

Researchers first determine what kind of data will be needed to achieve the objectives of the research. There are two types of data, namely: (i) secondary data, (ii) primary data. Secondary data were collected for some purpose other than helping to solve the current problem, whereas primary data are collected to solve the problem at hand. Secondary data are virtually always collected first because of their time and cost advantage.

Instrument of data collection is decided after that. There are four basic measurement techniques used in business research: (i) questionnaire, (ii) observation, (iii) interviews and (iv) mechanical instruments. Questionnaire is a formalised instrument for asking information directly from a respondent concerning behaviour, beliefs, feeling, attitudes etc. It is by far the most common instrument in data collection. It consists of a set of questions presented to respondents for their answers. Care should be taken in the wording and sequencing of questions. The researcher should use simple, direct, unbiased wording. There should also be a logical flow of questions. Observation is the direct examination of behaviour Fresh data can be gathered by observing the relevant actors and settings. A researcher, who is interested in knowing the travelers' perceptions, might wander about in airports, airline offices, and travel agencies, to hear how travelers talk about the different airlines. Depth interviews allow individuals to express themselves without any fear of disapproval, dispute, or advice from interviewer. Mechanical instruments are also used, though not frequently, for business research. Galvanometers measure, the respondent's interest or emotions aroused by an exposure to a specific advertisement or picture. Eye cameras study respondent's eye movements to see where his eyes land first, how long they linger on a given item, and so on.

After the data collection instrument is finalized, researcher decides about the contact methods he or she will be using for gathering data. The following contact methods may be used: -

(i) Mail Questionnaire - The mail questionnaire is the best way to reach individuals who would not give personal interviews or whose responses might be biased or destroyed by the interviewers or who are scattered at distant places. The response rate is usually low in case of mailed questionnaire.

(i) **Telephone interviewing -** It is the best method for gathering information quickly. The interviewer is also able to clarify questions if they are not understood. The response rate is "typically higher than in the case of mailed questionnaires. The two main drawbacks of this technique of data collection are that only people with telephones can be interviewed, and the interviews have to be short and not too personal.

(ii) **Personal Interviewing -** It is the most versatile of all the methods. The interviewer can ask more questions and can record additional observations about the respondent, such as dress and body language. Personal interviewing is the most expansive method and requires more administrative planning and supervision. It is also subject to interviewer bias and distortion.

Personal interviewing takes two forms, arranged interviews and intercept interviews, in arranged interviews, respondents are randomly selected and are either telephoned or approached at their homes or offices and asked to grant an interview. Intercept interviews involve stopping people at a shopping center or busy street corner and requesting an interview. Intercept Interviews have the drawback of being non-probability samples, and the interviews must be quite short.

e) **Deciding Sample design:** Most studies involve a sample or subgroup of the total population relevant to the problem, rather than a census or the entire group. The population is generally specified as a part of problem definition process. Sampling involves the decisions about the following

(i) Population- determines who (or what objects) can provide the required information.

(ii) Sample frame- develops a list of population members.

(iii) Sampling unit- determine the basis for drawing the sample (Individuals, households, city blocks, etc.)

(iv) Sampling method- choose between probability and non-probability methods. Probability sampling includes simple random sampling, stratified random sampling, and cluster sampling whereas non-probability sampling include convenience sampling, judgment sampling, and quota sampling.

(v) Sample size- determines how many population members are to be included in the sample. Usually, large samples give more reliable results than small samples.

(vi) Sample plan- develops a method for selecting and contacting the sample members.

(vii) Execution- carries out the sampling plan.

f) **Collecting the**: data Here the researcher puts the research plan into action. This involves collecting the data from the field. Data collection can be carried out by the company's research and/or field staff or by outside firms. The data collection phase of' the research process is generally most expensive and subject to error. The researcher should watch field work closely to make sure plan is implemented correctly.

g) **Data analysis and interpretation:** Data are useful only after analysis. Data analysis invokes converting a series of recorded observations into descriptive statements and/or inferences about relationships. The types of analyses that can be conducted depend on the nature of the sampling process, the measurement instrument, and the data collection method.

It is imperative that the researcher selects the analytical technique prior to collecting the data. Once the analytical techniques are selected, the researcher should generate dummy data to the measurement instrument. These dummy data are then analysed by the analytical technique selected to ensure that

the results of this analysis will provide the information required by the problem at hand. Failure to carry out this step in advance can result in a completed result project that fails to provide some or all of the information required by the problem. Further, it sometimes reveals that unneeded data are about to be collected.

Data are classified, coded, edited and tabulated. After that suitable tools and techniques are used to analyse data. Suitable parametric and non- parametric techniques are used to test the hypotheses already made. Pie charts, bar diagrammes and other graphs may also be used to present the data.

h) Report writing: A research report is a formal statement of the research process and its results. The purpose of a research report is to communicate to interested persons the methodology and the results of the study in such a manner as to enable them to understand the research process and to determine the validity of the conclusions. The aim of the report is not to convince the reader of the value of the result, but to convey to him what was done, why it was done, and what was its outcome.

There are various types of reports like technical reports, interim reports, and summary reports etc. Proper planning is required in writing a report. Every report has well defined contents. Adequate care must be taken in writing various sections like introduction, research methodology, analysis and interpretation, bibliography, appendixes etc. of report.

While writing the report, keep in mind that you are writing for communicating with the target audience. Keep the purpose of each chapter, section and paragraph in mind. Do not struggle for words and phrases. Give appropriate headings to chapters, sections and paragraphs. Ensure the correctness of facts and citations.

Depending on the size, and degree of involvement in business a company in need of research can rely on an outside agency or can create and use its own facilities or employ a combination of its own research force with the assistance of an outside agency.

In the following circumstances, the use of outside research agency is likely to be preferred:

(i) When the research is of a highly specialized nature as for instance, with motivation research.

(ii) When the, company has little or no previous experience of the market and/or research.

(iii) When communication difficulties, linguistic or cultural, are anticipated.

(iv) When the company has limited research resources or its resources are already fully loaded.

(v) When there is a clear need for an independent and objective assessment of the market, as may be the case, for instance when a joint venture is contemplated.

A company is more likely to undertake its own research when:

(i) The research is industrial, and requires a limited number of interviews.

(ii) The company has significant experience in the market.

(iii) Communication difficulties may arise between the company and the research agency, as for instance, with a high technology product.

(iv) The company has available trained researchers with appropriate linguistic competence and experience; and

(v) Suitably competent research agencies are not available in the market.

A number of fundamental questions, however, arise while thinking of organizing research and creating and placing research department:

- Should research department/section be organised in a centralised or decentralised fashion?
- In case centralized structure is selected, how does one manage personnel located ten thousand miles away? Furthermore, in a centralised structure, what is the relationship between local researchers (who are responsible to the centre) and other field personnel who are in the local line hierarchy?
- In a decentralised structure how does one communicate findings from one location to another and are such findings transferable?
- Who should be responsible for and where should research plans be prepared?
- Who should administer supervision of the work?
- In a multi-product/muiti-units company who should determine the allocation of the necessary resources?
- How does one ensure that results of the research offer comparability?

The appropriate degree of centralisation depends to a large extent on the organisational structure of the company, the nature of the decision, and location of where the decision is made. Companies vary considerably in structure and, in particular, with regard to the degree of centralisation. In a highly centralised organisation, plans are established at corporate headquarters and local subsidiaries or operating units implement these plans with only minor modifications to local market conditions, in a highly decentralised organisation, operations are organised on a market to market basis at local level. Local operating units develop their own plans and adapt tactics to local market conditions. Central headquarters thus exercises iittle control over local operations other than in financial terms. Between these two extremes are a number of alternatives. Such as, providing mechanisms like regional committees to coordinate and integrate operations across geographic areas.

In essence, three major approaches to organizing research may be identified:

(a) Centralized

(b) Coordinated

(c) Decentralized

These are outlined in figure below. Centralised research directed and controlled at corporate headquarters, may be the most appropriate where the purpose of the research is to provide input into corporate policy and strategic decision making. There is, however, a danger of misinterpreting local nuances and downplaying environmental factors. In coordinated research, an outside agency is used to design and coordinate research conducted in different locations. Management in local subsidiary operations is thus likely to review the research plan and monitor its implementation, in the case of decentralised research, responsibility for the establishment of research specifications and organisation is delegated to local management, once broad guidelines have been established by corporate headquarters. This may, however, result in the collection of data that are not comparable across places.

(a) Centralised Organization: Where, a centralised mode of organisation is adopted, the research unit at corporate headquarter establishes the specification for the research that is to be conducted in each area. The researcher may use secondary data, where, for example, screening studies are concerned, or it may entail primary data collection, in either case the detail of the research design and data analysis are specified at corporate headquarters. Secondary data or field work may be purchased from an outside agency/organisation but data analysis is conducted at headquarters.

This approach provides maximum control and also ensures comparability in data across locations. In addition, it may help to hold down costs. Often, however, the research staff at corporate headquarters will not be sufficiently large or have the technical expertise to handle large scale and complex projects. Consequently, it is better suited for simple studies, such as initial market entry or country-screening studies, or in situations involving, confidential data, where It may be desirable to limit the number of external participants involved.

On the other hand, central headquarters will prefer a uniform research design with minimal adaptation to differences in local conditions, since it is consistent with strategic, as opposed to a tactile, orientation. Problems of communication and coordination can, however, arise when research findings are implemented by local operating units. As they did not participate in the research process, they may complain of a lack of attention to specific local factors and environmental conditions and hence of inappropriate or unimplementable corporate policy.

(b) Coordinated Organisation: In the case of coordinated organisation, corporate headquarters will participate in the definition of the research to be conducted, but an external research agency or organisation will spell out the details of the research design, take charge of administration and coordination of the field-work in different locations and data analysis. Then they report results to corporate or regional headquarters.

There may, however, be some problems of communication and. coordination between corporate headquarters and local operating units if responsibility for research design and field operations is delegated to an external agency. This can to some extent, be alleviated by requesting management or research staff in local operating units to examine the research design and data collection plan. They may then indicate their opinion, based on their experience with previous research and knowledge, of local market conditions, concerning the suitability and likely cost efficiency of the proposed plan. They may also control the fieldwork, data collection, and analysis.

(c) Decentralised Organisation: A trend towards decentralisation of the research function is apparent. Here, corporate headquarters establishes research objectives in broad terms, and leaves the detailed specifications of the research design and management of the research process to local operating units/ offices. Local management is thus responsible for data collection and analysis, and once this is concluded, presents a report on relevant findings to corporate headquarters. This approach is likely to be most appropriate where research is intended as an input to tactical, as opposed to strategic decisions.

Decentralised approach has the following characteristics:

(i) A small Research Department, forming part of Central Services, at corporate office. Its role is mainly advisory, educational and residual viz. dealing with corporate matters.

(ii) Research activities undertaken at local level.

(iii) Larger units/subsidiaries have their Own research department; small units will use outside agencies as required. As soon as expenditure rises to a certain level, tendency to have own research facilities increases.

(iv) Aggregate expenditure throughout is heavy.

The Strengths of this approach include:

- Adaptability to local needs.

- Local research personnel understand market conditions.
- Can be a useful source of creative ideas.
- Control rests in hands closer to the market.

Ideally, the organisation of research requires a delicate balance between centralisation and decentralisation. The former may result in lack of attention to specific local problems of implementation. The later is likely to lead to research and data that are not comparable across different geographic areas. In either case, however, mechanisms to ensure effective communication and control between local units and central administrative units are essential.

2.3 Self-Assessment Questions:

Q1: Define research process?

Q2: Briefly explain organising research?

Q3: Discuss about centralised organisation?

Q4: what do you meant by decentralised organisation?

Q5: What are the objectives of research?

2.4 Summary:

Research process consists of series of steps necessary to effectively carry out research. These steps are not mutually exclusive and are not separate and distinct. The major steps of research process are, identification of problem, setting the objectives, setting the hypotheses, development of research design, deciding sampling design, data collection, analysis of data, and report writing.

The organisation of research requires a delicate balance between centralisation and decentralisation. The former may result in lack of attention to specific local problems of implementation. The later is likely to lead to research and data that are not comparable across different geographic areas. In either case, however, mechanisms to ensure effective communication and control between local units and central administrative units are essential.

2.5 Glossary:

Research: It is creative and systematic work undertaken to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications.

Organization: It is an entity comprising multiple people, such as an institution or an association, that has a particular purpose.

Exploratory: It is a research conducted for a problem that has not been studied more clearly, intended to establish priorities, develop operational definitions and improve the final research design.

Hypothesis: It is a proposed explanation for a phenomenon. For a hypothesis to be a scientific hypothesis, the scientific method requires that one can test it

Questionnaire: It is a research instrument consisting of a series of questions for the purpose of gathering information from respondents.

Interpretation: It is the act of explaining, reframing, or otherwise showing your own understanding of something.

Decentralised: Transfer (authority) from central to local government.

2.6 Answers to self-check questions:

Q1: Refer to 2.2.1

Q2: Refer to 2.2.2

Q3: Refer to 2.2.2

Q4: Refer to 2.2.2

Q5: Refer to 2.2.1

2.7Terminal Questions

1. Discuss the steps involved in conducting a research.
2. What is research? How is it conducted?
3. How a company should organize research activities?
4. Compare and contrast centralized and decentralized approach of designing research activities.
5. Write short notes on the following:

   a. Research design

   b. Problem identification and formulation

   c. Decentralised research organization structure.

2.8 Suggested Readings

1. T.S. Wilkinson, and P.L. Bhandarkar, "Methodology and techniques of Social Research", Himalaya Publishing House, New Delhi.
2. S.P. Gupta, "*Statistical methods"* Sultan Chand & Sons publication, New Delhi.
3. Donald S. Tull and Dei S. Hawkins, "*Marketing Research - Measurement and Method",* Prentice Hall of India Pvt. Ltd., New Delhi.
4. William G. Zikmund, *"Exploring Marketing Research",* Thomson South-Western Publication, Singapore.
5. Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited. Delhi.

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Lesson-3
Research Design

Structure

3.0 Introduction

Business research is a management tool that companies use to reduce uncertainty in decision making. It is the manager's source of information about the organisational and environmental conditions. It is basically a systematic and objective process of gathering, recording, and analysing data for decision making. Without research a manager has to rely on his experience and intuition. The accuracy and reliability of any research, however, is essential. One of the most important steps to ensure accuracy and reliability is careful formulation of research problem and development of research design. This lesson, therefore, is focused on the development of research design. This lesson, therefore, is focused on the development of research design.

3.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

3.2.1 Types of business research

3.2.2 Concepts of Research design

3.2.3 Need for research design

3.2.4 Development of research design

3.25 Characteristics of good research design

Business research covers a wide range of phenomena. Certainly research in the production, finance, marketing or personnel management areas of a for-profit as well as nonprofit organisations form the domain of business research. A financial manager may ask, "Will the environment for long term financing be better two years from now?" A personnel manager may ask, "What kind of training is necessary for production employees?" or "What is the reason for the company's high turnover?" A marketing manager may ask,

"How can I monitor my sales in retail trade activities?" Each of these questions requires information about how the environment, employees, customers, or the economy will respond to executives' decisions. Research may be one of the principal tools for answering these practical questions.

3.2 Presentation of Contents

3.2.1 Types of Business Research

Business research can be classified on the basis of, either technique or function. Experiments, surveys, and observational studies are just a few common research techniques. Classifying them on the basis of either technique or function allows us to understand how the nature of the problem influences the choice of research method. The nature of the problem will determine whether the research is exploratory, descriptive, or causal.

(i) Exploratory Studies - Exploratory studies are conducted to clarify ambiguous problems.. Management may have discovered general problems, but research is needed to gain better understanding of the dimensions of the problems. Usually, exploratory research is conducted with the expectation that subsequent research will be required to provide conclusive evidence. Exploratory researches are conducted to gain familiarity with a phenomenon or to achieve new insights into it. The objective of exploratory research is the development of hypotheses rather than their testing.

(ii) Descriptive Research - The major purpose of descriptive research is to describe characteristics of a population or phenomenon. It seeks to answer to who, what, when, where and how questions. Accuracy is of paramount importance in descriptive research. Descriptive research includes surveys and fact finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present, in social science and business research we quite often use the term *Ex post facto research* for descriptive research studies. The main characteristic of this method is that the researcher has no control over the variables. He can only report what has happened or what is happening. Most ex post facto research projects are used for descriptive studies in which the researcher seeks to measure such items as, for exampie, frequency of shopping, preferences of people, or similar data.

(iii) Causal Research - The main goal of causal research is identification of cause and effect relationships between, variables. Exploratory and descriptive research normally precedes cause and effect relationship studies. In causal studies it is typical to have an expectation of the relationship to be explained, such as predicting the influence of price, packaging, advertising, and the like, on sales. Causal research attempts to establish that when we do one thing another thing will follow.

3.2.2 Concept of Research Design

The research design involves identifying a problem or opportunity; translating that problem/opportunity into a research problem; collecting, analysing, and reporting the information specified in the research problem. Decisions regarding what, where, when how much, by what means concerning an inquiry or a research design. In fact, the research design is the conceptual structure research is conducted. It constitutes the blueprint for the collection, measurement and analysis of data. More explicitly, the design decisions happen to be in respect of:

- What is the study "about?
- Why is the study being made?
- Where will the study be carried out?

- What type of data is required?
- Where can the required data be found?
- What will be the sample design?
- What techniques of data collection be used?
- How will the data be analysed?
- In what style the report be prepared?

Keeping in view the above stated design decisions; one may split the overall research design in the following parts:

(i) The *sampling design* which deals with the method of selecting items to be observed for the study;

(ii) The *observational design* which relates to the conditions under which the observations are to be made;

(iii) The *statistical design* which concerns with how the information and data gathered are to be analysed; and

(iv) The *operational design* which deals with the techniques by which the procedures specified in the sampling, statistical, and the observational designs can be carried out.

From what has been stated above, We can describe the important features of a research design which are as under:

- It is a plan that specifies the sources and types of information relevant to the research problem.
- It is a strategy specifying which approach will be used for gathering and analyzing the data.
- It also tells about the time and cost estimates since most studies are" done under these constraints.

3.2.3 Need for Research design

Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimum time, effort, and money. Just as for better, economical, and attractive construction of a house we need a blueprint, or what is commonly called the map of the house, well thought out and prepared by an expert architect, similarly we need a research design or a plan in advance of data collection and analysis for our research project. Research design stands for advance planning of the methods to be adopted for collecting the relevant data and the techniques to be used in their analysis keeping in view the objectives of the research and the availability of the staff, time, and money. Preparation of the research design should be done with great care as any error in it may upset the entire project. Research design, in fact, has a great bearing on the reliability of the results arrived at and as such' constitutes the firm foundation of the entire edifice of the research work.

Thoughtlessness in designing the research project may result in rendering the research exercise futile. It is, therefore, imperative that an efficient and appropriate must be prepared before starting research operations. The design helps the researcher to organize his ideas in a form whereby it will be possible for him to look for the flaws and inadequacies. Such a design can be given to others for their comments and critical evaluation. In the absence of such a course of action, it will be difficult for the critic to provide a comprehensive review of the proposed study.

3.2.4 Developing Research Design

The process involves various phases that are not watertight compartments. The phases of research design are as follows:

(a) Define and formulate the research problem - Problem definition is the most critical part of the research process. Research problem definition involves specifying the information needed by management. Unless the problem is properly defined, the information produced by the research process is unlikely to have any value.

The word problem, in general usage, suggests something has gone wrong. Unfortunately, the term problem does not connote a business opportunity, such as expanding operations into a foreign country, nor does it can note the need for evaluation for an existing programme, such as employee satisfaction with professional development programmes. Actually, the research task may be to clarify a problem, to evaluate a programme, or to define an opportunity, and problem discovery and definition will be used in this broader concept. It should be noted that the initial stage is problem discover/, rather than definition. Often only symptoms are apparent to begin with. Profits may be declining, but the management may not know the exact nature of the problem.

It was Albert Einstein who noted that, "the formulation of a problem is often more essential than its solution". This is good advice for managers. Too often managers concentrate on finding the right answer rather than asking the right question. Many don't realise that defining a problem may be more difficult than solving it. In business research, if the data are collected before the nature of the business problem is carefully thought out, the data probably will help not solve the problem.

The adage "a problem well defined is half solved" is worth remembering. This adage emphasizes that an orderly definition of the research problem gives a sense of direction to the investigation. Careful attention to problem definition allows the researcher to set the proper research objectives. If the purpose of the research is clear, the chances of collecting the necessary and relevant information - without collecting surplus Information will be much greater.

Research problem definition involves four interrelated steps:

(i) management problem / opportunity clarification,

(ii) situation analysis.

(iii) model development, and

(iv) specification of information requirements.

(i) Management problem/opportunity clarification - the basic goal of problem clarification is to ensure that the decision 'makers' initial description of the management decision is accurate and reflects the appropriate area of concern for research. If the wrong management problem is translated into a research problem, the. probability of providing management with useful information is low.

As a staff person, the research investigator must attempt to satisfy the objectives of the line manager who requested the information. The major hitch comes from the fact that decision-makers usually fail to spell the accurate objectives.

One effective technique for uncovering elusive research objectives consists of presenting the manager with each possible solution to a problem and asking whether he or she would follow that course of action. If the decision-maker says 'no', further questioning to determine why the course of action is inappropriate usually will help formulate the objectives.

(ii) **Situation analysis -** The management problem can be understood only within the context of the decision situation. The situation analysis focuses on the variables that have produced the stated management problem or opportunity. It involves giving careful attention to company records; appropriate secondary sources such as census data, industry .sales figures, economic indicators, and so on; and interviews with experts both external and internal.

(iii) **Model development -** Once the researcher has a sound understanding of the decision situation, it is necessary to get as clear an understanding as possible of the situation model of the manager. A situation model is a description of the outcomes that are desired, the relevant variables, and the relationships of the variables to the outcomes.

(iv) **Specification of information requirements -** Research can't provide solutions. Solutions require executive judgment. Research provides information relevant to the decisions by the executive. The output of the problem definition process is a clear statement of the information required to assist the decision-maker. A common temptation is to try to collect data on all possible variables. Unfortunately, this is generally impractical and a ways costly. The best approach for ensuring that any data collected is indeed relevant is to ask questions concerning the estimate use of the data. Specifically, the researcher should list the findings that seem possible.

(b) **Estimate the value of the information -** The principle involved in deciding whether to do research is that the research should be conducted only when it is expected that the value of the information to be obtained will be greater than the cost of obtaining it. Cost and value of information also helps the research department in determining which research projects to conduct, which research design to use, amid whether to gather more information after the initial results are in. Two approaches can be taken to arrive at an assessment of whether the expected value of the information in a proposed research project is greater than at estimated cost; the intuitive and the expected value approaches to the problem.

(i) **The intuitive approach -** It relies entirely on the private judgment of the person making the assessment.

(ii) **The expected value approach -** It uses application of Bayesian statistics that allow judgmental probabilities to be used.

(iii) **Select the data collection approach -** There are three basic data collection approaches in marketing research: (i) secondary data (ii) survey data, and (iii) experimental data. Secondary data were collected for some purpose other than helping to solve the current problem but may be used for research purpose, whereas primary data are collected expressly to help solve the problem at hand. Survey and experimental data are therefore secondary data if they were collected earlier for another study; they are primary data if they were collected for the present one. Secondary data are virtually always collected first because of their time and cost advantage. Companies generally rely on both primary as well as secondary data. Companies usually rely on two kinds of information 'soft data' obtained from visits to dealers and other channel members, and 'hard data' from shipments, inventory levels, and retail sales details.

The selection of the data collection method is one of the key aspects of the research design. Although creativity and judgment play a major role in this 'stage of the design process, the decision is constrained by the type of the information required, its value, and the characteristic of the respondents.

When the data collection method is finalised, researcher decides about the contact methods he or she will be using for gathering data. The following contact methods may be use.

(i) Mail Questionnaire - The mail questionnaire is the best way to roach individual who will not give personal interviews or whose responses might be biased or distorted by ire interviewers or who are scattered at distant places. The response rate is usually low in case of mailed questionnaire.

(ii) Telephone Interviewing - It is the method for gathering information quickly. The interviewer is also able to clarify questions if they are not understood. The response rate is typically higher than in the case of mailed questionnaires. The two main drawbacks of this technique of data collection are that only people with telephones can be interviewed, and the Interviews have to be short and not too personal.

(iii) Personal Interviewing - It is the most versatile of the three methods. The interviewer can ask more questions and can record additional observations about the respondent such as dress and body language. Personal interviewing is the most expensive method and requires more administrative planning and supervision. It is also subject to interviewer bias and distortion.

Personal interviewing, takes two forms, arranged interviews and intercept interviews. In arranged interviews, respondents are randomly selected and are either telephoned or approached at homes or offices and asked to give an interview, intercept interviews involve stopping people at a shopping centre or busy street corner and requesting an interview. Intercept interviews have the drawback of being non-probability samples, and the interviews must be quite short.

(d) Select the measurement technique - There are six basic measurement techniques in marketing research: (i) questionnaire, (ii) attitude scales, (iii) observation, (iv) depth interviews and projective techniques, (v) focus group research and, (vi) mechanical instruments.

(i) Questionnaire - It is a formalised instrument for asking information directly from a respondent concerning behaviour, beliefs, feeling, attitudes etc. It is by far the most common instrument in data collection, it consists of a set of questions presented to respondents for their answers. The questionnaire is usually very flexible in the sense that there are many number of ways to ask questions. They need to be carefully developed, and debugged before they are administered a large scale.

In preparing a questionnaire, the professional researcher carefully chooses the questions, their form, wording, and sequence. A common type of error occurs in the questions asked, that is, in including questions that cannot, would not, or need not be answered and in omitting questions that should be answered. Each question should be checked to determine whether it contributes to the research objectives.

The form of questions can also influence the response of the respondents. Researchers usually use closed-end and open-end questions. Closed-end questions pre-specify all the possible answers, and respondents are asked to make a choice among them. Open-end questions allow respondents to answer in their own words. Generally speaking, open-end questions often reveal more because respondents are not constrained in their .answers. Open-end questions are especially useful in the exploratory stage of research where the researcher is looking for insight into how people think rather than in measuring how many people think in a certain way

Care should be taken in the wording and sequencing of questions. The researcher should use simple, direct, unbiased wording. There should also be a logical flow of questions.

(ii) **Attitude scales -** It is a formalised instrument for eliciting self-reports of beliefs and feelings concerning an object. These are particularly useful on knowing the attitudes, preferences, perceptions, beliefs, etc. of the respondents. One can use ordinal, ratio,, and interval scales depending upon the information one is seeking to obtain.

(iii) **Observation** - It is the direct examination of behaviour, the results of behaviour, or physiological changes. Fresh data can be gathered by observing the relevant actors and settings. A searcher, who is interested in knowing the travelers' perceptions; might wander about in airports, airline offices, and travel agencies to hear how travelers talk about the different airlines.

(iv) **Projective techniques** - It allows respondents to project or express their own feelings, characteristic of someone or something else. Depth interviews allow individuals to express themselves without any fear of disapproval, dispute or advice from interviewer.

(v) **Focus group research -** A focus group is a gathering of 5 to 10 persons who are invited to spend a few hours with a skilled moderator to discuss a product, service, and organisation.

(vi) **Mechanical instruments** - Mechanical devices are also used, though not frequently, for business research. Galvanometers measure the respondents' interest or emotions aroused by an exposure to a specific advertisement or picture. The tachistoscope flashes an advertisement to a respondent with an exposure interval that may range from less than one hundredth of a second to several seconds. After each exposure, the respondent describes everything he or she recalls. Eye cameras study respondent's eye movements to see where his eyes land first, how long they linger on a given item, and so on. The audiometer is attached to TV sets in participating homes record when the set is on and to which channel it is tuned. Similarly video slow motion cameras are used to record the working movements of employees to eliminate unnecessary movements.

(e) **Select the sample -** Most studies including marketing studies involve a sample or subgroup of the total population relevant to the problem, rather than a census or the entire group. The population is generally specified as a part of problem definition process. Sampling involves the decisions about the following:

(i) **Population =** determines who (or what objects) can provide the requires information.

(ii) **Sample frame =** develops a list of population members.

(iii) **Sampling unit =** determines the basis for drawing the sample - individuals, -Households, city blocks, etc.

(iv) **Sampling method =** choose between probability and non-probability methods. Probability sampling include simple random sampling, stratified random sampling and cluster sampling whereas non-probability sampling include convenience sampling, judgment-sampling, and quota sampling.

(v) **Sample size -** determines how many population members are to be included in the sample. Usually, large samples give more reliable results than small samples.

(vi) **Sample plan -** develops a method for selecting and contacting the sample members.

(vii) **Execution -** carries out the sampling plan.

(f) Select the method (s) of analysis - Data are useful only after analysis. Data analysis involves converting a series of recorded observations into descriptive statements and/or inferences about relationships. The analysis of data requires a number of closely related operations such as establishment of categories, coding, tabulation etc. The unwieldy data should necessarily be condensed into a few manageable groups and tables for further analysis.

The types of analyses that can be conducted depend on the nature of the sampling process, the measurement instrument, and the data collection method.

It is imperative that the researcher selects the analytical technique prior to collecting the data. Once the analytical techniques are selected, the researcher should generate dummy data to the measurement instrument. These dummy data are then analysed by the analytical technique selected to ensure that the results of this analysis will provide the information required by the problem at hand. Failure to carry out this step in advance can result in a completed result project that fails to provide some or all of the information required by the problem. Further, it sometimes reveals that unneeded data that are about to be collected.

(g) Evaluate the ethics of the research - It is essential that researchers restrict their research activities to practices that are ethically sound. Ethically sound research considers the interests of the general public, the respondents, the clients, and the research profession as well as those of the other researchers.

(h) Estimate time and financial requirements - Once the research design (s) has been devised and checked for ethical soundness, the researcher must estimate the resource requirements. These requirements can be broken down into two broad categories; time and financial. Time refers to the time needed to complete the-project.

The financial requirement is the monetary representation of personnel time, computer time, and the materials requirements.

(i) Prepare the research proposal - The research design process provides the researcher with a blueprint, or guide, for conducting and controlling the research project. This blueprint is written in the from of research proposal. A written research proposal should precede any research project. The basic elements of research proposal are described below:

(i) Executive summary - a brief statement of the major points from each of the sections. The objective is to allow an executive to develop a basic understanding of the proposal without reading the entire proposal.

(ii) Background - a statement of the management problem and the factors that influence it.

(iii) Objectives - a description of the types of data the research project will generate and how these data are relevant to the management problem.

(iv) Research approach - a non-technical description of the data collection methods, measurements, instruments, sample, and analytical techniques.

(v) Time and cost requirements - an explanation of the time and money required.

(vi) Technical Appendixes - any statistical or detailed information in which only one or a few of the potential readers may be interested.

3.2.5 Characteristics of a good research design

A good design is often characterized by adjectives like flexible, appropriate, efficient, and economical and so on. Generally the design which minimizes bias and maximizes the reliability of the data collected and analysed is considered a good design. The design which gives the smallest experimental error is supposed to be the best design in many investigations. Similarly a design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered most appropriate and efficient design in respect of many research problems. Thus, the question of good design is related to the purpose or objective of research problem and also with the nature of the problem to be studied. A design may be quite suitable in one case, but may be found wanting in one respect or the other in the context of some other research problem. One single design cannot serve the purpose of all types of research problems.

We can, however, highlight the following characteristics of a good research design:

(i) Scientific method - Effective research uses the principles of the scientific method careful observation, formulation of hypotheses, prediction, arid testing.

(ii) Research creativity - At its best, research develops innovative Ways to solve a problem. So every research must contain the elements of creativity.

(iii) Multiple methods - Competent researchers shy away from over-reliance on any one method, preferring to adapt many methods to the problem rather than the other way around. They also recognise the desirability of gathering information from multiple sources to give greater confidence.

(iv) Interdependence of models and data - Competent researchers recognise these facts.

Anyway, if the research study happens to be an exploratory or a formularize one wherein the major emphasis is on discovery of ideas and insights, the research design most appropriate must be flexible enough to permit the consideration of many different aspects of a phenomenon. But when the purpose of a study is accurate description of a situation or of an association between variables, or in what is called the descriptive studies, accuracy becomes a major consideration and a research design which minimizes bias and maximizes the reliability of the evidence collected is considered a good design.

Studies involving the testing of a hypothesis of a causal relationship between variables require a design which will permit inferences about causality in addition to the minimization of bias and maximization of reliability. But in practice, it is the most difficult task to put a particular study in a particular group, for a given research may have in it elements of two or more of the functions of different studies. It is only on the basis of its primary function that a study can be categorised either as an exploratory or descriptive or causal research and accordingly the choice of a research design may be made in case of a particular study. Besides, the availability of time, money, skills of the research staff and means of obtaining the information must be given due weight age while working out the relevant details of the research design.

3.3 Self-Assessment Questions:

Q1: What are the types of business research?

Q2: Explain the concept of research design?

Q3: Briefly explain the characteristics of good research design?

Q4: What do you meant by developing of research design?

Q5: Why do we need research design?

Q6: Define questionnaire?

3.4 Summary

Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimum time, effort, and money.

Research design focuses on defining research problem, estimating the value of information, selecting the data collection approach, selecting the measurement technique, selecting the sample, selecting the method of analysis, and estimating the time and financial requirements etc.

Generally the design which minimizes bias and maximizes the reliability of the data collected and analysed is considered a good design. The design which gives the smallest experimental error is supposed to be the best design in many, investigations. Similarly a design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered most appropriate and efficient design in respect of many research problems. Thus, the question of good design is related to the purpose or objective of research problem and also with the nature of the problem to be studied. A design may be quite suitable in one case, but may be found wanting in one respect or the other in the context of some other research problem. One single design cannot serve the purpose of all types of research problems. A good research design, however, must use scientific method, research creativity, and multiple methods. The availability of time, money, skills of the research staff and means of obtaining the information must also be given due weightage while working out the relevant details of the research design.

3.5 Glossary:

Research design: It is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the problem research.

Business research: It is a systematic inquiry that helps to solve business problems and contributes to management knowledge. It is an applied research.

Exploratory: It is a research conducted for a problem that has not been studied more clearly, intended to establish priorities, develop operational definitions and improve the final research design.

Descriptive: It is the pattern of narrative development that aims to make vivid a place, object, character, or group.

Questionnaire: It is a research instrument consisting of a series of questions for the purpose of gathering information from respondents.

3.6 Answers to self-check questions:

Q1: Refer to 3.2.1

Q2: Refer to 3.2.2

Q3: Refer to 3.2.5

Q4: Refer to 3.2.4

Q5: Refer to 3.2.3

Q6: Refer to 3.2.4

3.7 Terminal Questions:

(1) Discuss in details the steps involved in the research design process?

(2) What is a research design? How it is formulated? Discuss with the help of suitable examples.

(3) Write short notes on the following:

(i) Questionnaire

(ii) Random sampling

(iii) Schedule

4. Discuss the essentials of a good research design.

3.8 Suggested Readings

(1) Donald S. Tull, and Del I. Hawkins, *"Marketing Research - Measurement & Method',* Prentice Hall of India Pvt. Ltd., New Delhi

(2) William G. Zikmund, "*Exploring Marketing Research*", Thomson South-Western Publication, Singapore.

(3) S.P. Gupta, "*Statistical methods*" Sultan Chand & Sons publication, New Delhi

(4) Harper W. Boyd, Jr., Ralph Westfall, and Stanley F. Stasch, *"Marketing Research - Text and Cases',* Richard D. Irwin, Inc., Homewood, Illinois, USA.

(5) Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Delhi.

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Lesson - 4
Research Design

Structure

4.0 Introduction

Data constitute the most important part of any research. Without it no information can be generated. It is food for analysis and ultimately helps us in tackling research problem. There are a number of methods of collecting data. This lesson focuses on some of the methods of data acquisition. The objectives of the lesson are:

4.1 Learning Objectives

After studying this lesson, you will familiarize with following concepts:

- Source of data
- Methods of collecting data
- Observation method
- Experimentation
- Interview method
- Case studies
- Tele-conferencing

4.2 Presentation of Contents

Data are facts, figures and other relevant materials, past and present, serving as bases for study and analysis. Without an analysis of factual data, no specific inferences can be drawn concerning the hypotheses.

Inferences based on imagination or guess work cannot provide correct answers to research questions. The relevance, adequacy and reliability of data determine the quality of the findings of a study. Thus, the scientific process of measurement, analysis, testing and inferences depends on the availability of relevant data and their accuracy, hence, the importance of data for any research study.

4.2.1 Source of Date

The sources of data may be classified into: a

a) Primary Sources, and

b) Secondary Sources.

a) **Primary Sources:** Primary sources are original sources from which the researcher directly collects data that have not been previously collected. Primary data are first-hand information collected through various methods such as observation, interviewing etc.

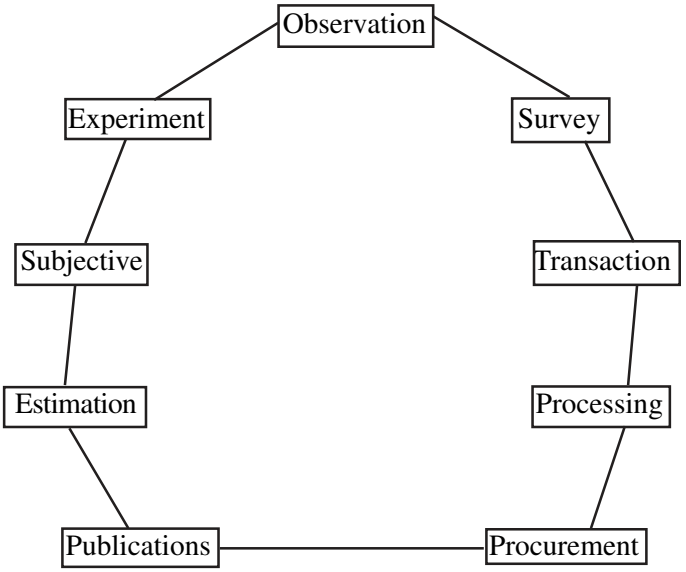
b) **Secondary Sources:** These are sources containing data, which have been collected and compiled for some other purpose. The secondary sources consist of readily available information and reports developed by other researchers and government.

4.2.2 Methods of collecting Date

Primary data are directly collected by the researchers from original sources. There are various methods of data collection. The important methods include:

(a) **Observation -** Here, the data are collected by observing the things as they happen. A researcher may visit the customer for assessing the customer complaints. Similarly, an accident site may be visited for assessing the accidental damage. This technique is useful as the first hand knowledge avoids a response bias. However, this technique is dependent on the observer and is influenced by his bias.

(b) **Experiment -** This technique is used to obtain information on a specific parameter by the applications of certain variables on it. For example, market response to a new packaging can be determined by test marketing.



(c) Survey - This technique enables researchers to cover the interested population on specific aspects. Market surveys and opinion polls are examples of survey method. The questionnaire and/or schedule are the important instruments for data collection in survey technique. Most of the researches are survey oriented.

(d) Subjective estimation - Here, the expert opinions may be used to collect information. For examples, data pertaining to future like alternate source of energy, life style in 21st century can be obtained through subjective estimation. Here, the focus is on estimation and efforts are made to make it as accurate and reliable as possible.

(e) Transaction processing - This technique uses existing data and extract information by processing it. For example, various types of information can be obtained after processing data from ledger, payroll, stock statements, and sales reports.

(f) Publications - The information may also be obtained by scanning various publications of government and private agencies and organisations, books, magazines, newspapers, and journals etc. This type of data can be obtained at a low cost but it may not be directly useful. This data are usually not the latest.

(g) Procurement - Data and information can also be procured from outside agencies by paying a price. Databases on specific subjects, research studies a"; consumer behaviour are available for a price. Now a day's various r.res o'' data are available on CD-ROMs. Many companies are in the business of creating databases and marketing it also.

4.2.3 Observation Method:

The observation method is the most commonly used, especially in studies relating to behavioural science. Observation means viewing or seeing. It is defined as systematic viewing of a specific phenomenon, in its proper setting, for the specific purpose of gathering data for a particular study. Observation as a method includes both 'seeing' and 'hearing'. It is accompanied by perceiving as well. Observation as a method of data collection has certain characteristics:

(i) In observation method, the information is sought by way of investigator's own direct observation without asking for the respondent.

(ii) It is both a physical and mental activity.

(iii) Observation is purposive and not casual. It is made for the specific purpose of noting things relevant to the study.

(iv) It captures the natural social context in which person's behaviour occurs.

Observation may be classified in different ways. With reference to the nvestigator's role, it may be classified into a) participant observation, and b) non-participant observation. This distinction depends upon the observer's sharing or not sharing the life of the group he is observing. If the observer observes by making himself, more or less, a member of the group he is observing so that he can experience what the members of the group experience, the observation is called as the *participant observation* but when the observer observes as a detached emissary without any attempt on his part to experience through participation what others feel, the observation of this type is termed as *non-participant observation.*

In terms of mode of observation, it may be classified into a) direct observation, and d) indirect observation. When the observer is observing the event directly, it is *direct observation.* His presence may be known to the people he is observing. However, when the observer is observing in such a manner that his presence may be unknown to the people he is observing, it is described as *indirect or disguised information.*

In case the observation is characterized by a careful definition of the units to be observed, the style of recording the observed information, standardized conditions of observation and the selection of pertinent data of observation, then the observation is called *structured observation.* But when the, observation is to take place without these characteristics to be thought of in advance, the same is termed as *unstructured information.* Structured observation is considered appropriate in descriptive studies, whereas in an exploratory study the observational procedure is most likely to be relatively unstructured.

Sometimes we talk of controlled and uncontrolled observation. If the observation takes place in natural setting, it may be termed as *uncontrolled observation,* but when observation takes place according to definite pre-arranged plans, involving experimental procedure, the same is then termed as *controlled observation.* In non-controlled observation, no attempt is made to use precision instruments. The major aim of this type of observation is to get a spontaneous picture of life and persons. In controlled observation, we use mechanical or precision instruments as aids to accuracy and standardization. Such observations have a tendency to supply formilsed data upon which generalizations can be built with some degree of assurance. The main pitfall of non-controlled observation is that of subjective interpretation.

The use of observation method requires proper planning. First, the researcher should carefully examine the relevance of observation method to the data needs of the selected study. Second, he must identify the specific investigative questions which call for use of observation method. Third, he must decide the observation comment and specific conditions, events and activities that have to be observed for the required data. Fourth, for each variable chosen, the operational definition should be specified. Fifth, the observation setting, the subjects to be observed, the timing and mode of observation, recording procedure, recording instruments to be used, and other details of the task should be determined. Last, observers should be selected and trained. The persons to be selected must have sufficient concentration powers and strong memory power. Selected persons should be imparted both theoretical and practical training.

Observation method has following advantages;

(i) The main virtue of observation is its directness; it makes it possible to study behaviour as it occurs. The researcher need not ask people about their behaviour and interactions; he can simply watch what they do and say.

(ii) Data collected by observation may describe the observed phenomena as they occur in their 'natural' settings. Other methods introduce elements of artificiality into the researched situation.

(iii) Observation is more suitable for studying subjects who are unable to articulate meaningfully, e.g., studies which involve children, tribal's, animals, birds as the subjects of study.

(iv) Observation makes it possible to capture the whole event as it occurs. For example, only observation can provide an insight into all the aspects of process of negotiation between union and management representatives.

(v) Observation is less demanding of the subjects and has less biasing effect on their conduct than does questioning.

(vi) It is easier to conduct disguised observation studies than disguised questioning.

(vii) Mechanical devices may be used for recording data in order to secure more accurate data and for making continuous observations over longer periods.

(viii) The observation obtained by this method relates to what is currently happening; it is not complicated by either the past behaviour or future intentions or attributes.

Observation cannot be used indiscriminately for all purposes. It has its own limitations.

(i) Observation is of no use for studying past events or activities. One has to depend upon documents or narrations by people for studying such things.

(ii) It is not suitable for studying opinions and attitudes.

(iii) The observer normally should be at the scene of the event when it takes place. Yet it may not be possible to predict when the event will occur, e.g., road accident, communal clashes etc.

(iv) Observation is a slow and expensive process, requiring human observers and/or costly surveillance equipments.

4.2.4 Experimentation

Experimentation is a research process used to study the causal relationships between variables. It aims at studying the effect of an independent variable on dependent variables by introducing some type of control. Experiment requires special efforts. The general procedure in experimentation is as follows:

(a) Determine the hypothesis to be tested and the independent and dependent variables involved in it.

(b) Operationalize the variables by identifying their measurable dimensions.

(c) Select the type of experimental plan.

(d) Choose the setting. The setting may be field or laboratory.

(e) Make the experimental conditions as nearly the same as the expected real life conditions. This is essential in order to make the findings reliable.

(f) Make a record of pre-experimenta! conditions.

(g) Introduce appropriate methods for controlling extraneous variables that are not manipulated in the experiment.

(h) Apply the experimental treatment and record observations and measurements using appropriate measurement devices. If feasible, repeat the tests several times in order to ensure the accuracy of results.

(i) Analyse the results, using appropriate statistical devices.

(j) Interpret the results, giving consideration to a possible extraneous condition No possible cause should be overlooked, as unforeseen conditions might influence the results.

Experimentation has some specific advantages and disadvantages. The Advantages are:

- Its power to determine causal relationships between variables surpasses that of all other methods.
- The element of human error is reduced to the minimum.
- More conditions may be created and tested in experimentation than may be possible in other methods.
- Experimentation yields generally exact measurements and can be repeated for verifying the results.

The Limitations are:

- It is difficult to establish experimental and control groups.

- The scope for experimentation with human beings is limited.
- The experiment is often difficult to design, tends to be expensive and time-consuming.
- It is artificial to some extent and may lack realism.
- Experimentation can be used only in studies of the present but not in studies relating to past or future.
- It is of no use in determining opinions, motives and intentions of persons.

Let us know understand the different types of Experiments.

(i) Laboratory Experiment: *A laboratory experiment is an investigation conducted in a setting created specifically for the purpose.* The researcher manipulates an independent variable and studies its effect on a dependent variable, keeping other variables constant. The purpose of laboratory experiments is to discover causal relations under uncontaminated. The method is useful not only in physical sciences research, but also in social sciences research.

(ii) Field Experiment: This is an experiment conducted in a real life situation in which the experimenter manipulates an independent variable in order to test a hypothesis. This method is well suited to both testing of theory and finding solutions to practical social problems. It has been used for studying a variety of social action programmes such as improving the quality of work life in assembly-lines, post offices and insurance companies and banks; the learning process in educational institutions and training centres. The major limitation of this method is the practical difficulty involved in the manipulation of independent variables and randomization in many field situations. Another weakness inherent in this method is lack of precision. Precise measurement in realistic situation is not possible.

4.2.5 Interview Method

Interviewing is one of the major methods of data collection. It may be defined as a two-way systematic conversation between an investigator and an informant for obtaining information relevant to a specific study. It involves not only conversation, but also learning from the respondent's gestures, facial expressions, and also his environment. Interviewing is the only suitable method for gathering information from illiterate or less educated respondents. Interviewing is often superior to other data- gathering methods, it enables the investigator to grasp the behavioural context of the data furnished by the respondents., it permits the investigator to seek clarifications and brings to the forefront those questions that, for one reason or another; respondents do not want to answer.

There are several real advantages of personal interviewing:

- The greatest value of this method is the depth and detail information that can be secured.
- The interviewer can do more things to improve the percentage of responses and the quality of information received than with other methods.
- The interviewer can gather 'other supplementary, information like economic level, living conditions etc. through observation of the respondents' environment.
- The interviewer can use special scoring devices, visual materials and the like, in order to improve the quality of interviewing.
- The accuracy and dependability of the answer given by the respondent can be checked by observation and probing.
- Interview is flexible and adaptable to individual situations. Even more control can be exercised over the interview situation.

Interviewing is not free from limitations. Its greatest drawback is that it is costly, both in money and time.

The interviews may be classified into:

a) **Structured or directive interview:** This is an interview made with a detailed standardised schedule. The same questions are put to all the respondents and in the same order. Each question is asked in the same way in each interview, which ensures measurement reliability. This type of interview is used for the large-scale formalised surveys.

b) **Unstructured or non-directive interview:** This is the least structured one. The interviewer encourages the respondent to talk freely about a given topic with a minimum of prompting or guidance. In this type of interview, a detailed pre-planned schedule is not used. Only a broad interview guide is used. The interviewer avoids channeling the interview directions. Instead, he develops a very permissive atmosphere. Questions are not standardised and are not ordered in a particular way.

This interviewing is more useful in case studies rather than in surveys. It is particularly useful in exploratory research where the lines of investigation are not clearly defined. It is also useful for gathering information on sensitive topics such as divorce, social discrimination, class conflict, generation gap, drug addiction etc. it provides opportunity to explore the various aspects of the problem in an unrestricted manner.

c) **Focused Interview:** This is a semi-structured interview where the investigator attempts to focus the discussion on the actual effects of a given experience to which the respondents have been exposed. It takes place with the respondents known to have been involved in a particular experience, e.g., seeing a particular film, viewing a particular programme on T.V., involved in a train/bus accident, etc.

b) **Clinical Interview:** This is similar to the focused interview but with a subtle difference. While the focused interview is concerned with the effects of a specific experience, clinical interview is concerned with broad underlying feelings or motivations or with the course of the individual's life experiences.

e) **Depth interview:** This is an intensive and searching interview aiming at studying the respondent's opinion, emotions or convictions on the basis of interview guide. This requires much more training in interpersonal skills than structured interviewing. This deliberately aims to elicit unconscious as well as extremely personal feeling and emotions.

f) **Telephone Interviewing:** Telephone interviewing is a non-personal method of data collection. It may be used as a major method or supplementary method It is used when the universe is composed of those persons whose names are listed in telephone directories, e.g., business houses, business executives, doctors, other professionals etc. it is used when the study requires responses to five or six simple questions, e.g. Radio or Television programme survey. It may also be used when the respondents are widely scattered and when there are many call backs to make.

The advantages of this method are that the survey can be completed at very low cost and the information can be collected in a short period of time. It also does not involve field work.

The disadvantage of this method is that it is limited to persons with listed telephones. There is also a limit to the length of interview. Telephone is also not suitable tor complex surveys. The respondent's characteristics and environment cannot be observed. It is also not possible to use charts, maps or complex scales.

g) **Group Interviews:** A group interview may be defined as a method of collecting primary' data in which a number of individuals with a common interest are Involved. In a personal interview, the flow of information is multidimensional The group interview technique can be employed by researchers in studying people's reactions on public health projects, welfare schemes, etc. It Is a popular method in research to evaluate new products or service concepts, brand names, packages, promotional strategies and attitudes. St can be used to generate primary data in the exploratory phase of a project. The advantages of this technique are:

- The respondents comment freely and in detail.
- The method is highly flexible. The flexibility helps the research work with new concepts or topics which have not been previously investigated.
- Visual aids can be used
- A group can be interviewed in the time required for one personal interview.
- Respondents are more articulate in a group than in the individual interview.

This method is not free from drawbacks:

- It is difficult to get a representative sample.
- There is the possibility of the group being dominated by one individual.
- The respondents may answer to please the interviewer or the other members in the group.

4.2.6 Case studies

Evolved from the behavioral sciences, case study is extensively used in business research today. Using situations analogous to or relevant to the problem situation and in depth investigation is carried out to thoroughly study the case situation. The emphasis of the study is on identifying key variables, defining the nature of the relationships and possibly defining the problem/ opportunity in order to suggest alternative courses of action for the decision situation. Examples would be research problems involving;

a) Study of changes in sales performance with the entry of a new competitor,

b) Transitional stages like study of sales territories where the company is altering its distribution channels from indirect to direct sales.

Case studies are often described as exploratory research, used in areas where there are few theories or a deficient body of knowledge. However, this is not there only form. Case studies may be of following types:

(i) ***Descriptive case studies*** - In these type of case studies the objective is restricted to describing current practice.

(ii) ***Illustrative case studies*** - Here, the attempt is made to illustrate new and possibly innovative practices adopted by particular companies.

(iii) ***Experimental case studies -*** Here, the effort is made to examine the difficulties in implementing new procedures and techniques in an organization and evaluating the benefits.

(iv) ***Explanatory case studies*** - Here, existing theory is used to understand and explain what is happening.

4.2.7 Teleconferencing

The satellite based teleconferencing system provides excellent opportunities to interact with the respondents at different ends. Teleconferencing is of three types:

(i) **Audio-conferencing:** It involves transmission of voices. The voices are amplified at each end by a speaker system. It can usually be handled over regular telephone lines rather than needing a satellite, being limited to voice only, it is most cost- effective type.

(ii) **Audio-Graphic conference:** It employs voice plus graphic display capability. The most frequently used graphic supplement is a facsimile machine, which transmits electronically and reproduces at remote locations anything that can be pointed on paper.

(iii) **Video- conferencing:** in Video conferencing a television type picture is transmitted and displayed along with audio message. Normally it requires dedicated ISDN lines.

Data are facts, figures and other relevant materials, past and present, serving as bases for study and analysis. There are various methods of data collection. The important methods include Observation, Experimentation, and Interviewing. Observation means viewing or seeing. But observation as a method of data collection is different from casual viewing, It is systematic viewing of a specific phenomenon, in its proper setting, for the specific purpose of gathering data for a particular study.

4.3 Self-Assessment Questions:

Q1:Name the types of source of data.

Q2: What are the methods of collecting data?

Q3: What do you meant by observation methods?

Q4: Briefly explain the tele-conferencing?

Q5: Explain interviewing methods?

Q6: what are the advantages of observation methods?

4.4 Summary

Data are facts, figures and other relevant materials, past and present, serving as bases for study and analysis. There are various methods of data collection. The important methods include Observation, Experimentation, and interviewing. Observation means viewing or seeing. But observation as a method of data collection is different from casual viewing. It is systematic viewing of a specific phenomenon, in its proper setting, for the specific purpose of gathering data for a particular study. Observation as a method includes both ‘seeing’ and ‘hearing’. It is accompanied by perceiving as well.

Experimentation is a research process used to study the causal relationships between variables. It aims at studying the effect of an independent variable on dependent variables through introducing some type of control. Experiment requires special efforts. It is often extremely difficult to design, and it is also a time consuming process.

Interviewing is one of the major methods of data collection. It may be defined as a two-way systematic conversation between an investigator and an informant for obtaining information relevant to a specific study.

4.5 Glossary:

Data: These are individual units of information.

Observation: It is the active acquisition of information from a primary source.

Survey: It is defined as a research method used for collecting data from a pre-defined group of respondents to gain information and insights on various topics of interest.

Case study: It is a research strategy and an empirical inquiry that investigates a phenomenon with its real-life context.

Teleconference: It is the live exchange and mass articulation of information among several persons and machines remote from one another but linked by a telecommunications system.

Experimentation: The process of performing a scientific procedure, especially in a laboratory, to determine something.

Interview method: The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses.

4.6 Answers to self-check questions:

Q1: Refer to 4.2.1

Q2: Refer to 4.2.2

Q3: Refer to 4.2.3

Q4: Refer to 4.2.7

Q5: Refer to 4.2.5

Q6: Refer to 4.2.3

4.7 Terminal Questions

1. Discuss some of the methods of collecting data highlighting their respective advantages and disadvantages.
2. Write a detailed note on observation method of data collection.
3. What do you understand by experimentation? Discuss the process of experimentation technique of data collection.
4. Discuss interview technique of data collection highlighting its advantages and limitations.
5. Discuss various types of interviews highlighting their main objectives.
6. Discuss, case studies method of data collection.
7. Compare and contrast observation and interview methods of data collection.

4.8 Suggested Readings

1. Susan P. Douglas and C. Samuel Craig, "International *Marketing Research*", Prentice Hall of india Pvt. Ltd., New Delhi.
2. William G Zikmund, *"Exploring Marketing Research",* Thomson South- Western Publication, Singapore.
3. Donald S. Tull and Dei S. Hawkins, *"Marketing Research - Measurement and Method",* Prentice Hall of India Pvt. Ltd., New Delhi.
4. S.P. Gupta, *"Statistical methods"* Sultan Chand & Sons publication, New Delhi.
5. Kothari, C.R., "*Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Delhi.

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Lesson - 5
Questionnaire Design

Structure

5.0 Introduction

One of the most important tools of data collection is questionnaire. Most of the researchers rely on this tool for data collection, especially when primary data is needed. The construction of a questionnaire is, however, not an easy job. Tremendous efforts, expertise, and skills are needed to design a questionnaire. It also takes lot of time to design a good questionnaire. Results of any research more or less depend on the questions selected in a questionnaire. This lesson is devoted to the questionnaire and its design. The main objectives of the lesson are:

5.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- Construction of a questionnaire
- Question construction
- Check list for question construction
- Characteristics of a good questionnaire

5.2 Presentation of Contents

5.2.1 Construction of a questionnaire

5.2.2 Question construction

5.2.3 Check list for question construction

5.2.4 Characteristics of a good questionnaires

5.2.1 Construction of Questionnaire

The process of construction of a questionnaire is not a matter of simply listing questions that comes to researcher's mind. It is a rational process involving much time and effort. It consists of the following major steps:

(i) ***Data need determination:*** As questionnaire is an instrument for gathering data for a specific study, its construction should flow logically from the data required for the given study. Hence the data need determination is the first step in the questionnaire design process.

The data required for a specific study can be determined by a deep analysis of the research objectives, hypothesis, and the operational definitions of the concepts used in them.

(ii) ***Preparation of Dummy tables:*** As we are concerned with information required for the study and also with securing the information in the most-usable form. The best way to ensure these requirements is to develop "dummy" tables in which to display the data to be gathered. The adequacy of the dummy tables for describing the possible distributions or relationship related to the problem or hypothesis should be examined. This will help to identity gaps and duplications in the instrument and enable the designer to make appropriate additions, corrections and deletions.

(iii) ***Determination of respondents' level:*** Who are our respondents? Are they persons with specialized knowledge or are they lay people? What is their level of knowledge and understanding? The choice of words and concepts depends upon all these questions.

(iv) ***Data gathering method decision:*** At this stage we must choose the method of collection of data to be used. Which communication mode is most appropriate-face-to face or mail? The choice of question structure depends largely on the communication mode chosen. For example, it is necessary to use structured questions for a mail survey, to the extent possible.

(v) ***Instrument drafting:*** After determining the data required for the study, first, a broad outline of the instrument may be drafted listing the various broad categories of data. For example, the outline of a questionnaire for a survey of consumer behaviour towards colour televisions may consist of such sections as (a) Identification data, (b) Brand awareness, (c) Brand choice, (d) Purchase decision, (e) Brand loyalty, (f) Post-purchase behaviour, and (g) Personal information.

Second, the sequence of these groupings must be decided. They must be arranged in a logical order. For example in the questionnaire outline given above, 'brand choice' cannot precede 'brand awareness', because the choice is made out of brands known.

Third, the questions to be asked under each group heading must be listed. All conceivable items relevant to the 'data need' should be compiled. The goal of this listing is to ensure that all questions that are required to obtain the needed data are compiled. In compiling this draft, the content, wording and other aspects should be considered.

(vi) ***Evaluation of the draft instrument:*** In consultation with other qualified persons, the researcher must rigorously examine each question in the draft instrument. This evaluation may be done in terms of the following criteria:

a) The relevance of each question to the research objectives and investigative questions.

b) The appropriateness of the type of question, open ended or structured.

c) The clarity and unambiguity of the question.

d) The practicability of the question: i.e., it should not demand knowledge and information that the respondent does not possess; it should not test his memory span.

(vii) ***Pre-testing:*** The revised draft must be pre-tested in order to identify the weaknesses of the instrument and further revisions are required to rectify them.

(viii) ***Specification of procedures/instructions:*** After the instrument is finalised after pre-tests, the procedures or instructions, relating to its use must be specified. The definitions of concepts and variables should be given. The procedure for recording responses and approaches to deal with various situations must also be specified. If the instrument is meant for mail survey, instructions regarding the mode of answering should be specified at the top of the first page. The anonymity should be assured

The questionnaire itself should be carefully and clearly laid out, using bold types and capitals to emphasize particular words and instructions. It should be neatly printed on quality paper, as the primary consideration in questionnaire design is attractiveness and clarity.

(ix) ***Designing the format:*** The format should be suited to the needs of the research. The instrument should be divided into different sections relating to the different aspects of the problem. Each section heading should be printed in thick/bold letters. There must be more space for the answer of each open-ended question. There should be space between one questions and another so that the interviewer/ respondent will not easily confuse the line from which he is reading.

5.2.2 Question Construction

A questionnaire is useful for collecting various types of information, viz., (a) factual information about the respondents such as sex, age, marital status, education, religion, caste or social class, income and occupation; and facts about events and circumstances, (b) psychological information such as attitudes, opinions, beliefs, and expectations, and (c) behavioural information like social participation, and so on.

Once the information need is determined, we can begin question construction. This involves four major decision areas: (a) question relevance and content, (b) question wording, (c) response form, and (d) question order or sequence.

(a) ***Question relevance and content*** : Any question to be included in the instrument should pass certain tests. Is it relevant to the research objectives? Can it yield significant information? Dose the question provides the information needed to interpret the response fully? If we have to ask about the operational efficiency of X enterprises, a single question about it cannot provide adequate information to judge the operational efficiency. We should ask several questions on various dimensions of this variable.

Another test is to consider whether the respondents know the answer to the question. Respondents may prefer to give some answer even if they are not aware of a topic. General public cannot be expected to know the correct meanings of technical concepts. The question designer should consider the respondent's information level when determining the content and appropriateness of a question. A question should not call for more information than the potential respondent's ability and willingness to provide.

The most important guideline for asking about behaviours of respondents is that the equation should be specific. What brand or brands of coffee do you have in the house today? Do you usually buy that brand? These specific questions are preferable to a more general question like "what brand of coffee do you usually use?"

Finally, it must be determined whether questioning would secure the required information or not. If we find that through questioning we cannot succeed in securing needed information, we should think of other alternatives.

(b) ***Question wording:*** This is a difficult task. The function of a question in a schedule/ questionnaire is to elicit particular information without distortion. Questioning people is more like trying to catch a particular elusive fish, by hopefully casting different kinds of bait at different depths, without knowing what goes on beneath the surface. As the meaning of words differs from person to person, the question designer should choose words which have the following characteristics:

(i) **Shared vocabulary:** The collection of data is ultimately an exchange of ideas between the investigator and the respondent. The exact understanding between them calls for the use of vocabulary common to both parties. Each must understand what the other says.

(ii) **Uniformity of meaning:** word should mean the same thing to all respondents.

(iii) **Exactness:** The words should be exact or precise, reflecting what the question content is intended to mean.

(iv) **Simplicity:** The words should be simple. The questions should also be simple. Instead of designing a single complex question on a complicated subject it is desirable to compile a series of simple questions.

(v) **Neutrality:** Words that cause undue influence on prestige or bias can result in inaccurate answers.

The question designer should be aware of question wording problems and take every care to develop unbiased and unambiguous questions. After developing them, he should test and revise those two or more times in order to improve the quality of the wordings. The general rules should be clear, having few or no adjectives; and they should be positive rather than negative.

(c) **Response form or type of Questions:** The third major area in question construction is the types of questions to be included in the instrument. They may be classified into open questions and closed questions. Closed questions may be dichotomous, multiple choice or declarative ones.

If the objective of questionnaire is to classify the respondents' characteristics/viewpoints into some specific categories, then the closed form of question is preferable. For example, the age of the respondents may be structured as upto 20 years, 20 to 40 years, 41 to 60 years; and 60 years and above. Open questions are appropriate when the objective is to discover opinions and knowledge or to seek suggestions and information.

When the subject matter of a question is likely to be outside the range of the respondent's experience, the open questions are preferable for determining the depth of feelings and expressions of intensity. Where the respondent has not yet thought through the topic, an open question may give him a chance to think through it. Finally, it is better to use open questions when the investigator has no clear idea of respondents' level of information. This situation is likely to prevail in exploratory research or the pilot stage of a study.

(i) **Open-ended questions:** These are unstructured ones, providing free scope to the respondents to reply with their own choice of words and ideas, e.g., what you propose to do after graduation? Open responses are useful in studies where discovery is the objective. Response freedom encourages a variety of frames of references which may provide unanticipated insights.

Open questions of general type may be included in the opening part of the tool in order to arouse the interest of the respondents. Open questions are also useful to start a depth interview. However, they make compilation and classification of responses difficult.

(ii) **Close-ended questions:** Closed questions are structured ones with two or more alternative responses from which respondent can choose. They contain standardised answers and they are simple to administer and easy to compile and analyse. As the alternative responses are designed with reference to the requirements of the study, the chances of securing relevant answers are better.

(iii) **Multiple choice Questions:** These questions contain more than two alternatives, e.g., Why have you preferred this brand of two wheeler?

- Reasonable price
- Fuel-efficient
- Sturdy
- Riding comfort
- Others (please specify)

The list may not necessarily be all-inclusive. To solve this problem, we should add the category "others (please specify)" to provide for any other options. The Multiple-choice questions should satisfy the following requirements:

- The list of alternative choices should be exhaustive, i.e., it should contain all the possible choices that the respondents would like to have. The category of "others (please specify)" should be included to provide for unanticipated choices.
- They should not contain overlapping choices.
- There should be a fair balance in choices.
- A alternatives should be reasonable.

(iv) **Declarative Questions:** A declarative question is a type of multiple choice questions in which a series of statements about a subject is given. The respondent is asked to tick one of them which represent his view. For example:

Which of the following statements best describes your company's philosophy?

- A business firm is responsible for making a profit and helping to solve social problems which it may directly create.
- A business firm is responsible for making profits while abiding by legal requirements.
- In addition to making profit a firm should help to solve social problems, whether or not it created them as long as there is some profit potential.
- In addition to making a profit, a firm should help solve social problems around it, even if there is probably no profit potential.

When the responses are best expressed in degrees of agreement or disagreement or like or dislike, the declarative form should be considered.

Types of questions to he avoided: The question designer should avoid the following types of questions:

a) Leading questions: A leading question is one that is worded in such a way as to influence the respondent to give a certain answer, it does not elicit an accurate answer or correct view point of the respondent.

b) Loaded question: A loaded' question is one that contains words which are emotionally coloured and suggests an automatic feeling of approval or disapproval.

c) Ambiguous questions: An ambiguous question is one that does not have a clear meaning. It may mean different things to different people.

d) Double-barreled questions: They contain two or more different ideas or reference, e g , Do you favour or oppose increased job security and productivity-linked wage system? This should be split up into two questions: (1) Do you favour or oppose increased job security? (2) Do you favour or oppose productivity-linked wages system?

e) Long Questions: When questions become long they often become ambiguous and confusing. For example, the question "Do you have any impairments or handicapped conditions, even though they may not interfere with your usual activities"? Causes confusion. It can be split into two points.

f) Avoid double negative: A question with a double negative will cause confusion. Hence double negative construction should be avoided.

(d) ***Question order and Sequence:*** The order in which questions are arranged in schedule/questionnaire is as important as question wording. It has two major implications. First, an appropriate sequence can ease the respondent's task of answering. Second, the sequence can either create or avoid biases due to context effects, i.e., the effects of preceding questions on the response to later questions.

There should be a logical progression such that the respondent is (1) drawn into the questioning process by awakening his interest, (2) not confronted by an early and sudden request for personal information, (3) easily brought along items which are simple to answer to those which are complex, (4) never asked to give an answer which could be embarrassing, without being given an opportunity to explain and (5) brought smoothly from one frame of reference to another rather than made to jump back and forth.

The question sequencing has two dimensions: (1) overall sequence, i.e,, the sequence among topical areas within the instrument, and (2) intra sequence, i.e., sequence within a topical area.

(i) Overall sequence: The researcher is a stranger to respondents and the latter are under no obligation to oblige. They may also have some doubts about their competence to- answer research questions. Therefore, the investigator's first challenge is to. awaken the respondents' interest in the study and motivate participation, in order to bring this about, the instrument should begin with attention catching non-controversial and simple but interesting questions. In fact, the first few questions may set the tone of the entire questioning process.

(ii) Intra sequence: There are two general patterns in arranging the questions within a specific topical area. They are the funnel- sequence and the inverted funnel sequence. The *funnel sequence* refers to the procedure of listing the most general question first and following it with increasingly

specific and detailed questions. The general question introduces the general subject and the respondent answer to it. Each successive question is related to the previous question and it is progressively more specific.

The objective of funnel approach is to learn the respondent's frame of reference and to extract the full range of desired information without the distortion effect of earlier questions on later ones.

In the *inverted funnel sequence* narrower question are followed by broader once. Another requirement in arranging is to avoid context effects, i.e., the influence of one question on another.

5.2.3 Check list for question construction

A useful checklist of points to be considered while evaluating the questions constructed is given below:

(a) Question content

- Is this question necessary for clear understanding?
- Are several questions needed on the subject matter?
- Do the respondents have information necessary to answer the question?
- Does the question needed to be more concrete, more specific, and more closely related to respondent's experience?
- Is the question content sufficiently general and free from specificity?
- Is the question content biased or loaded in one direction without accompanying questions to balance the emphasis?

(b) Question wording

- Do the questions contain difficult or unclear phrases tending toward misunderstanding?
- Do the questions adequately express the alternatives with respect to choices of responses?
- Are the questions misleading by reason of unstated assumptions or unseen implications?
- Is the wording biased? Is it emotionally loaded?
- Is the question wording likely to be objectionable to the respondents?
- Would a more personalized or less personalized wording of the question produce better results?
- Can the question be better asked in a more direct or more indirect form?

(c) Question sequence

- Are the answers to the questions likely to be influenced by the content of the preceding question?
- Are the questions led up to in a natural way? Are they in correct psychological order?
- Do some questions come too early or too late from the point of view of arousing interest and receiving sufficient attention, avoiding resistance and inhibitions?

(d) Items of the form

The following items are mandatory for questionnaire:

- The name of the organization collecting the data should appear at the top of front page. The name of the sponsor of the study, if any, should also be shown. If the instruments are to be returned by mail, the address to which they are to be sent must be clearly specified.

The title of the study should appear in large print next to the name of the organization on the first page. Below this title, the title of the tool- e.g., 'Questionnaire for consumers' - may be noted.

- The confidentialness of the data should be made clear.
- A serial number to each copy of the tool may be assigned.
- The pages of the instrument should be numbered.

Question designing remains primarily a matter of common sense and experience and of avoiding known pitfalls, as there are no hard and fast rules relating to it. Hence alternative versions of questions must be rigorously tested in pre-tests.

5.2.4 Characteristics of a good questionnaire

A summary of the main characteristics or a good schedule/questionnaire is given below:

- It asks for and obtains all the information required for achieving the research objectives.
- It contains questions relevant to the study and does not include any irrelevant and unimportant questions.
- It does not aim at obtaining any information which can be more accurately and effectively obtained by other data-gathering methods like observation.
- It contains no questions that are unclear, ambiguous, double, 'leading, loaded or uninformative, and long.
- It contains no open ended or discussion questions unless they are absolutely necessary.
- It does not contain questions which are beyond the memory span of respondents.
- It contains questions that can be answered as quickly and easily as possible.
- It avoids unwarranted presumptions about the respondents.
- It does not restrict the choices of answers so as to bias or distort replies to be given.
- Choices to closed questions are adequate, reasonable, uni-dimensional and logically consistent.
- Each question is limited to a single idea or single reference.
- No embarrassing questions are given without providing an opportunity to explain.
- Appropriate balance between personalisation and indirect form is maintained.
- Filler questions are used wherever necessary.
- Topics and questions are arranged in a logical and psychological sequence that is natural, and easy for the respondent.
- Transition between one section and another is smooth.
- Inter-related question are so positioned as to avoid context effects.
- Questions seeking 'reasons for are based on reason analysis.
- Questions and alternative answer choices are properly coded.
- Design requirements like, spacing etc., are taken care of.
- Appropriate introduction and instructions are included.
- The instrument has been adequately pre-tested and revised so as to be a satisfactory tool for the particular survey.

5.3 Self-Assessment Questions:

Q1: Explain the construction of a questionnaire?

Q2: What do you meant by question construct?

Q3: Define instrument drafting?

Q4: Write a short note on intra drafting?

Q5: What is declarative question?

Q6: Briefly explain closed-ended question?

5.4. Summary

One of the most important tools of data collection is questionnaire. The construction of a questionnaire is, however, not an easy job. Tremendous efforts, expertise, and skills are needed to design a questionnaire. If also takes lot of time to design a good questionnaire. Results of any research more or less depend on the questions selected in a questionnaire.

Researcher must ensure that the questionnaire should enable him to get all the information required for achieving the research objectives. It must contain questions relevant to the study and does not include any irrelevant and unimportant questions. It should not contain questions that are unclear, ambiguous, non-informative, and inaccurate. Topics and questions in a questionnaire must be arranged in a logical sequence that is natural and easy for the respondent.

5.5. Glossary:

Questionnaire: It is a research instrument consisting of a series of questions for the purpose of gathering information from respondents.

Design: It is a visual look or a shape given to a certain object, in order to make it more attractive, make it more comfortable or to improve another characteristic.

Evaluation: It is a systematic determination of a subject's merit, worth and significance, using criteria governed by a set of standards.

Open-ended question: It is a question that cannot be answered with a "yes" or "no" response, or with a static response.

Closed-ended question: It refers to any question for which a researcher provides research participants with options from which to choose a response.

Declarative: A statement in the form of a declaration.

5.6 Answers to self-check questions:

Q1: Refer to 5.2.1

Q2: Refer to 5.2.2

Q3: Refer to 5.2.1

Q4: Refer to 5.2.2

Q5: Refer to 5.2.2

Q6: Refer to 5.2.2

5.7 Terminal Questions

1. What do you understand by a questionnaire? How is it constructed?
2. How can you construct questions in a questionnaire? Explain with the help of suitable examples.
3. Construct a questionnaire for studying the consumer behaviour with regards to motorcycles In India.
4. Discuss some of the characteristics of a good questionnaire.

5.8 Suggested Readings

1. T.S. Wilkinson, and P.L. Bhandarkar, "Methodology and techniques of Social Research", Himalaya Publishing House, New Delhi.
2. S.P. Gupta, *"Statistical methods"* Sultan Chand & Sons publication, New Delhi.
3. Donald S. Tull and Del S. *Hawkins, "Marketing Research - Measurement and Method',* Prentice Hall of India Pvt. Ltd., New Delhi.
4. William G. Zikmund, *"Exploring Marketing Research",* Thomson South- Western Publication, Singapore.
5. Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Delhi.

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Lesson-6
Attitude measurement & Motivation research Techniques

Structure

6.0 Introduction

One of the most difficult challenges for any researcher is to measure and take care of qualitative aspects in a research. Attitude and motivation are such qualitative aspects that pose quite a challenge to researcher. Conventional tools and methods can't measure attitude and motivation of respondents and we have to employ different tools to measure these. This lesson will describe tools that may help us in measuring attitudes and motivation. The objectives of the lesson are:

6.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- Motivation research
- Nature of motivation research
- Kinds of information sought in motivation research
- Attitude research
- Attitude and motivation research techniques
- Uses of motivation research
- Limitation of motivation research

6.2 Presentation of Contents

6.2.1 Motivation Research

Motivation Research" is a term used to describe the application of psychiatric and psychological techniques to obtain a better understanding of why people respond as they do with products, advertisements and various other situations." It was after the Second World War that the motivation research specialists appeared on the business scene suggesting the use of psychological techniques in research particularly in the field of ascertaining consumer attitudes, preferences, motives etc. Motivation research attempts to gather information buried in the unconscious mind of the consumer. The basic methods used by motivation researchers are Projective Techniques and Depth Interview.

6.2.2 Nature of motivation research

Motivational research by its very nature is different from traditional research. The biggest problem in motivational research is that direct approaches generally do not work. The researcher cannot simply go up to a consumer and ask him why he prefers one product/brand over another and expect to get a correct answer for one of the two reasons : either the consumer does not know his true reasons or he knows but is unwilling to tell them to the researchers or gives illogical reasons. Let us try to explain these situations:

(a) ***The consumer does not know the "why" of purchase***

Consumers are generally unaware of their own "true" reasons for specific brand and product selection. For instance, cigarette smokers are often extremely brand loyal. If you ask them why they prefer specific brands, they will answer without hesitation, because of the "Taste"! Unfortunately, this answer does not square with the well-documented fact that the average consumer is unable to distinguish among various same-size cigarettes. This can be tried out by putting a cover on the brand names of different brands of the cigarettes. Now these cigarettes with their brand names covered may be given to a person who boasts of having developed brand loyalty for cigarettes on the basis of taste at random, it will be extremely difficult from him to identify his own brand out of the ones supplied to him. So we can conclude that the smokers are brand loyal not to a specific taste but to a specific cigarette image or corporate image of its manufacturer. Thus, if we are interested to know why someone is brand loyal to a particular cigarette (or almost any similar product, viz. beer), we should not ask him directly. Instead of this, we must investigate his attitudes toward various brands. Thereby we can indirectly determine the images, and personality profiles of the consumers pertaining to concerned brands.

There exists another reason of consumers not knowing the true reasons for purchasing and subsequently their failure to give accurate answer to direct questioning. Regardless of the specific purchase situations, they tend to repeat the answer that has been conditioned by the advertising. The consumers can also get confused about the brand they actually bought. This happens because of the Influence of heavy product identification (generic names) with a single brand. They may consider all facial creams as "Ponds all soft drinks as "Coke", all toothpastes as "Colgate", all photocopiers as "Xerox", and so forth.

(b) ***The Consumer Will Not Tell About Their Purchase***

Another reason for incorrect answers lies in the choice made by many consumers, not to tell the correct answer even if they know it. Generally speaking, it can be assumed that a significant amount of deliberate misrepresentation will occur at any time the subject area is either morally sensitive or status-related. Thus, people tend to overestimate their income, their charitable giving, and their purchase of brand items, and they tend to underestimate their drinking, their smoking, their adultery, and their purchases of house-brand items. Respondents will, also modify their answers in an attempt to appear logical and intelligent.

6.2.3 Kinds of information Sought in Motivation Research

We need to focus attention on the whole battery of inner conditions that play a dynamic role in a person's buying or not buying responding favourably or unfavourably to some communication. The battery of inner conditions include any information which has something to do with the why part of the consumer behaviour becomes significant in the motivational research. Ail information related to perceptions, learning, ethnic relations, culture, society, personality, and group influences have to do something with motivation research Therefore, the information on the entire field of human behavior is needed for conducting motivation research. This is difficult to say which information should or should not be included for carrying out such studies. However, some of the major fields of human behavior regarding which information is commonly sought while conducting motivation research include attitudes, assumptions, sensations, images and motives.

6.2.4 Attitude Research

Attitudes are assumed as the predictors of human behavior. They represent a predisposition to respond to given stimuli. Consumers are believed to have stable sets of attitudes. These sets are different for different individual consumers. The stable set of attitudes toward a product-brand may be favorable or unfavorable.

6.2.5 Attitude and Motivation research techniques

There are four major techniques of conducting motivation research as given below.

(a) ***Non-disguised Structured Techniques:*** This approach employs a standardized questionnaire to collect data on beliefs, feelings, and attitude from the respondent. The purpose of study is explained clearly to the respondents and nothing about the purpose of study is concealed from the respondents. Three variants might be employed to collect data as explained below:

(i) ***Single-Question Method:*** This is the simplest method used to collect data on attitudes. A single question is asked with a variety of given response choices. The respondent is required to give one answer selected from various choices given to them. For example, to find out consumer's attitudes toward a given product the following question might be asked:

Which one of the following responses (statements) best describe your feelings about X brand of product?

- I like it
- I dislike it;

Or more elaborate alternative might be made available as follows:

- I think it is an excellent product.
- I think it is a very good product. .
- I think it is a good product.
- I think it is a fair product.
- I think it is a poor product.
- I think it is a very poor product.

The single-question technique has the advantage of being easy to administer and analyse. It does, however, possess serious demerits. First the subject-matter being specific, therefore, it is difficult to construct meaningful categories. For example, the responses to the general question, "How do you feel about X brand of the product?" would be difficult to interpret because the respondent gets confused on what basis the evaluation of the product should be made. The respondent answers according to his own value of system regarding the product brand and not what the researcher wants.

Finally, although respondents can be ranked relative to one-another according to the category they choose, there is no way to determine how much one person differs in terms of "favourableness" or "unfavourableness" from any other person.

(ii) ***Multi Question Methods:*** In this method a number of questions are asked about the attitudes and total score from all the questions is determined. Responses give the score or total attitude of the respondent. Generally, scales are used to conduct the research.

(iii) ***Physiological Tests:*** Various laboratory tests such as galvanic skin response, eye movement, and pupil dilation are used to measure attitudes of the people toward products. These tests, however, have got their own limitations that only qualified and experienced experts can use these tests and reach at a significant conclusion.

(b) ***Non-disguised Non-structured Techniques:*** These techniques use a non standardized questionnaire. The purpose of the study is revealed fully to the respondent. Neither the questions asked nor the answers given are predetermined. These techniques are also called depth interviews, qualitative interviews, unstructured interviews, clinical interviews, non-directive interviews, focused interviews, and cameras- action interviews. All these techniques are designed to gather information on various aspects of human behaviour including the "why" component.

This type of method can achieve its purpose to the extent that the subject's responses are spontaneous rather than focused, are highly specific and concrete rather than diffused and general, are self-revealing and personal rather than superficial. There can be a variation of this technique-the *non-directive approach.* In this approach, the respondent is motivated to reveal more and more details on the initial question like, "Tell me how you feel about-subject? The encouragement of respondent may be done by asking phrases like "Tell me more", why"? "That's interesting". The interviewer must create a friendly atmosphere during the interview so that the respondent feels absolutely free to discuss his feelings without a fear of disapproval or loss of status.

The main disadvantage of the depth interview-non-directive approach is that the data obtained is highly qualitative and ambiguous. This is because the respondent is not so articulate in his remarks and thus rambles in various unwanted directions while responding. Therefore, it is extremely difficult to interpret data by the researcher. To remove this disadvantage, a more structured approach is required to be used. Despite this limitation, the data obtained from the non-directive approach can be used as source for hypothesis development.

(c) ***Disguised Non-Structured Techniques.*** In this case, the purpose of study is not revealed. A list of unstructured questions is used to collect data on consumer's attitudes. The purpose of the research is disguised, this is done because many a consumer either does not know or they are unwilling to reveal or express the reasons of their product purchase. If at all they are asked directly, the answers are illogical and misleading. In order to get the true information on the subject under study, indirect questions are asked from the respondents. This art of using disguised and unstructured method is referred to as *projective techniques.* The projective techniques include several tests given to the respondents. They may be asked to give their comments on cartoons, pictures, stories, etc. This is method which compels a respondent to protect himself on the "why" part of his behaviour while associating words, completing sentences, or completing incomplete stories. The respondent has his own choice to interpret the given thing. There are unlimited alternatives available to him for expressing his inner feelings on the subject. The stimuli used for this purpose are capable of arousing the respondent to a variety of reactions.

A number of projective techniques are available to the researchers for the purpose of analyzing "why" part of consumer behaviour. The main projective techniques are:

(i) **Word Association Test (W.A.T**): The interviewer calls a series of listed words one by one and the respondent quickly replies with the first word that enters his mind. For instance, the question asked may be: What is the first word that enters your mind for each of these products: coal, beer, crystal, and wool? If the respondent answers were strike, belch, break, and itch, then those products may be facing some image problems that need to be addressed in their advertising.

The researcher is required to prepare a list of "stimulating" and "neutral" words. What stimulating words should be included depends upon the purpose of study. There are several variations to the simple test situation. For example, the respondent may be asked to give not only the first word that comes to mind, but the first three or four. Variations of this technique may be run as controlled tests as contrasted to free associations. For example, respondent may be asked, what brand of cake mix comes to your mind first when I mention soft and fluffy clothes? The words obtained as responses are analysed by arranging them into favourable/unfavourable, or pleasant/unpleasant categories.

(ii) **Sentence Completion:** Sentence completion test is similar to word association test except that the respondent is required to complete an unfinished sentence. For example, "I do not use shampoos because", "A man who uses shampoos is ...' "Brand X of shampoo is liked by ", " Shampoo as a hair wash appeals to…..".

These are the few unfinished sentences taken from study conducted to know people's attitudes toward various brands of shampoo. The respondent is asked to complete such sentences. By doing so, he projects himself not only in an unfinished sentence but also into the person of someone else. By answering for someone else, he can reveal things which he feels embarrassed if asked directly for himself. For example, a person may say that persons who use shampoos are rich. But, if he asked why he does not use shampoos directly, he may say it is meant for ladies but actual reason may be the poverty that he cannot afford shampoos for daily use. But he does not reveal this as the real cause if asked directly. On the other hand, when asked' to complete a sentence he says that rich people use- shampoos, which can be interpreted that the respondent himself is poor.

If asked directly "Are you afraid of flying". The respondent may say boldly "no". But if asked in the form of an unfinished sentence like "Most people do not prefer flying because", the answer may be "because they are afraid of flying." It can be easily interpreted that the person (respondent) is afraid of flying himself.

Thus the hidden motives of peoples get projected in the completion of unfinished sentences. If the sentences are chosen with utmost care then a large amount of valuable information on a person's motives can be gathered through sentence completion technique.

(iii) ***Story Completion:*** In this technique the respondent is asked to complete a story, end of which is missing. The respondent in this case is provided with an unfinished (in complete) story which is enough to draw attention to a specific issue but not sufficient enough to indicate the ending remarks. The respondent is asked to provide the end of the story. For example, we may consider the following story:

Anil and Ashok purchased a 'Bullet' motorcycle. After 10,000 kilometers the transmission began knocking violently. The mechanic at the local filling station said that it sounded like the whole transmission was about to give out. Anil and Ashok took the motorcycle to the dealer from whom they had bought it and

In this case an attempt is made to extract out information on buyer's attitude toward a specific make of motorcycle and warranties in general. The buyer will vigorously express his attitude while completing an incomplete story. Such attitudes, however, will not be expressed by the same buyer in such vigorous and frank manner if asked directly. This is the most significant reason that there is a great application of story' completion test in research problems. We are able to find out the almost exact version of images and feelings of people toward a company's product. This helps in finalizing the advertising and promotional themes for the product in question.

(iv) ***Error-Choice Tests:*** This test consists of a statement or series of statements that have a scaled groups of answers from which the respondent makes his choice. Hopefully, the respondent is unaware of the normal answer, which usually rests towards the middle of the scale. His attitude will be revealed by where he picks his response. The chief advantages of this test are the simplicity of administration and.

(v) ***Paired Pictures Test:*** In this technique paired pictures are used. For example, one picture shows a woman opening a popularly priced refrigerator of another brand. After showing the picture, the respondents are required to tell any story which comes to their minds about these pictures and are asked their opinion of the women opening the refrigerator. As the paired pictures are similar, the presumption here is that the difference in interpretation of the pictures is occasioned by the different attitudes they have towards the two refrigerators.

(vi) ***Rosenwieg Picture Frustration Test:*** In this test a respondent is shown a cartoon-type drawing or picture, usually involving two characters. One of the caption balloons is completed but the other is kept blank. The respondent is asked to fill the blank balloon.

(vii) ***Thematic Apperception Test (TAT):*** In the Thematic Apperception Test {TAT), balloons are not provided but the frustration cartoons are shown to the respondent. The respondent is asked to interpret the situation with regards to a particular product, company, or other business phenomenon. With the knowledge of respondent's appreciation regarding the product, the seller is able to programme his/her selling and promotional strategies.

(viii) ***Psychographic Technique*****:** The psychographic techniques include galvanic skin response, eye movement, pupil dilation, eye blink test, etc. Various equipments used to measure these physiological responses of respondent are: inelegant, unscientific and even unethical, yet they are only ways to extract information in certain circumstances.

(ix) ***Espionage Technique:*** There are two main methods adopted to conduct espionage for research. These are (i) use of hidden recorders, and (ii) rubbish research. Hidden recorder technique makes use of hidden tape recorders, hidden cameras, and hidden observers to watch consumers as they purchase and consume items. The- hidden recorders may be put in shops or, and houses depending upon the information needed. Rubbish research is another method of espionage activity. Here, the researcher shifts through the garbage of individuals or groups and record pattern of consumption, waste, and brand preference. Although the rubbish research look blatantly awkward and ridiculous yet it given most required estimates of consumption of products, viz. liquor, cigarettes, medicine, drugs, hygiene products, contraceptive products, sex-related products, magazines, and so on.

(d) ***Disguised Structured Techniques:*** When we are to measure those attitudes which respondents might not readily and accurately express, we can use disguised structured techniques. The disguised structured questionnaires are easy to administer and code. Respondents are given questions which they are not likely to be able to answer accurately. In such circumstances they are compelled to "guess at" the answers. The respondent's attitudes on the subject are assumed to be revealed to the extent and direction in which these guessing errors are committed.

For example, we can use this technique to measure attitudes toward management labour relations. One part of this test can consist of giving the respondent two alternative answers to question; in these questions each alternative may be equally wrong, but in the opposite direction from the right answer. For example, we can give one of such questions as "Average wage of workers in the pre-independence period was (i) Rs.2, (ii) Rs. 5? " It can be assumed here that a few people know the correct answer. Also that pro-management respondents will give the high figure whereas others will quote low figures.

6.2.6 Uses of Motivation Research

Knowledge and measurement of the true attitude of customers help in choosing the best selling appeal for the product and the best way to represent the product in the sales talk, and in determining the appropriateness and weightage of various promotional methods.

Motivation research leads to useful insights and provides inspiration to creative person in the advertising and packing world. They may be able to create more effective appeals aimed at the private world of customers, hopes, dreams and fears rather than merely economic or rational appeals.

Strategies to position the offer of the company in a particular market segment should be based on the findings of motivation research.

6.2.7 Limitations of Motivation Research

There are many limitations of motivation researches. Some of them are as under:

(i) Cautions are required to be exercised not only in the application of these techniques but also the resultant data should be analysed and interpreted according to the psychological theory.

(ii) Originally these techniques were developed to collect data from a single individual over a period of time. It is not free from drawbacks while we apply these techniques to gather data from a number of individuals.

(iii) The designing and administering of these techniques need qualified and experienced researchers. Such personnel are hardly available.

(iv) Generally, small samples are taken for conducting motivation research; generalizations if drawn on this basis are misleading.

Despite these limitations, the motivation research has become a very significant part of business research. More and more researchers are making use of motivation techniques for research. It is expected that motivation research techniques will widely be used in the coming decades and help to solve the time-old problem of managers that why consumers behave as they do. It may be predicted that motivation research techniques would be comparatively used more than any other research technique.

6.3 Self-Assessment Questions:

Q1: Explain motivation research?

Q2: What do you meant by attitude research?

Q3: What the limitations of motivation research?

Q4: What is the nature of motivation research?

Q5: Discuss the uses of motivation research?

Q6: What is the full form of WAT?

6.4 Summary

Motivation research attempts to gather information buried in the unconscious mind of the consumer. All information related to perceptions, learning, ethnic relations, culture, society, personality, and group influences have to do something with motivation research. Therefore, the information on the entire field of human behavior is needed for conducting motivation research.

Attitudes are assumed as the predictors of human behavior. They represent a predisposition to respond to given stimuli. Consumers are believed to have stable sets of attitudes. These sets are different for different individual consumers.

There are four major types of methods of motivational measurement researches namely non-disguised structured; non-disguised unstructured; disguised structured; and disguised unstructured.

6.5 Glossary:

Attitude: It is a psychological construct, a mental and emotional entity that inheres in, or characterizes a person.

Research: It is creative and systematic work undertaken to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications.

Motivation research: It is a type of marketing research that attempts to explain why consumers behave as they do.

Espionage: The practice of spying or of using spies, typically by governments to obtain political and military information.

Paired: Occurring in pairs or as a pair.

6.6 Answers to self-check questions:

Q1: Refer to 6.2.1

Q2: Refer to 6.2.4

Q3: Refer to 6.2.7

Q4: Refer to 6.2.2

Q5: Refer to 6.2.6

Q6: (WAT) Word Association Test.

6.7 Terminal Questions:

1. What do you understand by the term motivation research? Explain with suitable examples.
2. What techniques can be used to carry out motivation research?
3. Define motivation research. Highlight the nature, scope, uses, and limitations of motivation research.
4. State and explain the major motivation research techniques.

5. Write short notes on the following ;

   (i) Motives.

   (ii) Attitudes.

   (iii) Sensations.

   (iv) Thematic apperception Tests (TAT)

   (v) Sentence completion Test.

6.8 Suggested Readings

1. T.S. Wilkinson, and P.L. Bhandarkar, "Methodology and techniques of Social Research", Himalaya Publishing House, New Delhi
2. S.P. Gupta, *"Statistical methods"* Sultan Chand & Sons publication, New Delhi
3. Donald S. Tull and Del S. Hawkins, *"Marketing Research - Measurement and Method',* Prentice Hall of India Pvt. Ltd., New Delhi.
4. William G. Zikmund, *"Exploring Marketing Research",* Thomson South-Western Publication, Singapore.
5. Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Delhi.

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Lesson - 7
Sampling and Sample Design

Structure

7.0 Introduction

Data collection stage of any research requires considerable time, effort, and money. If primary data are collected using census method, time and cost increases considerably. Sampling techniques help us in this situation. A true representative sample not only gives accurate results but also saves on time, effort, and money. This" lesson is devoted to sampling methods and techniques. The objectives of the lesson are as follows:

7.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- Introduction to Sampling
- Essentials of sampling
- Merits of sampling
- Limitation of sampling
- Non-probability sampling methods
- Probability sampling methods

7.2 Presentation of Contents

7.2.1 Introduction to Sampling

Statistical data may be collected by complete enumeration called census inquiry or by partial enumeration called sample inquiry. In the former case the information is collected about each and every item comprising the whole (called universe or population in statistical parlance), while in the later case information is collected about a small number of items which are representative of the whole so as to form an estimate of the characteristics of the whole. If such a sample is adequate representative of the whole, is properly drawn and interpreted, then it is most likely to represent the conditions of the whole and can be fairly relied upon as if the observations had been based on complete enumeration. For example, in the field of business while the accounting results are based on complete compilation of business transactions, test checks or test audits cover only a small number of entries to verify the truth of all the entries.

While taking a sample, the population is assumed to be composed of individual units or members, some of which are included in the sample. The total number of members of the population and the number included in the sample are called population size and 'sample size' respectively. A statistical population is called 'finite' or 'infinite' according to its size. When the number of members of the population can be expressed as a definite quantity the population is said to be 'finite'. Otherwise the population is 'infinite'. In particular, if a sample is known to have been drawn from a continuous probability distribution, then the population is infinite. Also the population may be 'existent' or 'hypothetical'.

The primary object of sampling is to obtain the maximum information about the population with the minimum effort, and also to set out the limits of accuracy of estimates based on sampling.

7.2.2 Essentials of Sampling

If the sample results are to have any worthwhile meaning, it is necessary that a sample possesses the following essentials characteristics:

(i) **Representativeness:** A sample should be so selected that it truly represents the universe otherwise the results obtained may be misleading. To ensure representativeness, the random method of selection should be used.

(ii) **Adequacy:** The size of sample should be adequate; .otherwise it may not represent the characteristics of the universe.

(iii) **Independence:** All items of the sample should be selected independently of one another and all items of the universe should have the same chance of being selected in the sample. By independence of selection we mean that the selection of a particular item in one draw has influence on the probabilities of selection in any other draw.

(iv) **Homogeneity:** When we talk of homogeneity we mean that there is no basic difference in the nature of units of the universe and that of the sample. If two samples from the same universe are taken, they should give more or less the same unit.

7.2.3 Merits of. Sampling

(i) **Less time-consuming:** Since the sample is a study of a part of the population, considerable time and labour are saved when sample survey is carried out. Time is saved not only in collecting data but also in processing it. For these reasons a sample provides more timely data in practice than a census.

(ii) **Less cost:** Although the amount of effort and expense involved in collecting information is always greater per unit of the sample than a complete census, the total financial burden of a sample survey is generally less than that of a complete census. This is because of the fact that in sampling, we study only a part of population and the total expense of collecting data is less than that required when the census method is adopted. This is a great advantage particularly in an underdeveloped economy where much of the information would be difficult to collect by the census method for lack of adequate resources.

(iii) More reliable results: Although the sampling technique involves certain inaccuracies owing to sampling errors, the result obtained is generally more reliable than that obtained from a complete count.

There are several reasons for it. First, it is always possible to determine the extent of sampling errors. Secondly, other types of errors to which a survey is subject, such as inaccuracy of information, incompleteness of returns, etc., are likely to be more serious in a complete census than in a sample survey. This is because more effective precautions can be taken in a sample survey to ensure that information js accurate and complete. For these reasons not only the total error made be expected to be smaller in a sample survey but sample result can also be used with a greater degree of confidence because of our knowledge of the probable size of error. Thirdly, it is possible to avail of the services of experts and to impart thorough training to the investigators in a sample survey which further reduces the possibility of errors. Follow-up work can also be undertaken much more effectively in one sampling method. Indeed, even a complete census can only be tested for accuracy by some type of sampling check.

(iv) Only method sometimes - Sampling method is the oniy method that can be used in certain cases. There are some cases in which the census method is inapplicable and the. only practicable means is provided by the sample method. For example, if one is interested in testing the breaking strength of chalks manufactured in a factory under the census method all the chalks would be broken in the process of testing. Hence, census method is impracticable and the sample method has to be used. Similarly, if the producer wants to find out whether the tensile strength of a. lot of steel wires meets the specified standard, he must resort to sample method because census would mean complete destruction of all the wires. Also if the population under investigation is infinite, sampling is the only possible solution.

7.2.4 Limitations of Sampling

Despite various advantages of sampling, it Is not completely free from limitations. Some of the difficulties involved in sampling are stated below:

(i) A sample survey must be carefully planned and executed otherwise the results obtained may be inaccurate and misleading. Even if a complete count care is taken still serious errors ‘may arise in sampling, if the sampling’ procedure is not perfect.

(ii) Sampling generally requires the services of experts, even only for consultation purposes, in the absence of qualified and experienced persons, the information obtained from sample surveys cannot be relied upon. In India, shortage of experts in the sampling field is a serious hurdle in the way of reliable statistics.

(iii) At times the sampling plan may be so complicated that it requires more time, labour and money than a complete count. This is so if the size of the sample is a large proportion of the total population and if complicated weighted procedures are used-. With each additional complication in the survey, the chances of error multiply and greater care has to be taken which, in turn, means more time and labour.

7.2.5 Non-probability Sampling Methods

Non-probability sampling methods are those which do not provide every item in the universe with a known chance of being included in the sample. The selection process is at least partially subjective. The following methods are generally categorised as non-probability sampling methods:

(A) Deliberate. Purposive or Judgment sampling: It is a method under which items for the samples are selected generally on certain predetermined criteria. The fixation of criteria and deliberate choice of sampling units may bring in personal element and introduce bias. The selection of items would differ from person to person, at times by personal fancy and judgment of the individual determining the sample. This method is generally used and considered appropriate in small inquiries and researches by individuals, especially when they are familiar with almost all terms of universe. Inferences drawn under this method are not amenable to statistical treatment.

Merits: Though the principles of sampling theory are not applicable to judgment sampling, the method is sometimes used in solving many types of economic and business problems. The use of judgment sampling is justified-under a variety of circumstances:

(i) When only a small number of sampling units are in the universe, simple random selection may miss the more important elements, whereas judgment selection would certainly include them in the sample.

(ii) When we want to study some unknown traits of a population, some of whose characteristics are known, we may then stratify the population according to these known properties and select sampling units from each stratum on the basis of judgment. This method is used to obtain a more representative sample.

(iii) In solving everyday business problems and making public policy decisions, executives and public officials are often pressed for time and cannot wait for probability sample designs. Judgment sampling is then the only practical method to arrive at solutions to their urgent problems.

⇒ **Limitations:** (i) This method is not scientific because the population units to be sampled may be affected by the personal prejudice or bias of the investigator. Thus judgment sampling involves the risk that the investigator may establish foregone conclusions by including those items in the sample which conform to his preconceived notions. For example, if an investigator holds the view that the wages of workers in a certain establishment are very low, and if he adopts the judgment sampling method, he may include only those workers in the sample whose wages are low and thereby establish his point of view which may be far from the truth. Since an element of subjectiveness is possible, this method cannot be recommended for general use.

(ii) There is no technique of evaluating the reliability of sample results.

The success of this method-depends upon the excellence in judgment. If the individual making decisions is knowledgeable about the population and has good judgment, then the resulting sample may be representative, otherwise the inferences based on the sample may be erroneous. It may be noted that even if a judgment, sample is reasonably representative, there is no objective method for determining the size or likelihood of sampling error. This is a big defect of the method.

(B) Quota Sampling : It is that method in which each person engaged in the primary collection of data is assigned a certain quota of investigations. The actual selection of items for the sample is left to the investigator's discretion. This method is convenient and is relatively inexpensive but this allows some bias to enter into the inquiry; Inferences drawn using this method are not amenable to statistical treatment in a formal way.

Quota sampling and stratified random sampling are similar in as much as in both methods the universe is divided into parts and the total sample is allocated among the parts. However, the two procedures diverge radically. In stratified random sampling the sample within each stratum is chosen at random. In quota sampling, the sampling within each cell is not done at random and the field representatives are given wide latitude in the selection of respondents to meet their quotas.

Quota sampling is often used in public opinion studies. It occasionally provides satisfactory results if the interviewers are carefully trained and if they follow their instructions closely. It is often found that since the choice of respondents within a cell is left to the field representatives, the more accessible and articulate people within a cell will usually be the ones who are interviewed. Slight negligence on the part of interviewers may lead to interviewing ineligible respondents. Even with alert and conscientious field representatives it is often difficult to determine such control category as age, income, educational qualifications, etc.

(C) Block or cluster sampling It is used when there is unequal concentration of individual units in the universe. Under this method certain blocks or clusters of higher concentration are selected for complete inquiry. Clusters and not 'individual elements' are selected but all elements in a selected cluster are studied. This method makes the sampling procedure relatively easier, and may increase the efficiency of field work.

(D) Area Sampling It is closer to cluster sampling. Under area sampling the total geographical area (when it happens to be a big one) is divided into a number of smaller non-overlapping areas and then some of the smaller areas are selected and all units of the selected areas constitute the sample. This method generally, makes field interviewing efficient and is suited in inquiries to be conducted over a large area, when the list of population concerned is not available.

(E) Convenience Sampling A convenience sample is obtained by selecting 'convenient' population units. The method of convenience sampling is also called the 'chunk'. A chunk refers to that fraction of the population being investigated which is selected neither by probability nor by judgment but by convenience. A sample' obtained from readily available lists such as automobile registrations; telephone directories, etc., is a convenience sample and not a random sample even if the sample is drawn at random from the lists. If a person is to submit a project report on, labour management relations in textile industry and he takes a textile mill close to his office and interviews some people over there, he is following the convenience sampling method. Convenience samples are prone to bias by their very nature. Selecting population elements which are convenient to choose almost always make them special or different from the best of the elements in the population in some way.

Hence the results obtained by following convenience sampling method can hardly be representative of the population. They are generally biased and unsatisfactory. However, convenience sampling is often used for making pilot studies. Questions may be tested and preliminary information may be obtained by the chunk before the final sampling design is decided upon.

⇒ Merits of Non-probability Sampling:

(i) The methods require lesser level of skill and experience.

(ii) This does not require more amount of time and much money to execute.

(iii) It is based on personal judgment so that it can be easily changed to suit the situation.

7.2.6 Probability Sampling Methods

Probability sampling methods are those in which every item in the universe has a known chance, or probability, of being chosen for the sample. This implies that the selection of sample items is independent of the person making the study, that is, the sampling operation is controlled so objectively that the items will be chosen strictly at random.

(a) Simple Random Sampling: This is a method of sampling in which each unit of the population has exactly the same chance of being included in the sample. Under it, it is the chance alone that determines whether one item or the other is selected. There can be several ways, of selecting items for the sample under random sampling designs but most frequently, items are selected with the help of random number tables. The results obtained under this method can be assessed in terms of probability, i.e., errors of estimation can be measured. This method ensures the law of statistical regularity and generally gives representative sample without selector's bias. In short this method provides an objective basis for selection.

(b) Random sampling is of two types: Random sampling with replacement, and random sampling without replacement. In first type, the same unit of population may occur more than once; and in the second, the same population unit cannot come more than once in the sample.

⇒ Merits

- Since the selection of items in the sample depends entirely on chance, there is no possibility of personal bias affecting the results.
- As compared to judgment sampling a random sample represents the universe in a better way. As the size of the sample increases, it becomes increasingly representative of the population.
- The analyst can easily assess the accuracy of his estimate because sampling errors follow the principles of chance. The theory of random sampling is further developed than that of any other type of sampling which enables the analyst to provide the most reliable information at the least cost.

⇒ Limitations

- The use of simple random sampling necessitates a completely catalogued universe from which to draw the sample. But it is often difficult for the investigator to have up-to-date lists of all the items of the population to be sampled. This restricts the use of this method in economic and business data where very often we have to employ restricted random sampling designs.
- The size of the sample required to ensure statistical reliability is usually larger under random sampling than stratified sampling.
- From the point of view of field survey it has been claimed that cases selected by random sampling tend to be too widely dispersed geographically and that the time and cost of collecting data become too large.
- Random sampling may produce the most non-random-looking results. For example, thirteen cards from a well-shuffled pack of playing cards may consist of one suit. But the probability of this type of occurrence is very low.

(c) Stratified Sampling: When the population is not homogeneous with respect to a character under study, we divide the population into a number of homogeneous groups (called Strata), which differ in that character from one another but each group is homogeneous within itself. Then units are sampled at random from each of these stratum, the sample size in each stratum, varies according to the relative importance of the stratum in the population. The sample which is the aggregate of the sampled units of each of the stratum is called a Stratified Sample and this technique is called Stratified Sampling.

Such a sample can be considered as the representative of the population from which it has been drawn. The main purposes of stratification are:

(i) to ensure that all sections of the population are adequately represented;

(ii) to avoid a large size of the population;

(iii) to avoid the heterogeneity of the population;

(iv) to bring gain in precision of the estimates obtained.

⇒ **Merits: (i) More representative** Since the population is first divided into various strata and then a sample is drawn from each stratum there is a little possibility of any essential group of the population being completely excluded. A more representative sample is thus secured. It has been rightly pointed out that this type of sampling balances the uncertainty of random sampling against the bias of deliberate selection.

(ii) Greater accuracy - Stratified sampling ensures greater accuracy. The accuracy is maximum if each stratum is so formed that it consists of uniform or homogeneous items.

(iii) Greater geographical concentration: As compared to random sample, stratified samples can be more concentrated geographically, i.e., the units from the different strata may be selected in such a way that all of them are localised in one geographical area. This would greatly reduce the time and expenses of interviewing.

⇒ **Limitations:**

(i) Utmost care must be exercised in dividing the population into various strata. Each stratum must contain, as far as possible, homogeneous items otherwise the results may not be reliable. If proper stratification of the population is not done, the sample may have the effect of bias.

(ii) The items from each stratum should be selected at random. But this may be difficult to achieve in the absence of skilled sampling supervisors and-a random selection within each stratum may not be ensured.

(iii) Because of the likelihood that a stratified sample will be more widely distributed geographically than a simple random sample, cost per observation may be quite high.

3. Systematic sampling involves the selection of sample units at equal intervals, after all the units in the population have been arranged in some order. If the population size is finite, the units may be serially numbered and arranged in order. From the list of these, a single unit is chosen at random. This unit and every k-th unit thereafter constitute a Systematic Sample. In order to obtain a systematic sample of 100 villages out of 10,000, i.e., one out of 100 on an average, all the villages have to be numbered serially. From the first 100 of these, a village is selected at random, suppose with the serial number 5. Then the villages with serial numbers 5,105,205,305, constitute the systematic sample.

⇒ **Merits:** The systematic sampling design is simple and convenient to adopt. The time and work involved in sampling by this method are relatively less. The results obtained are also found to be generally satisfactory provided care is taken to see that there are no periodic features associated with the sampling interval. If populations are sufficiently large, systematic sampling can often be expected to yield results similar to those obtained by proportional stratified sampling.

⇒ **Limitations:** The main limitation of the method is that it becomes less representative if we are dealing with populations having "hidden periodicities". Also if the population is ordered in a systematic way with respect to the characteristics the investigator is interested in, then it is possible that only certain types of items will be included in the population, or at least more of certain types than others. For instance, in a study of workers wages, list may be such that every tenth worker on the list gets wages above Rs. 750 per month.

(e) Multi-stage sampling refers to a sampling procedure which is carried out in several stages. The population is first divided into large groups, called first-stage units. These first-stage units are again divided into smaller units, called second-stage units the second-stage units into third-stage units, and so on, until we reach the ultimate units, e.g., in a survey of rural debt in India, one may like to apply a sampling technique for selection of districts; then villages; then household, and so on.

⇒ **Merits:** Multi-stage sampling introduces flexibility in the sampling method which is lacking in the other methods, it enables existing divisions and sub-divisions of the population to be used as units at various stages, and permits the field work to be concentrated and yet large area can be covered. Another advantage of the method is that subdivision into second stage units (i.e., the construction of the second stage frame) need be carried out for only those first stage units which are included in the sample. It is, therefore, particularly variable in surveys of under-developed areas where no frame is generally sufficiently detailed and accurate for subdivision of the material into reasonably small sampling units.

⇒ **Limitations:** However, a multi-stage sample is in general less accurate than a sample containing the same number of final stage units which have been selected by some suitable single stage process.

Merits of probability sampling:

(i) Since the sample is objective and unbiased, it is defensible before the superiors or even before the courts of law.

(ii) The size of the sample does not depend upon the expediency or mere tradition but on demonstrable statistical method and therefore, has a justification for the expenditure involved.

(iii) The degree of deviation from the parameter i.e., the statistical measures based on the population can be estimated and evaluated in terms of certain degree of precision required.

(iv) It provides a more accurate method of drawing conclusion about the characteristics of the population expressed as parameters. Even when qualified persons are not available, it provides an objective basis for selection.

(v) The sample may be combined and evaluated, even though accomplished by different individuals.

(vi) The results obtained can be assessed in terms of probability, and the sample accepted or rejected on a consideration of the extent to which it can be considered representative.

7.2.7 Limitations of Probability sampling Methods

Despite the great advantages of probability sampling techniques mentioned above it has certain limitations because of which non-probability sampling is quite often used in practice. These limitations are:

(i) Probability sampling requires a very high level of skill and experience for its use.

(ii) It requires a lot of time to plan and execute a probability sample.

(iii) The costs involved in probability sampling are generally large as compared to non-probability sampling.

7.3 Self-Assessment Questions:

Q1: What is sampling?

Q2: What are the merits of sampling?

Q3: Discuss the limitations of sampling?

Q4: Briefly explain the probability sampling methods?

Q5: What are the essential characteristics of sampling?

Q6: Explain non-probability sampling methods?

7.4 Summary

A true representative sample not only gives accurate results but also saves on time, effort, and money. Actually, if primary data are collected using census method, time and cost increases considerably. Sampling techniques help us in this situation.

Sampling method is the only method that can be used in certain cases. There are some cases in which the census method is inapplicable and the only practicable means is provided by the sample method. For example, if one is interested in testing tfje breaking strength of chalks manufactured in a factory under the census method all the chalks would be broken in the process of testing.

Despite various advantages of sampling, it is not completely free from limitations. A sample survey must be carefully planned and executed otherwise the results obtained may be inaccurate and misleading. Even if a complete count care is taken still serious errors may arise in sampling, if the sampling procedure is not perfect. Sampling generally requires the services of experts, even only for consultation purposes. In the absence of qualified and experienced persons, the information obtained from sample surveys cannot be relied upon. In India, shortage of experts in the sampling field is a serious hurdle in the way of reliable statistics.

Sampling techniques may be classified into two broad categories namely probability and non-probability sampling. Non-probability sampling methods are those which do not provide every item in the universe with a known chance of being included in the sample. These include purposive, judgment, quota, cluster and convenience sampling techniques. Probability sampling include simple random, stratified, systematic, and multistage sampling etc. Each of the methods has its own advantages and limitations.

7.5 Glossary:

Sampling: It is a process used in statistical analysis in which a predetermined number of observations are taken from a larger population.

Sample design: It is a mathematical function that gives you the probability of any given sample being drawn.

Homogeneity: The quality or state of being all the same or all of the same kind.

Non-probability: It is a sampling technique where the samples are gathered in a process that does not give all the individuals in the population equal chances of being selected.

Deliberate: It means slow and measured, the pace of this kind of careful decision making.

Cluster: A group of similar things or people positioned or occurring closely together.

Stratified: It is a method of sampling from a population which can be partitioned into subpopulations.

7.6 Answer to self-check questions:

Q1: Refer to 7.2.1

Q2: Refer to 7.2.3

Q3: Refer to 7.2.4

Q4: Refer to 7.2.6

Q5: Refer to 7.2.2

Q6: Refer to 7.2.6

7.7 Terminal Questions

1. "Sampling is necessary under certain conditions". Explain this with suitable examples.
2. Critically examine the various probability sampling methods.
3. What are the methods of sampling? How do you select a sample in an audit of accounts?
4. Distinguish between random sampling, purposive sampling and stratified sampling. How is a random sample obtained?
5. What is sampling? Point out the merits and demerits of sampling techniques.
6. Do you agree 'with' the view that random sampling is synonymous with haphazard sampling?
7. State the merits and limitations of simple random sampling.
8. Point out the role and limitations of sampling.

7.8 Suggested Readings

1. S.P. Gupta, *"Statistical methods"* Sultan Chand & Sons publication, New Delhi.
2. S.P. Gupta and M.P. Gupta, *"Business Statistics"* Sultan Chand & Sons publication, New Delhi.
3. Donald S. Tull and Del S. Hawkins,"*Marketing Research - Measurement and Method*", Prentice Hall of India Pvt. Ltd., New Delhi.
4. William G. Zikmund, *"Exploring Marketing Research",* Thomson South- Western Publication, Singapore.
5. Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Deihi.

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Lesson - 8
Field Work, Data Collection, and Tabulation

Structure

8.0 Introduction

In most of the researches, data have to be gathered by field work. This task is not very easy and one has to be very careful while collecting data. Many biases or problems may creep in if the care is not taken while collecting data. Gathered data, then have to classified, codified and tabulated. Without putting into tables, it is difficult to analyse and interpret data. This lesson focuses on these important aspects namely field work, data collection, and tabulation. The major objectives of this lesson are:

8.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- Nature of field work
- Data preparation process
- Tabulation

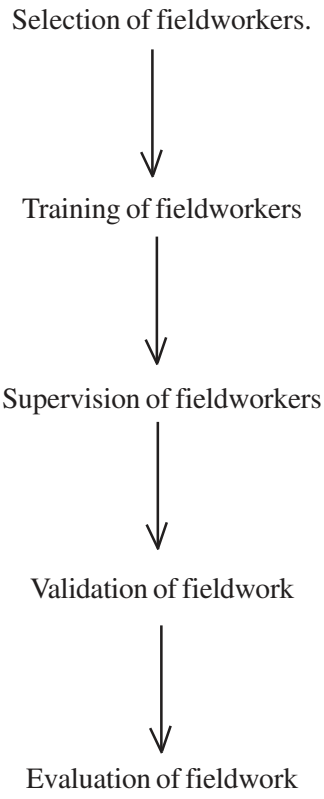
8.2 Presentation of Contents

Managers take decisions on the basis of available information or data. Raw data may be available to managers in scattered form. Unless data are properly collected, analysed and presented, it may not be useful for decision making. Raw data may not be easily comprehensible, and it becomes essential to classify and present them in a meaningful manner. For example, a sales manager may find it difficult to identify the sales pattern by merely looking through the invoices issued during a certain period. However, if this information is properly organized, classified, and presented, the sales manager's task will become easier.

8.2.1 Nature of fieldwork

Research data are rarely collected by the persons who design the research. Researchers have two major options-for collecting their data. They can develop their own organizations or they can contact with a fieldwork agency, in either case, data collection involves the use of some kind of field force. The field force may operate either in the field or from an office (telephone, mail, e-mail, and Internet surveys). The field workers who collect the data typically have little research background or training.

All field work involves the selection, training, and supervision of persons who collect data. The validation of fieldwork and the evaluation of field workers are also part of the process. Figure given below represents a general framework for the fieldwork/data collection process.



It should be recognized that the nature of fieldwork varies with the mode of data collection, and the relative emphasis on the different steps will be different for telephone, personal, mail and electronic interviews.

(i) Selection of field workers:

The first step in the field work process is the selection of field workers. The researcher should: (1) develop job specifications for the project, taking into account the mode of data collection; (2) decide what characteristics the field workers should have; and (3) recruit appropriate individuals. Interviewers' background characteristics, opinions, perceptions, expectations, and attitudes can affect the responses they elicit.

In a survey dealing with emotional well-being and mental health, older interviewers got better cooperation from respondents than younger interviewers. However, this performance appeared to be independent of years of experience. In USA, differences in non response rates also appeared between black and white interviewers. Black interviewers produced higher non-response rates with white respondents than did white interviewers. The more the interviewer and the respondent had in common, the greater the cooperation and the better the quality of the data.

Thus, to the extent possible, interviewers or field staff should be selected to match respondents' characteristics. The job requirements will also vary with the nature of the problem and the type of data-collection method. However, there are some general qualifications of field workers:

- Healthy - Fieldwork can be strenuous and the workers must have the stamina required to do the job.
- Outgoing - The interviewer should be able to establish rapport with the respondents. They should be able to relate to strangers.
- Communicative - Effective speaking and listening skills are a great assets.
- Pleasant appearance - If the field worker's physical appearance is unpleasant or unusual, the data collected may be biased,
- Educated - interviewers must have good reading and writing skills. A majority of fieldwork agencies require a high school education and many prefer some college education.
- Experienced - Experienced interviewers are likely to do a better job in following instructions, obtaining respondent cooperation, and conducting the interview.

(ii) Training of field workers

Training of field workers is critical to the quality of data collected. Training may be conducted in person at a central location or, if the interviewers are geographically dispersed, by mail. Training ensures that all interviewers administer the questionnaire in the same manner so that the data can be collected uniformly. Training should cover making the initial contact, asking the questions, probing, recording the answers, and terminating the interview.

Even a slight change in the wording, sequence, or manner in which a question is asked can distort its meaning and bias the response. Asking questions is an art. Training in asking questions can yield high dividends in eliminating potential sources of bias. Changing the phrasing or order of questions during the interview can make significant differences in the response obtained. "While we could be faulted for not writing as perfect a questionnaire as we possibly could, still it must be asked in the exact way it was written. It was written, it's a challenge for us to try to get the interviewers more conversational, but despite this, the field force absolutely must ask questions as they are written. The following are guidelines for asking questions:

1. Be thoroughly familiar with the questionnaire.
2. Ask the question in the order in which they appear in the questionnaire.
3. Use the exact wording given in the questionnaire.
4. Read each question slowly.
5. Repeat questions that are not understood.
6. Ask every applicable question.
7. Follow instructions and skip patterns, probing carefully.

Although recording respondent answers seems simple, several mistakes are common. All interviewers should use the same format and conventions to record the interview and edit completed interviews. Although the rules for recoding answers to structured questions vary with each specific questionnaire, the general rule is to check the box that reflects the respondent's answer. The following specific guidelines for recoding answers may help:

1. Record responses during the interview.
2. Use the respondent own words
3. Do not summarize or paraphrase the respondents' answers.
4. Include everything that pertains to the question objectives.

5. Include all probes and comments.
6. Repeat the response as it is written down.

(iii) Supervision of field workers

Supervision of field workers means making sure that they are following the procedures and techniques in which they were trained. Supervision involves quality control and editing, sampling control, control of cheating, and central office control.

• ***Quality Control and Editing***

Quality control of field workers requires checking to see if the field procedures are being properly implemented, if any problems are detected, the supervisor should discuss them with the field workers and provide additional training, if necessary. To understand the interviewer's problems, the supervisors should also do some interviewing. Supervisors should collect questionnaires and other forms and edit them daily. They should examine the questionnaires to make sure all appropriate questions have been completed, unsatisfactory or incomplete answers have not been accepted, and the writing is legible.

• ***Sampling control***

An important aspect of supervision is sampling control, which attempts to ensure that the interviewers are strictly following the sampling plan rather than selecting sampling units based on convenience or accessibility. Interviewers tend to avoid dwellings or sampling units that they perceive as difficult or undesirable. If the sampling unit is not at home, the interviewers may be tempted to substitute the next available unit rather than call back. Interviewers sometimes stretch the requirements of quota samples. For example, a 58-year old person may be placed in the 46 to 55 age category and interviewed to fulfill quota requirements.

To control these problems, supervisors should keep daily records of the number of calls made, number of not-at homes, number of refusals, number of completed interviews for each interviewer, and the total for all interviewers under their control.

• ***Control of Cheating***

Cheating involves falsifying part of a question or the entire questionnaire. An interviewer may falsify part of an answer to make it acceptable or may fake answers. The most blatant form of cheating occurs when the interviewer falsifies the entire questionnaire, merely filling in fake answers without contacting the respondent. Cheating can be minimized through proper training, supervision, and validation of fieldwork.

(iv) ***Validation of fieldwork***

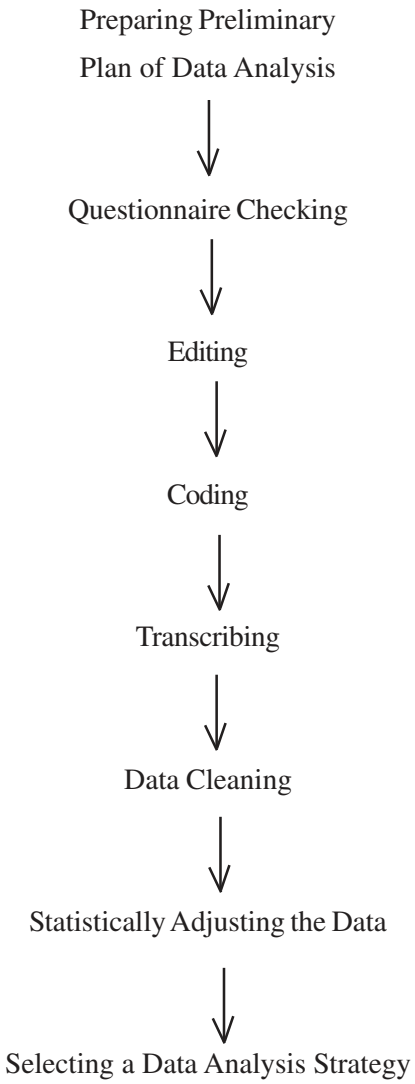
Validation of fieldwork means verifying that the field workers are submitting authentic interview. To validate the study, the supervisors call 10 to 25 percent of the respondents to inquire whether the field workers actually conducted the interviews. The supervisor asks about the length and quality of the interview, reaction to the interviewer, and basic demographic data. The demographic information is cross-checked against the information reported by the interviewers on the questionnaires.

(v) ***Evaluation of field workers***

It is important to evaluate field workers to provide them with feedback on their' performance as well as to identify the better field workers and build a better, high quality field force. The evaluation criteria should be clearly communicated to the field workers during their training. The evaluation should be based on criteria of cost and time, response rates, quality of interviewing, and quality of data.

8.2.2 Data preparation process

The data-preparation process is shown in the figure below. The entire process is guided by the preliminary plan of data analysis that was formulated in the research design phase. The first step is to check for acceptable questionnaire. This is followed by editing, coding, and transcribing the data. The data are cleaned and a treatment for missing responses, prescribed. Often, statistical adjustment of the data may be necessary to make them representative of the population of interest. The researcher should then select an appropriate data analysis strategy. The final data analysis strategy differs from the preliminary plan of data analysis due to the information and insights gained since the preliminary plan was formulated. Data preparation should begin as soon as the first batch of questionnaire is received from the field, while the fieldwork is still going on. Thus if any problems are detected, the fieldwork can be modified to incorporate corrective action.



⇒ ***Questionnaire checking***

The initial step in questionnaire checking involves a check of all questionnaires for completeness and interviewing quality. Often these checks are made while fieldwork is still underway. If the fieldwork was contracted to a data-collection agency, the researcher should make an independent check after it is over. A questionnaire returned from the field may be unacceptable for'several reasons.

- Parts of the questionnaire may be incomplete.
- The pattern of responses may indicate that the respondent did not understand or follow the instructions.
- The returned questionnaire is physically incomplete: one or more pages are missing.
- The questionnaire is received after the pre-established cutoff date.
- The questionnaire is answered by someone who does not qualify for participation.

If quotas or cell group sizes have been imposed, the acceptable questionnaire should be classified and counted accordingly. Any problems in meeting the sampling requirements should be identified and corrective action taken, such as conducting additional interviews in the underrepresented cells, before the data are edited.

⇒ ***Editing***

Editing is the review of the questionnaires with the objective of increasing accuracy and precision. It consists of screening questionnaires to identify illegible, incomplete, inconsistent, or ambiguous responses.

Response may be illegible if they have been poorly recorded. This is particularly common in questionnaires with a large number of unstructured questions. The data must be legible if they are to be properly coded. Likewise, questionnaires may be incomplete to varying degrees. A few or many questions may be unanswered.

At this stage, the researcher makes a preliminary check for consistency. Certain obvious inconsistencies can be easily detected. For example, a respondent reports an annual income of less than Rs. 1, 00,000, yet indicates frequent shopping at prestigious department stores.

Responses to unstructured questions may be ambiguous and difficult to interpret clearly. The answer may be abbreviated, or some ambiguous words may have been used. For structured questions, more than one response may be marked for a question designed to elicit a single response. Suppose a respondent circles 2 and 3 on a five- point rating scale. Does this mean that 2.5 was intended? To complicate matters further, the coding procedure may allow for only a single-digit response.

Unsatisfactory responses are commonly handled by returning to the field to get better data assigning missing values, or discarding unsatisfactory respondents.

⇒ **Returning to the Field:** The questionnaire with unsatisfactory responses may be returned to the field, where the interviewers re-contact the respondents. This approach is particularly attractive for business and industrial marketing surveys, where the sample sizes are small and the respondents are easily identifiable. However, the data obtained the second time may be different from those obtained during the original survey. These differences may be attributed to changes over time or differences in the mode of questionnaire administration (e.g. telephone versus in-person interview.)

⇒ **Assigning Missing Values:** If returning the questionnaires to the field is not feasible, the editor may assign missing values to unsatisfactory responses. This approach may be desirable if (1) the number of respondents with unsatisfactory responses is small, (2) the proportion of unsatisfactory responses for each of these respondents Is small, or (3) the variables with unsatisfactory responses are not the key variables.

⇒ **Discarding Unsatisfactory Respondents:** In this approach, the respondents with unsatisfactory responses are simply discarded. This approach may have merit when (1) the proportion of unsatisfactory respondents is small (less than 10%), (2) the sample size is large, (3) the unsatisfactory respondents do not differ from satisfactory respondents in obvious ways (e.g. demographic, product usage characteristics), (4) the proportion of unsatisfactory responses for each of these respondents is large, or (5) responses on key variables are missing. However, unsatisfactory respondents may differ from satisfactory respondents in systematic ways and the decision to designate a respondent as unsatisfactory may be subjective. Both these factors bias the results. If the researcher decides to discard unsatisfactory respondents, the procedure adopted to identify these respondents and their number should be reported.

⇒ ***Coding***

Coding means assigning a code, usually a number, to reach possible response to each question. The code includes an indication of the column position (field) and data record it will occupy. For example, sex of respondents may be coded a 1 for females and 2 for males. A field represents a single item of data, such as sex of the respondent. A record consists of related fields, such as sex, marital status, age, household size, occupation, etc. Often all the data for a respondent will be contained in a single record, although a number of records may be used for each respondent. A convenient way for entering data is to use a spread sheet such as Excel, where specific columns can be easily designated for specific question responses. Each row contains the data for one respondent.

⇒ ***Transcribing***

Transcribing data involves transferring the coded data from the questionnaire or coding sheets onto disks or directly into computers. Now-a-days this step may be eliminated as the data are directly entered into computers.

⇒ ***Data cleaning***

Data Cleaning includes consistency checks and treatment of missing responses. Although preliminary consistency checks have been made during editing, the checks at this stage are more thorough and extensive, because they are made by computer.

• ***Consistency Checks*** identify data that are out of range, logically inconsistent, or have extreme values. Out of range data values are inadmissible and must be corrected. For example, respondents have been asked to express their degree of agreement with a series of lifestyle statements on a 1 to 5 scale. Assuming that 9 has been designated for missing values, data values 0,6,7 and 8 are out of range. Computer packages like SPSS, SAS, EXCEL, and MINITAB can be programmed to identify out-of-range values for each variable and print out the respondent code, variable code, variable name, record number, column number, and out-of-range value. This makes it easy to check each variable systematically for out-of- range values. The correct responses can be determined by going back to the edited and coded questionnaire.

• ***Treatment of missing responses:*** Missing responses represent values of a variable that are unknown, either because respondents provided ambiguous answers or their answers were not properly recorded. Treatment of missing responses may be done either by substituting a neutral value or by substituting an

imputed response. A neutral value, typically the mean response to the variable, is substituted for the missing responses. The respondents' pattern of responses to other questions may also be used to impute or calculate a suitable response to the missing questions. The researcher attempts to infer from the available data the responses the individuals would have given if they had answered the questions.

• ***Statistically adjusting the data***

Procedures for statistically adjusting the data consist of weighting, variable re--specification, and scale transformations. These adjustments are not always necessary but can enhance the quality of data analysis.

8.2.3 Tabulation

Data can be presented in the form of tables and graphs. In tabular form, classification of data is made with reference to time or to some other variables. Graphic analysis presents a visual picture of the given data.

Tabular presentation is used for summarization and condensation of data. It also helps in analysis of relationships, trends, and relative sizes of given data. Actually, a statistical table is a cross classification of data. This can be done in two different ways: (i) classification with respect to time, (ii) classification with respect to some other variable.

Table 8.1: Product wise Sales of Anil Chemicals (in thousands)

Product	1984	1985	1986
P_1	40	45	48
P_2	20	18	24
P_3	35	35	38

A generalized form of tabular presentation is given in Table 3.1. Following observation can be made from Table 8,1: (i) the table has a number, (ii) it has a title, (iii) it has captions (captions of a table are headings of the column), (iv) it has stubs (the stubs of table are headings of the rows). Some additional features in tabular presentation include indication of sources of data and footnotes.

Data classified with respect to time: Whenever the time variable enters the classification, it is known as time series classification. In the simplest form of time series classification, time occupies the stubs and a single form of the variable occupies one caption of the table as shown in Table 8.2

Table 8.2 Annual Sales of Electronic calculators by an Indian Manufacturer

Time	Sales (Rs. In lakhs)
1376	20.15
1977	19.49
1378	19.41
1979	19.54
1980	18.74

Data classified with respect to other variables: This can be done either by a two-way classification or a three way or a multiple classification. In two- way classification, a table is set up in such a way that two different variables can be compared or contrasted. This type of table is also known as a contingency table. We can represent the sales data of a company by product and by sales territory as shown in Table 8.3.

Table 8,3: Sales Data of XYZ Company, Product wise and Territory wise for 1988

		Territory			
Product	East Zone	West Zone	North Zone	South Zone	CentralZone
P_1	**25**	10	5	3	8
P_2	**75**	25	30	10	24
P_3	20	**15**	13	20	17

8.3 Self-Assessment Questions:

Q1: Explain the nature of fieldwork?

Q2: Write a short note on sampling control?

Q3:Define editing?

Q4: What is tabulation?

Q5: Explain data preparation process?

Q6: What is questionnaire checking?

8.4 Summary

Managers take decisions on the basis of available information or data Raw data may be available to managers in scattered form. Unless data are properly collected, analysed and presented, it may not be useful for decision making.

Data collection involves the use of some kind of field force. The field force may operate either in the field or from an office. AH field work involves the selection, training, and supervision of persons who collect data. The validation of fieldwork and the evaluation of field workers are also part of the process.

The data-preparation process is guided by the preliminary plan of data analysis that was formulated in the research design phase. The first step is to check for acceptable questionnaire. This is followed by editing, coding, and transcribing the data. The data are cleaned and a treatment for missing responses, prescribed. Often, statistical adjustment of the data may be necessary to make them representative of the population of interest.

Data then are presented in the form of tables and graphs. In tabular form, classification of data is made with reference to time or to some other variables. Graphic analysis presents a visual picture of the given data. Tabular presentation is used for summarization and condensation of data. It also helps in analysis of relationships, trends, and relative sizes of given data.

8.5 Glossary:

Data collection: The process of gathering and measuring information on targeted variables in an established system, which then enables one to answer relevant questions and evaluate outcomes.

Tabulation: The way of processing information or data by putting it in a table.

Supervision: The action of supervising someone or something.

Evaluation: It is a systematic determination of a subject's merit, worth and significance, using criteria governed by a set of standards.

Transcribing: Put (thoughts, speech, or data) into written or printed form.

Coding: It refers to creating computer programming code. In a more general sense, the word coding is used to refer to assigning a code or classification to something.

Editing: The process of selecting and preparing writing, photography, visual, audible, and film media used to convey information.

8.6 Answers to self-check questions:

Q1: Refer to 8.2.1

Q2: Refer to 8.2.1

Q3: Refer to 8.2.2

Q4: Refer to 8.2.3

Q5: Refer to 8.2.2

Q6: Refer to 8.2.2

8.7 Terminal Questions:

1. Discuss the process of fieldwork in collecting data.
2. Describe the steps involved in a data preparation process.
3. Discuss the methods of constructing various types of tables.
4. Describe the major sources of error related to fieldwork.
5. Discuss the process of editing and coding of data..
6. What options are available for treatment of missing data?

8.8 Suggested Readings

1. T.S. Wilkinson, and P.L. Bhandarkar, "Methodology and techniques of Social Research", Himalaya Publishing House, New Delhi.
2. S.P. Gupta, *"Statistical methods"* Sultan Chand & Sons publication, New Delhi.
3. Donald S. Tull and Del S. Hawkins, *"Marketing Research - Measurement and Method",* Prentice Hall of India Pvt. Ltd., New Delhi.
4. William G. Zikmund, *"Exploring Marketing Research",* Thomson South-Western Publication, Singapore.
5. Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Deihi.

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Lesson-9
Descriptive Statistics & ANOVA

Structure

9.0 Introduction

Analysis of data is not possible without the use of statistics. Statistics provide us necessary tools and techniques of classification, editing, coding, tabulation, presentation and analysis of data. Researchers must have adequate knowledge of latest statistical tools and techniques and also their application. This lesson provides an overview of some of the statistical tools and techniques that are frequently used in research. The objectives of the lesson are:

9.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- Introduction to descriptive statistics
- Measure of central tendency
- Measure of dispersion

9.2 Presentation of Contents

9.2.1 Introduction to Descriptive Statistics:

The origin of the word statistics may be traced to 'status' of Latin or 'statista' of Italian or 'statistic of German language which means "Political State". In ancient times it was used to collect information about the population & wealth so that taxes can be imposed. It is a science, which deals with method of collecting, classifying, presenting, comparing, and interpreting numerical data collected to throw light on any sphere of enquiry.

There are two major areas of statistics, namely: descriptive statistics and inferential statistics. *Descriptive statistics* is concerned with the development of certain indices from the raw data, whereas *inferential statistics* is concerned with the process of generalization. After the classification and tabulation

we go a step further and develop certain indices or measures to summaries the collected/classified data only after this we can use inferential statistics, i.e., the estimation of population parameters and testing of hypothesis.

Two measures are very common in descriptive statistical field and are extensively used in researches. They are measures of central tendency and measures of dispersion.

9.2.2 Measure of Central tendency

When 2 or more different series of the same type are compared, tabulation of observations is not sufficient. Tabulation arranges facts in a logical order and helps their understanding and comparison but often the groups tabulated are still too large for their characteristics to be readily grasped. What is desired is a numerical expression which summarizes the characteristics of the group. Measure of central tendencies or measure of location (also popularity called Average) serve this purpose.

There are 2 fundamental characteristics in which similar type of data differ.

(i) They may differ in measure of location i.e. in the value of variety x round which they center. Measure of this kind is generally known as averages.

(ii) They may differ in the extent of which observations are scattered about central value. Measure of this kind is known as dispersion.

There are mainly 5 types of averages but 3 of them are commonly used.

1) A.M. (Arithmetic Mean) 3) H.M (Harmonic Mean) 5) Mode

2) G.M (Geometric Mean) 4) Median

Arithmetic Mean: It is the simplest measurement of central tendency and is widely used measure. It helps in comparing data. Let us see how it is calculated

(i) In case of individual observations (i.e. when f is not given) arithmetic mean is calculated as: $\bar{x} = \frac{\sum x}{n} = \frac{x_1 + x_2 + \ldots + x_n}{n} = \frac{52 + 75 + 40 + 70 + 43 + 40 + 65 + 35 + 48}{9} = \frac{468}{9} =$

If x: $x_1, x_2 \ldots\ldots x_n$ *then* $\bar{x}$ *(A.M) is*

(ii) In case of Discrete Series arithmetic mean is calculated as:

x: $x_1, x_2 \ldots\ldots x_n$

f: $f_1, f_2 \ldots\ldots f_n$

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + \ldots\ldots\ldots f_nx_n}{f_1 + f_1\ldots\ldots\ldots f_n} = \sum \frac{fx}{n}.$$

where N= $f_1, f_2 + \ldots\ldots f_n \quad \sum f$

Example-1. Marks obtained by 9 students in Maths are as follows. Calculate A M 52, 75, 40, 70, 43, 40, 65, 35, 48

Example: 2 Calculate A.M. from the following data

Variable	Freq.	
X	f	fx
5	20	100
10	42	430
15	75	1125
20	75	1340
25	72	1800
30	45	1350
35	39	1365
40	9	360
45	8	360
50	6	300
	N = Σ f = 384	Σfx = 8530

$$\bar{x} = \sum \frac{fx}{n} = \frac{8530}{384}$$

= 22.2 Ans

Example 3: Calculate AM from the following data

Marks	No. of Students	Mid-value	
		x	fx
0-10	5	5	25
10-20	10	15	150
20-30	40	25	1000
30-40	20	35	700
40-50	25	45	1125
	Σf = 1000		Σfx = 3000

Median: It is the central value of variable when values are arranged in ascending or descending order or magnitude. Median is value which divides the observations in exactly two halves. It is a positional average and is used only in the context of qualitative phenomena. It is calculated as follows:

When n is odd — Middle value = (n+1)

When n is even — 2 mid values = n+1

& A.M. of these two values = median

2. When Class interval is given:

$$\text{Median} = l + \frac{i}{f}\left(\frac{n}{2} - C\right)$$

Where l = lower limit of median class, where median class is the class corresponding to Cumulative Frequency just greater than n/2.

i = Width of class

f = frequency of median class

n = Σf

C = Cumulative Frequency of class preceding the median class.

Quartiles: Those values of variables which divide total frequencies in 4 equal parts.

$$Q_1 = l + \frac{i}{f}\left(\frac{n}{2} - C\right) \quad Q_3 = l + \frac{i}{f}\left(\frac{3n}{4} - C\right)$$

Example1: Find the Median of the data 20, 18, 22, 27, 25, 12, 15

Arrange data in ascending order = 12, 15, 18, 20, 22, 25, 27

No. of Items = 7 (odd)

$$\therefore Median = \frac{1}{2}(n+1)th = 4th = 20\, Ans.$$

Example 2: Find Median and Quartiles from the following data:

Wages	No of Workers	C.f	
0-10	22	22	
10-20	38	60	$Median\ l + \frac{i}{f}\left(\frac{N}{2} - C\right)$
20-30	46	106	
30-40	35	141	i = 10
40-50	20	161	N = 161
N/2 = 80.5			
l = 20	f = 46	N = 60	

$$= 20 + \frac{10}{46}(85.5 - 60) = 20 + \frac{205}{46}\ 24.46 \quad Ans.$$

$$Q_1 = l + \frac{i}{f}\left(\frac{N}{4} - C\right) \quad \frac{N}{4} = 40.25$$

$$= 10 + \frac{182.5}{38} = 10 + 4.8 = 14.8$$

$$Q_3 = 30 + \frac{147.5}{35} = 34.21$$

Mode: It is the most commonly or frequently occurring value in a series. The mode in a distribution is that item around which there is maximum concentration.

1) When observations x are given: mode is maximum number of times x occurs.

For example, in a data 5, 6, 7, 8, 7, 9, 7, 10 mode is 7

- When frequencies are given, mode is the value of x corresponding to maximum frequency.
- When class intervals are given:

Mode = $L + (f_m - f_1) / (2f_m - f_1 - f_2)\ x\ i$

Where: L = lower limit of model class

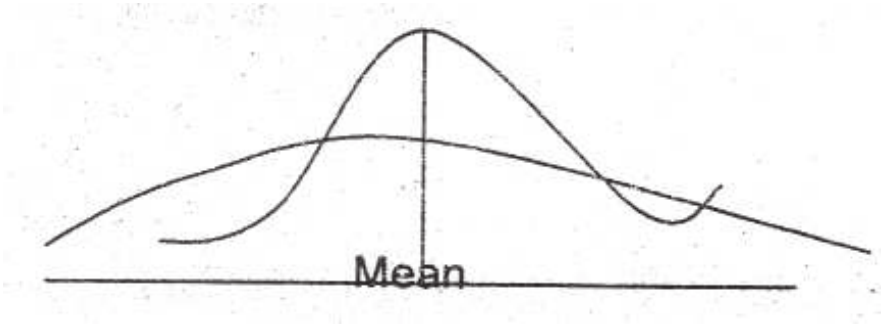
i = width

f_m = frequency of model class

$f_1 - f_2$ = frequency of classes preceding & succeeding model class

9.2.3 Measure of Dispersion

Two or more frequency distributions may have exactly identical averages but even then they may differ markedly in many ways



For example, (i) 10, 20, 40, 60, 70 → mean = 40 but values lie scattered.

(ii) 35, 40, 45, 50, 30 mean = 40 but values lie near mean

So it is essential to know how the variants are clustered around or scattered away from central point. The variation it called dispersion or spread or scatter. Dispersion is the extent or degree to which values are dispersed about the central value.

Measure of dispersion- following are measure of dispersion.

1. Range
2. Quartile deviation or semi-inter quartile range.
3. Average (or mean) deviation
4. Standard deviation

Range- It is the difference between extreme values.

$$Range = x_{max} - x_{min}$$

It is, however, not reliable as it depends on 2 extreme values only.

Quartile Deviation- Difference between upper & lower quartile & half of it is called quartile deviation.

Quartiledeviation = $(Q_3 = Q_1)$

It, however, uses only 50% of data.

Mean deviation - It is the average of difference of the values of items from some average of the series.

Mean deviation = $= \frac{1}{2}\sum f \mid x - a \mid$

A = Mean, Median & = $= \frac{1}{n}\sum f \mid x - A \mid \rightarrow$ *When frequency is not given*

Standard deviation - It is most widely used measure of dispersion. It is defined as square root of the average of squares of deviations.

= *Variance*

Co-efficient of Dispersion:-Whenever we want to compare the variability of 2 series which differ widely in their average. We calculate coefficient of dispersion, which being ratios are independent of units of measurement

a) C.D. based on range $= \frac{x_{\max} - x_{mim}}{x_{\max} + x_{mim}}$

b) C.D based on Quartile deviation $= \frac{Q_3 - Q_1}{Q_3 + Q_1}$ $\bar{x}$ $\sigma = \sqrt{\frac{1}{n}\sum f(x-\bar{x})^2}$, σ^2

c) C.D based on Mean deviation $= \frac{Meandevation}{A}$

d) C.D based on S.D. deviation $= \frac{S.D}{Mean}$

Example 1: Calculate S.D. from the following data;

X	*f*	*fx*	$(x-\bar{x})$	$(x- \quad)^2$	$f(x- \quad)^2$
1	6	**6**	-3	9	54
2	12	24	-2	4	48
3	18	54	-1	n	18
4	26	104	0	0	0
5	16	80	1	1	16
6	10	60	2	4	40
7	8	56	3	9	72
	N=96	Σfx = 384			**248**

$$\sigma = \sqrt{\frac{1}{96}(248)} \qquad \sigma = \sqrt{\frac{31}{12} = 1.607}\ \textit{Ans.}$$

9.2.4 Analysis of Variance (ANOVA)

The "analysis of variance" procedure is used in such problems where we want to test for the significance of the difference among more than two sample means. In fact, the technique of analysis of variance is one of the most powerful Statistical methods developed by R.A. Fisher.

The analysis of variance originated in agrarian research and its language is thus loaded with such agricultural terms as *blocks* (referring to land) and treatments (referring to population or samples which are differentiated in terms of varieties of seeds, fertilizers or cultivation methods). Today, analysis of variance finds application in every type of experimental design, in natural sciences as well as social sciences and has become a very broad and technical subject. The methods of analysis of variance are a fundamental part of planned research and the design of experiment, comparative studies, and in judging the effects of new technology, procedures and policies.

Assumptions in Analysis of variance

The analysis of variance technique is based on the following assumptions:

(1) Each sample is drawn randomly from a normal population and the sample statistics tend to reflect the characteristics of the population.

(2) The populations from which the samples are drawn have identical means and variances, i.e.,

$\mu_1 = \mu_2 = \mu_3 = \ldots\ldots\ldots \mu_n$ $\qquad \bar{x} = \frac{384}{94} = 4$

$\sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \ldots\ldots\ldots \sigma n^2$

In case we are not in a position to make these assumptions in a particular problem, the analysis of variance technique should not be used. In such cases we should consider using a "non- parametric (distribution free) technique.

Computation of Analysis of variance

The null hypothesis taken while applying of variance technique is that the means of different samples do not differ significantly. The procedure followed in the analysis of variance is different for

(i) One way classification and

(ii) Two-way classification.

Irrespective of the type of classification, the analysis of variance is a technique of partitioning the total sum of squared deviations of all sample values from the grand mean and is divided into two parts: sum of squares between samples and sum of squares within the samples. Individual observations in the same treatment samples, however can differ from each other only because of chance variation, since each individual within the group receives exactly the same treatment.

One-Way Classification Model

The term one-factor analysis of variance refers to the fact that a single variable or factor of interest is controlled and its effect on the elementary units is observed. In other words, in one-way classification the data are classified according to only one criterion. Suppose we have independent samples of n_1, n_2...., n_k observation from k population.

The population means are denoted by $\mu_1 = = \mu_2 = ... \mu_n$. The one-way analysis of variance is designed to test the null hypothesis.

$H_0 : \mu_1 = \mu_2 = \mu_2 = ... \mu_n$

i.e. the arithmetic means of the population from which the k samples are randomly drawn are equal to one another. The steps involved in carrying out the analysis are:

Step 1: Calculate the variance between the samples

The variance (sum of squares) between samples reflects the contribution of both different treatments and chance to inter-sample variability. Sum of squares is a measure of variation. The sum of squares between samples is denoted by SSC. For calculating variance between samples, we take the total grand average and divide this total by the degrees of freedom. Thus the steps in calculating variance between samples will be:

(a) Calculate the mean of each sample, i.e. ., $\bar{x}_{1\ \ 2}$ ..... $_k$;

(b) Calculate the grand average X. its value is obtained as follows:

$$\bar{X} = \frac{\bar{X}_1 + \bar{X}_2 + ...\bar{X}_k}{N_1 + N_2 + ...N_k}$$

(c) Take the difference between the means of the various samples and the grand average

(d) Square these deviations and obtain the total which will give sum of squares between the samples, and

(e) Divide the total obtained in step (d) by the degree of freedom. The degree of freedom will be one less than the number of samples, i.e. if there are 4 samples the degree of freedom will be 4-1= 3 or in general *v=k-1, where k = number of samples*

Step 2: Calculate the variance within the samples

The variance (sum of squares) within sample measure those inter-sample differences that arise due to chance only. It is denoted by SSE. For calculating the variance within the samples we take the total of the sum of squares of the deviation of various items from the mean values of the respective samples and divide this total by the degrees of freedom. Thus the step in calculating variance within the samples will be:

(a) Calculate the mean value of each sample, i.e., $\bar{X}_1 , \bar{X}_2 .....\bar{X}_k$.

(b) Take the deviations of the various items in a sample from the mean values of the respective samples.

(c) Square these deviations and obtain the total which gives the sum of squares within the sample, and

(d) Divide this total obtained in step (c) by the degree of freedom, the degree of freedom is obtained by deducting from the total number of items the number of samples, i.e. , *v* = n-k where k refers to the number of samples and n refers to the total number of all the observations.

Step 3: Calculate the F-ratio

Calculate the F-ratio as follows:

$$F^* = \frac{\text{Variance between the samples}}{\text{Variance within the samples}} \quad \text{or} \quad F = \frac{S_1^2}{S_2^2}$$

F is always computed with the variance between the sample means as the numerator and the variance within the sample means as the denominator. The denominator is computed by combining the variance within the k samples into single measures.

Step 4: Compare the calculated value of F

Compare the calculated value of F with the table value of F for the given degrees of freedom at a certain level (generally we take 5% level of significance). If the calculated value of F is greater than the table value of *f*, it indicates that the difference in sample means is significant, i.e., it could not have arisen due to fluctuations of random sampling or, in other words the *sample do not come from the same population.* On the other hand, if the calculated value of *F* is less than the table value, the difference is not significant and hence could have arisen due to fluctuations of random sampling.

Illustration: As head of a department of a consumer research organization. You have the responsibility for testing and comparing lifetimes of light bulbs for four brands of bulbs. Suppose you test the lifetime of three bulbs of each of the four brands. Your test data are as shown below, each entry representing the life-time of a bulb, measured in hundreds of hours

Brand			
A	B	C	D
20	25	24	23
19	23	20	20
21	21	22	20

Can we infer that the mean lifetimes of the four brands are equal?

Solution: The null hypothesis is that the average lifetimes of the four brands of bulbs are equal i.e. $\bar{X}_1 = 20$, $\bar{X}_2 = 23$, $\bar{X}_3 = 22$, $\bar{X}_4 = 21$

$$\bar{H}_0 : \mu_1 = \mu_2 = \mu_2 = \ldots\ldots\ldots \mu_n$$

Let X_1 X_2 X_3 and X_4 denote the mean lifetime of Brand A.B.C and D respectively and $\bar{X}$ be the overall grand mean. Then

X_1	x_2	x_3	X_4
20	25	24	23
19	23	20	20
21	21	22	20

$$\bar{X} = \frac{\bar{X}_1 + \bar{X}_2 + \bar{X}_3 + \bar{X}_4}{4} = \bar{X} = \frac{20 + 23 + 22 + 21}{4} = \frac{86}{4} = 21.5$$

The variance between samples can be computed as follows:

X	X	$(X-X)$	$(X-X)^2$
20	21.50	-1.50	2.25
23	21.50	+1.50	2.25
22	21.50	+0.50	.25
21	21.50	-. 50	.25
			$\sum(\overline{X}-\overline{X})^2=5.0$

$$s^2\,\overline{X} = \frac{\sum(\overline{X}-\overline{X})^2}{n-1} - \frac{5.0}{4-1} = \frac{5}{3}$$

But $\sigma\,X = \frac{\sigma}{\sqrt{n}}\ or\ \sigma^2 = n\,\sigma^2\,\bar{x} = 3\times\frac{5}{3} = 5.$

Here n represents the sample size and not the number of samples.

Therefore our first estimate of the population variance is based on the variance between the sample means and is given by

$S_1^2 = 5.$

The variance within samples can be computed as follows:

Brand A		*Brand B*		*Brand C*		*Brand D*	
X	$(X-\overline{X})^2$	X	$(X-\overline{X})^2$	*-X)²*	$(X-\overline{X})^2$	*X*	$(X-\overline{X})^2$
20	0	25	4	24	4	23	4
19	1	23	0	20	4	20	1
21	1	21	4	22	0	20	1
$\overline{X}=20$		$\overline{X}=23$		$\overline{X}=22$	$\Sigma(X-\overline{X})^2$	$\overline{X}=21$	$\Sigma(X-\overline{X})^2$

$\Sigma(X-\overline{X})^2 = \Sigma(X-\overline{X})^2 = 8$ = 8

Therefore

Sample variance, $S_1^2 = \Sigma(X-\overline{X})^2 \big/ n-1 = \frac{2}{2} = 1;$ Sample variance,

$$S_3^2 = \Sigma(X-\overline{X})^2 \big/ n-1 = \frac{8}{2} = 4;$$

$$S_4^2 = \Sigma(X-\bar{X})^2 \Big/ n-1 = \frac{6}{2} = 3;$$

Therefore, the pooled estimate s is given by

$$S^2 = \frac{S_1^2+S_2^2+S_3^2+S_4^2}{4} = \frac{1+4+4+3}{4} = 3$$

Thus the second estimate of the population variance based on within the samples is given by

$$S_2^2 = 3$$

$$F = \frac{\textit{Variance between samples}}{\textit{Variance within samples}} \quad \frac{S_1^2}{S_1^2} \quad \frac{5}{3} = 1.67$$

The table value of *F* for (3,8) d.f. and at 5% level of significance is 4.07. Since the computed value of *F*-1.67 is less than the table value of F=4.07, therefore, we accept our null hypothesis. Hence the difference is insignificant and we can infer that the average lifetime of different brands of bulbs are equal.

The Analysis of Variance Table

Since there are several steps involved in the computation of both the between and within sample variance, the entire set of results may be organized into an analysis, of variance (ANOVA) table. This table is summarized and shown below:

Source variation	of Sum squares SS	of Degree Freedom	of Mean *MS*	Square	Variance F	Ratio
Between	*SSB*	d *f* c-1	$MSB = \frac{SSB}{C-1}$			
Samples	SSW	n-c		$MSW = \frac{SSW}{n-c}$	$F = \frac{MSB}{MSW}$	
Within samples						
TOTAL	SST	n-1				

9.3 Self-Assessment Questions:

Q1: Explain descriptive statistics?

Q2: Define arithmetic mean?

Q3: Briefly explain measure of central tendency?

Q4: Explain the analysis of variance?

Q5:What do you meant by mean deviation?

Q6: Discuss about the measures of dispersion?

9.4 Summary

Statistics is a science, which deals with method of collecting, classifying, presenting, comparing, and interpreting numerical data collected to throw light on any sphere of enquiry. There are two major areas of statistics, namely: descriptive statistics and inferential statistics. Descriptive statistics is concerned with the development of certain indices from the raw data, whereas inferential statistics is concerned with the process

of generalization. After the classification and tabulation we go a step further and develop certain indices or measures to summaries the collected/classified data only after this we can use inferential statistics, i.e., the estimation of population parameters and testing of hypothesis.

Two measures are very common in descriptive statistical field and are extensively used in researches. They are measures of central tendency and measures of dispersion.

The "analysis of variance" procedure is used in such problems where we want to test for the significance of the difference among more than two sample means. The analysis of variance originated in agrarian research and its language is thus loaded with such agricultural terms as *blocks* (referring to land) and treatments (referring to population or samples which are differentiated in terms of varieties of seeds, fertilizers or cultivation methods). Today, analysis of variance finds application in every type of experimental design, in natural sciences as well as social sciences and has become a very broad and technical subject. The methods of analysis of variance are a fundamental part of planned research and the design of experiment, comparative studies, and in judging the effects of new technology, procedures and policies.

9.5 Glossary:

Descriptive: It is the pattern of narrative development that aims to make vivid a place, object, character, or group.

Statistics: It is a form of mathematical analysis that uses quantified models, representations and synopses for a given set of experimental data or real-life studies.

Inferential: Characterized by or involving conclusions reached on the basis of evidence and reasoning.

Variance: It is the expectation of the squared deviation of a random variable from its mean. Analysis: The process of breaking a complex topic or substance into smaller parts in order to gain a better understanding of it.

Central tendency: The tendency for the values of a random variable to cluster round its mean, mode, or median.

9.6 Answers to self-check questions:

Q1: Refer to 9.2.1

Q2: Refer to 9.2.2

Q3: Refer to 9.2.2

Q4: Refer to 9.2.3

Q5: Refer to 9.2.3

Q6: Refer to 9.2.3

9.7 Terminal Questions

1. What do you understand by descriptive statistics? Discuss some of its tools that may be used in research.
2. Write a detailed note on measure of central tendency Provide a detailed account of measure of dispersion.
3. What do you understand by ANOVA? Discuss its significance in business research.
4. Discuss the steps of ANOVA (one way classification)

5. Write short notes on the following:

   a. Arithmetic mean

   b. Median

   c. Standard Deviation

9.8 Suggested Readings

1. S.P. Gupta, "*Statistical methods"* Sultan Chand & Sons publication, New Delhi Donald S. Tull and
2. Del S. Hawkins, "*Marketing Research - Measurement and Method"*, Prentice Hall of India,Pvt. Ltd., New Delhi.
3. William G. Zikmund, "*Exploring Marketing Research",* Thomson South-Western Publication, Singapore.
4. Kothari, C.R., "*Research Methodology - Methods and Techniques*", Wiley Eastern Limited, Delhi.
5. Naresh K. Malhotra, "*Marketing Research - an applied orientation',* Pearson education (Singapore) pte. Ltd., Delhi.

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Lesson -10
Factor Analysis, Cluster Analysis, and Discriminant Analysis

Structure

10.0 Introduction

This lesson through light on three important tools of analysis, namely: Factor analysis, Cluster analysis, and Discriminate analysis. All these differ from each other but are extensively used in research now-a-days. It requires much effort to understand these techniques. Their application requires the services of experts. An effort here has been done here to provide basic understanding of these tools of analysis. The objectives of the lesson are:

- To understated the basics of Factor analysis.
- To understand the basics of Cluster analysis
- To understand the basics of Discriminate analysis

10.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- Factor analysis
- Cluster Analysis
- Discriminate Analysis

10.2 Presentation of Contents

10.2.1 Factor Analysis

The factor analysis was first used by Charles Spearman. Psychologists use it as a technique of indirect measurement. When they are interested to test human personality and intelligence, a set of questions and test is developed for this purpose. And their responses would from a certain pattern.

Unlike regression analysis, factor analysis is not based on the usual distinction between dependent and independent variables, instead it rather considers all the variables simultaneously. There are two objects of factor analysis. First, it simplifies the data by reducing a large number of variables to a set of small number of variables. Secondly, it analyses the interdependence of interrelationships among a total set of variables.

Let us try to understand use of factor analysis with the help of an example:

Example 1:

Purpose: To identify major factors for determining consumer's evaluation of brand of coffee.

Sample: 94 consumers (To whom brand of coffee was not told and they were asked to rate it on 14 semantic differentia! scales).

Conclusion: Four Factors could summaries the 14 attributes.

Table:

	Factor	**Attributes**
A	Comforting Quality	Pleasant Flavour
		Mellow taste
		Comforting taste
		Pure, Clear taste
		Deep distinct flavour
B	Heartiness	Hearty, full bodied, full flavour
C	Genuineness	Sparkling taste
		Expensive taste
		Smooth, friendly taste
		Alive, lively taste
		Tastes like real coffee
		Overall reference
D	Freshness	Tastes just brewed
		Row taste

Factor analysis is a multi-variety analysis technique. It uses an advanced form of correlation analysis to the responses to a number of statements. It identifies those variables (expressed through statement in the research) that are interrelated and reduces them to a smaller number of underlying dimensions called 'factor'. The relation is understood by determining highly correlated statements. Such statements tend to measure some 'factor' common to all of them.

It is done on continuous variables or intervally-scaied variables. It involves the labeling of the highly correlated statements by the researcher, as a factor. It is based on the research that includes a question which makes the respondents indicate their level of agreement/ disagreement (Likert scale) with a battery of statements. Each statement is description of a variable.

Factor analysis tries to fit factors, as best as possible, to a scatter diagram of the data in such a way that the factors explain the variance associated with the responses to each statement. Each factor, generated through the analysis, explain part of the total variance.

It involves three important measures, which are briefly discussed, below:

Standardization of responses

The response to different statements or questions (under consideration) may be ascertained through different scales (4 point or 5 point scale). In order to facilitate comparisons of the responses from such different scales, all the responses are standardized, The standardization is based on the following formula:

Individual's standardized score on a statement =

[(Individual s' actual response to the statement

- (Mean of ail N responses to the Statement)]

Divided by [Standard Deviation of all N response to the statement],

A standardized response is thus the actual response, measured in terms of the number of standard Deviations (+or-) it has away from the mean.

Correlation coefficients .

The analysis computes the correlation coefficient for each pair of statements. The statements represented by a factor are to be highly correlated (Say, r > =0.7), but not necessarily perfectly correlated (i.e., =1.0). It may be noted here that the factors generated are relatively uncorrelated with each other.

Factors are linear equations of the variables (i.e..., statements) measured. Each factor is a weighted liner combination of the variables being analyzed. If m variables are being factor analyzed, then factor equations would consist of weighted combination of all m variables. (Unlike regression analysis, where the independent variables are usually correlated, in factor analysis the factors are independent.)

Factor can be identified through, various procedures. One of the better-known procedures is the "Principal Components Analysis ". Through it, factors are selected one at a time, such that each factor 'best fits' the data. Factors are generated sequentially. The first factor is created such that it represents the most highly correlated set of variables. Each selected factor explains less of the variance than its predecessors do and each is uncorrelated with all its predecessors. This step-wise process continues till all the factors are extracted. All the factors selected explain the largest amount of residual variance in the entire set of standardized response scores.

Factor analysis' output characteristics

A typical output of Factor Analysis is as illustrated below. The same is being used for discussion that follows it.

	Factor			Communality
	1	2	3	
Eigenvalue	2.23	1.32	0.60	-
Explained variance Statement:	0.45	0.26	0.12	
S_1	0.91	0.06	0.11	0.84
S_2	0.89	0.14	0.24	0.87
S_3	0.75	0.25	0.10	0.64
S_4	0.20	0.86	0.18	0.81
S_5	0.10	0.76	0.70	0.99

Each statement has a factor loading with each extracted factor. All variables load on all factors, but they load highly on some specific factors. Factor loading is the correlation between a factor and a variable (the statement's standardized response scores). It helps interpret the meaning of a factor, by indicating how well the factor fits the standardized responses to a statement. The greater the value of factor loading, the better is the fit of the factor to the data from the concerned statement.

In the above table, F1 is a good fit on the data from statements 1, 2, and 3 but a poor fit with the other statements. This indicates that these three statements possibly measure the same basic aspect, and this indicates to a researcher that such a factor exists.

Factor loadings also help determine each statement's communality and each factor's eigenvalue, which is discussed later. The variance associated with the responses to each statement equals 1.0 as the statements are standardized. And so, the variance with all statements, say m, is m.0.

Each factor has an eigenvalue. It is a measure of the amount of variance explained by a factor: The maximum amount of variance (the square of the correlation) that can be explained by a factor is equal to the number of variables. In other words, eigenvalues, indicate how well each of the identified factors 'fit' the data from all the respondents, on ail the statements. A factor's eigenvalue is the sum of the squares of its factor loading.

For F1 , it is = $(0.91)^2 + (0.89)^2 + (0.75)^2 + (0.20)^2 + (0.10)^2 = 2.2371$.

As the eigenvalue is the variance accounted for by a factor, dividing it by the total variance (which is equal to the number of statements, as indicated earlier) gives the proportion of the total variance explained by that factor.

All the factors extracted also have an explained variance. The sum of the explained variance for the factors indicates the extent to which the factors together explain the variance in the entire set of response data. In the above table, it is 83%. It is believed that a factor analysis, which accounts for 60-70% or more of the total variance can be considered a good fit to the data.

Each statement has communality. It indicates the proportion of the variance in the responses to the statement, which is explained by the identified factors. In the preceding table, three factors explained 0.81 (or81%) of the variance in all of the responses to the statement and by 0.64 for statement 3. Further, the three factors explain 80% or more of the variance associated with statements 1,2,4 and 5, but only about two-third of statement 3's variance. The communalities can be used to understand how well the factors fit the data. A statement's communality is the sum of the squares of its factor loadings.

For statement 5, it is = $(0.10)^2 + (0.70)^2 + (0.70)^2 = 0.99$.

Once a factor is identified, the researcher should understand to what' extent the respondents mostly agreed or disagreed with the statements which have a high factor loading on the concerned factor. The standardized responses need to be studied for this. Most respondents would have earlier disagreed with the concerned statements.

How many factors?

There can be as many factors as variables. Since factor analysis is designed to reduce many variables to a fewer number of underlying factors, a critical question is: how many of the identified factors should be used? As a thumb-rule, all the included factors must explain at least as much variance as an "average variable". When the eigenvalue of a factor is less than 1, it explains less variance than a variable would by itself. Such a factor should not be considered.

Just because a lot of variance is explained by a factor, that does not necessarily- mean that it is useful. If an irrelevant statement were repeated many times with small modifications, a factor underlying those statements would explain much of the variance but would not be a very interesting factor as the statements on which it is based were not very interesting. A related rule of thumb is to look for a large drop in the variance explained between two factors. For example, if the variance explained by five factors were 45%, 35 %, 25 %, 5%, and 3% then it can be seen that there is a drop in variance explained in the fourth factor. Such a drop might signal the introduction of meaningless factors of relative unimportance.

Perhaps the most appropriate rule is to stop factoring when the factors stop making sense. Eventually, the smaller factors will represent random variation and should be expected to be interpretable. Conversely, if a factor, which would be excluded by one of the above mentioned rules of thumb, was theoretically interpretable and of practical interest, it may be considered. To sum it up, there is no particular rule to decide on the number of factor to be considered. It involves a good degree of subjectivity. However, a few thumb-rules can be referred to.

Few Limitations

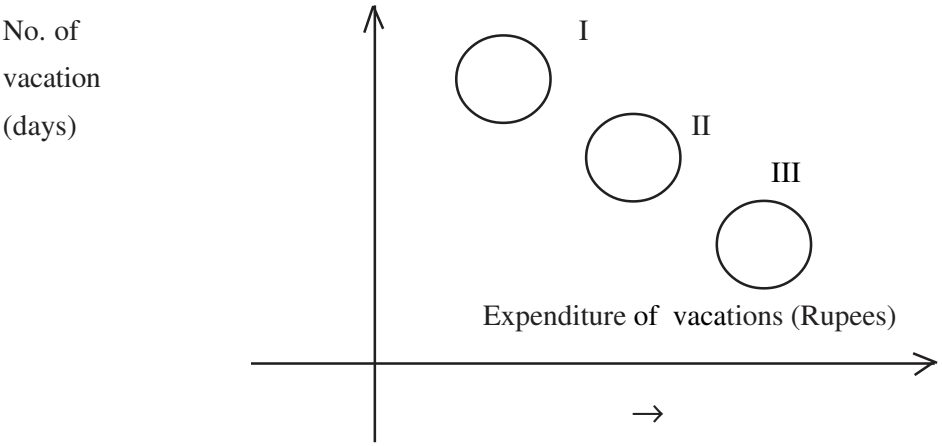
- A few limitations of factor analysis are indicated below:
- Sometimes, different factor analysis procedures may give different results.
- The manner in which factors are labeled can affect the way the data is read.
- The selection of the number of factors is, to a good extent, subjective.
- The factors generated may not be stable if the underlying relationships are not strong.
- In field of investigation, more relevant factors may be left out.
- Only researches, with good understanding of technique, can use this tool.
- Reliability of results is sometimes questionable.
- It is costly as well as bothersome.

10.2.2 Cluster Analysis

Cluster analysis is used to classify persons or objects into a small number of mutually exclusive and exhaustive groups. It is the technique in which objects are classified into homogeneous groups called clusters. Objects in one cluster tend to be similar to each other and dissimilar to objects in the other clusters. Cluster analysis is also called classification analysis, or numerical taxonomy.

Both cluster analysis and discriminant analysis are concerned with classification. However, discriminant analysis requires prior knowledge of the cluster or group membership of each object. In contrast, in cluster analysis there is no a prior information about the group or cluster membership for any of the objects.

Cluster analysis is mostly used in segmenting the markets, understanding buyer behaviour, identifying new product opportunities, and selecting test markets etc. *Hypothetical example*



This diagram shows three distinct clusters.

Cluster I	→	Comprising individuals who have too many vacations but they do not spend much.
Cluster II		Comprising individuals who have moderate vacations and spending on vacations.
Cluster III		Comprising individuals who have few vacations but spend substantial on vacations.

Matching Measures

Sometimes the researcher has to satisfy himself with the nominally scaled data. In such a case he has to use attribute matching coefficients.

Object	Attributes				
	1	2	3	4	5
A	1	0	0	1	0
B	0	0	1	1	1

1 indicates presence of attribute

0 indicates absence of attribute.

Formula

$S_{AB} = M / N$

Where S_{AB} denotes the measure of similarity between objects A&B.

M denotes the number of attributes held in common,

N denotes the number of attributes.

In our example, $S_{AB} = 2/5 = 0.4$

Methods in Cluster analysis

A. Hierarchical Method: New clusters are based on previously formed clusters.

(i) Top - down approach: In this all N entities are grouped in one cluster and divided into two sub clusters on the basis of highest average with cluster distance.

(ii) Bottom Up Approach: In this the two most similar points are placed. At Each subsequent stage, the proximity matrix is re-calculated in order to obtain the relationship of the new clusters with remaining entities.

B. Non Hierarchical Method:

In this first we define 'typical' members of each cluster and allocate objects to the cluster they are most similar to.

The input data for Cluster Analysis consist of any set of variables on which entities need to be grouped, e.g., demographics and psychographics (i.e. activities, interests, and opinion). The analysis is done by computing distances between entities, which helps decide on how close or how far apart any two entities are from each other.

$\sqrt{\text{Add the (difference)}^2}$.

***Example*:**

According to a study carried out, the following data was available for the importance of toothpowder attributes.

Rank	Respondent 1	Respondent 2
Cleans well	4	6
Foams well	7	8

Computing distance

Two methods to compute the distance between the two respondents are provided below:

Method 1: City block metric.

The difference in ratings for each attribute is added. This gives: distance = 3

Method II: Euclidean distance.

This is more popular method. The formula used is:

Distance, d=

In this case, $d = \sqrt{(2)^2 + (1)^2} = \sqrt{5} = 2.2.$

When there are a number of variables; the difference between two respondents is calculated by:

- Computing the difference in each attribute
- Squaring the difference
- Adding the squared differences
- Taking the square root of the sum.

Limitations of duster analysis

1. Lack of specificity has resulted into several methods of cluster analysis.
2. It lacks standard statistical tests.
3. It requires a good deal of computational time.

10.2.3 Discriminant Analysis

Discriminant analysis is a technique for analyzing data when the criterion or dependent variable is categorical and the predictor or independent variables are interval in nature. The objectives of discriminant analysis are as follows;

- Development of discriminant functions, or linear combinations of the predictor or independent variables, which will best discriminate between the categories of the criterion or dependent variable.
- Examination of whether significant differences exist among the groups, in terms of the predictor variables.
- Determination of which predictor variables contribute to most of the intergroup differences.
- Evaluation of the accuracy of Classification.

Discriminant analysis techniques are described by the number of categories possessed by the criterion variable. When the criterion variable has two categories, the technique is known as *two group discriminant analysis.* When three or more categories are involved, the technique is referred to as *multiple discriminant analysis.* The main distinction is that, in the two group case, it is possible to derive only one discriminant function, in multiple discriminant analysis, more than one function may be computed.

Examples of discriminant analysis abound in research. The technique can be used to answer questions such as:

- In terms of demographic characteristics, how do customers who exhibit product/brand/outlet loyalty differ from those who do not?
- Do heavy, medium, and iight users of a product differ in terms of their consumption?
- What psychographic characteristics help differentiate between price sensitive and non price sensitive buyers?
- Do various market segments differ in their media habits?

Discriminant analysis model

The discriminant analysis model involves linear combinations of the following form:

$$D = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \ldots\ldots\ldots\ldots + b_kX_k$$

Where

D = discriminant score

b_s = discriminant coefficients or weights

X_s = predictors or independent variables

The coefficients, or weights (b), are estimated so that the groups differ as much as possible on the values of the discriminant function.

10.3 Self-Assessment Questions:

Q1: What are factors analyses?

Q2: Write a short note on correlation coefficient?

Q3: Briefly explain Cluster analysis?

Q4: What are the methods in cluster analysis?

Q5: Write down the limitations of cluster analysis?

Q6: Explain discriminant analysis?

10.4 Summary

Factor analysis is a multi-variate analysis technique. It uses an advanced form of correlation analysis to the responses to a number of statements. It identifies those variables that are interrelated and reduces them to a smaller number of underlying dimensions palled 'factor'. It is done on continuous variables or intervally-scaled variables. It is based on the research that includes a question which makes the respondents indicate their level of agreement/ disagreement with a battery of statements. Each statement is description of a variable.

Cluster analysis is used to classify persons or objects into a small number of mutually exclusive and exhaustive groups. It is the technique in which objects are classified into homogeneous groups called clusters. Objects in one cluster tend to be similar to each other and dissimilar to objects in the other clusters. Cluster analysis is also called classification analysis, or numerical taxonomy.

Discriminant analysis is a technique for analyzing data when the criterion or dependent variable is categorical and the predictor or independent variables are interval in nature.

Both cluster analysis and discriminant analysis are concerned with classification. However, discriminant analysis requires prior knowledge of the cluster or group membership of each object. In contrast, in cluster analysis there is no a priori information about the group or cluster membership for any of the objects.

10.5 Glossary:

Analysis: The process of breaking a complex topic or substance into smaller parts in order to gain a better understanding of it.

Cluster: A group of similar things or people positioned or occurring closely together.

Discriminant: It is the part of the quadratic formula underneath the square root symbol: b^2-4ac.

Standardization: The process of implementing and developing technical standards based on the consensus of different parties that include firms, users, interest groups, standards organizations and governments.

Hierarchical: It is an arrangement of items in which the items are represented as being "above", "below", or "at the same level as" one another.

Correlation coefficient: It is a statistical measure of the strength of the relationship between the relative movements of two variables.

10.6 Answers to self-check questions:

Q1: Refer to10.2.1

Q2: Refer to 10.2.1

Q3: Refer to 10.2.2

Q4: Refer to 10.2.2

Q5: Refer to 10.2.2

Q6: Refer to 10.2.3

10.7 Terminal Questions

1. What do you understand by factor analysis? Discuss its uses.
2. What do you understand by cluster analysis? Discuss its uses.
3. What is Discriminant analysis? Where is it used?
4. Compare and contrast factor and cluster analysis.
5. Provide an overview of factor analysis, cluster analysis, and discriminant analysis.
6. Discuss the significance and uses of factor analysis, cluster analysis, and discriminant analysis.

10.8 Suggested Readings

1. S.P. Gupta, "*Statistical methods"* Sultan Chand & Sons publication, New Delhi
2. Donald S. Tull and Del S. Hawkins, *"Marketing Research - Measurement and Method',* Prentice Hall of India Pvt. Ltd., New Delhi.
3. William G. Zikmund, *"Exploring Marketing Research",* Thomson South-Western Publication, Singapore.
4. Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Delhi.
5. Naresh K. Malhotra, *"Marketing Research - an applied orientation",* Pearson education (Singapore) pte. Ltd., Delhi.

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Lesson-11
Conjoint Analysis & Multidimensional Scaling

Structure

11.0 Introduction

This lesson focuses on two important research tools namely conjoint analysis and multidimensional scaling. Conjoint analysis is a set of techniques designed to measure the importance individual consumer attach to each attribute and their degree of preference for each level of each attribute. In multidimensional scaling consumers do not rate brands on individual attributes. Instead, they rate brands in terms of similarity or preference. A computer programme then derives the number of dimensions and the location of each brand on each dimension that would be required to duplicate the consumer's similarity or preference judgments. An effort has been made here two simplify these two tools for proper understanding. The objectives of the lesson are as follows:

11.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- Conjoint Analysis
- Limitations of Conjoint Analysis
- Multidimensional Scaling

11.2 Presentation of Contents

11.2.1 Conjoint analysis:

Conjoint analysis estimates consumers' evaluation of product or options of attributes, through a study of tradeoffs made by them in terms of product attributes/features. The trade-offs are determined from preference data obtained from a sample of respondents, through rank-ordering of alternative products or options. By combining alternative attributes or features, or alternative levels of different attributes or features, one can generate alternative products.

It uses a complex form of ANOVA to the preference data. It calculates a value (utility) for each feature/attributes: Feature/attributes with the higher values are the most important to respondents.

It is applied to categorical variables which reflect different features/attributes of a product under consideration. It attempts to identify the interdependencies that exist between number of variables. It measures the relative importance of various combinations of the features/attributes.

It is based on the premises that

- A consumer has to choose from multi-attribute/multi-feature products or options.
- She/he ranks the options according to some criterion.
- Such ranking involves complex trade-offs, where, to obtain a desired product quality, the customer must sacrifice/compromise some other desired product quality.

This analysis is commonly used to identify the most desirable combination of features for a new product or service. In such research, the respondents are informed about the various combinations of features/ attributes under consideration, and are asked to indicate the combination they most prefer, and their second preference, and so on. The preference data thus obtained is used to determine what the respondents consider to be the product's /service's most important features/ attributes, and the most important combinations of features/attributes.

Conjoint analysis generates utilities for each level of each attribute/feature, for each respondent. The utilities indicate the following characteristics:

- When the utility of one attribute/feature is added to the utility of one or more other attribute(s) feature(s), the sum for that combination displays a good correspondence with that combination's position in the respondent's original preference ranking.
- A respondent's first preference has the largest combined utility, the second preference has the next largest combined utility, and so on.
- The utilities are useful representations of how a particular respondent views the relative importance of each attribute level or feature.

The concept is that each respondent's preference rankings reveal something about the relative utility that she/he has for each feature/attribute. The features/attributes that a respondent is reluctant to give up from one preference ranking to another, is considered to be of higher utility to that respondent than the features/attributes that are quickly given up in the process of ranking the options.

The utilities are arrived at through iterative techniques. These techniques try to fit different numbers, using a predetermined logic, to arrive at utilities that will satisfy the requirement specified below:

For each alternative combination, the following must be done.

a) Identify the utilities for each attribute level included in an alternative.

b) Add all the utilities for ali the attribute levels included in that attribute.

c) Rank the total utility from the highest to the lowest.

d) Check to see if the respondent ranking is similar to the one that is obtained by asking respondents to rate the importance of the different features of a product on a 10-point scale.

The output of a typical Conjoint Analysis would be as given below:

Attribute/Feature	Utility
A	1.2
B	1.8
C	1.5
D	3.1
E	2.5
F	4.5
G	3.9
H	2.0

Based on the above utilities, the relative importance of the attributes/features is in the following order-F, G, D, H, B, C and A. The utilities of various combinations and their relative preference, based on utilities, are as shown below:

Sr. No.	Combination	Combined Utility	Relative preference
1..	AC EG	9.1	5
2.	BADH	8.1	6
3.	GFDC	13.0	1
4.	AEFG	12.1	2
5.	BDEF	11.9	3
6.	CDEF	11.6	4

It may be noted here that utilities based relative preference may not match with the expressed relative preference for the combinations if the combined utility of two or more combinations are similar.

In order to understand the importance of each attribute/feature itself, it advised to calculate the absolute difference between the lowest and the highest utility value for each attribute. If the utilities are consistent across the respondents it is suggested that the Standard Deviation of the scores for each level of attribute/feature be studied.

We shall now touch upon a point of concern. Take the scenario when three levels each of three attribute, i.e, 27 combinations are to be evaluated. Such an assessment is asking far too much of the respondent. Further, their fatigue could affect the response sensitivity. However, there is an option for this. It involves the reduction of a large number of combinations to a reasonable number through “fractional factorial design”. Thus, it enables us to use fewer alternatives, and yet allows the derivation of utilities for each level of each attribute.

Let us now discuss an example and try to understand how conjoint analysis is performed.

A company wants to introduce a new range of neckties. Before releasing the new product, they wanted to determine the prospective customer’s reactions to the alternative prices, sizes and colors. The options were as given below:

Attribute/ Feature	Level (s)
Size	2 nos- A and B.
Color	2nos- Black and Brown.
Price	3 nos- Rs 45, Rs. 40, And Rs. 35.

The preference ranking obtained is listed below:

Combination	Size	Price	Color Ranking	Preference
1	A	45	Black	12
2	A	40	Black	8
3	A	35	Black	3
4	A	45	Brown	10
5	A	40	Brown	5
6	A	35	Brown	1
7	B	45	Black	11
8	B	40	Black	6
9	B	35	Black	4
10	B ‘	45	Brown	9
11	B	40	Brown	7
12	B	35	Brown	2

The Conjoint Analysis output on this data revealed the following:

Attribute/Feature	Utility
Size A	0.6
Size B	0.7
Black	0.3
Brown	0.7
Rs. 45	0.2
Rs. 40	0.5
Rs. 35	0.8

Based on the combination of utilities, the top two combinations were selected.

11.2.2 Limitations of Conjoint analysis

The limitations of Conjoint Analysis are listed below:

a) It assumes that the most important attributes have been used in the research.

b) It assumes the additivity of utilities for combinations of features/attributes.

c) Some products or services may involve utility functions and decision rules that ate not adequately captured.

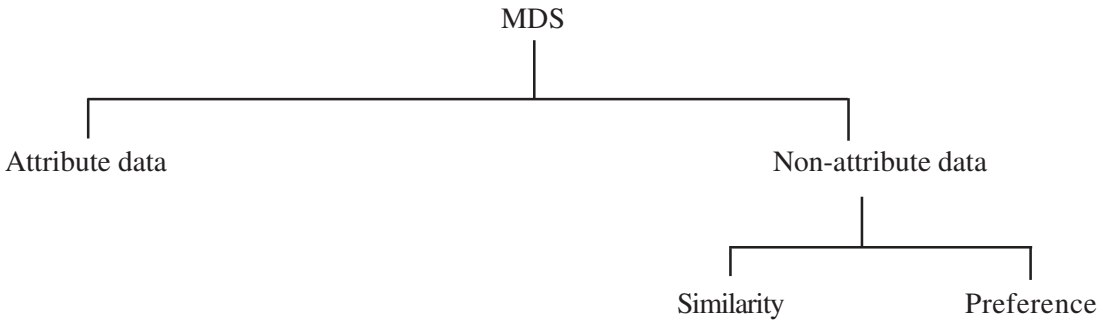
d) Some products may not lend themselves to descriptions in terms of component parts (i.e., features/ attributes).

11.2.3 Multi-dimensional scaling (MDS)

Certain quantitative research-based data ascertained or brand associations can be processed through Multi-Dimensional Scaling (MDS). It basically involves two processes:

- The identification of the dimensions upon which customers perceive or evaluate objects, and
- The arrangement of objects (i.e., brands) with respect to the dimensions,

MDS takes a set of distance data and tries to find a spatial configuration or arrangement of points in some number of dimensions whose distances best match the input data. The approaches to MDS are highlighted below:



MDS does not explain the perception about brands. It provides a useful representation of a set of subjective judgments about the extent to which a respondent views various pairs of entities (i.e., brands) as being dissimilar. It represents psychological relations among stimuli-either empirically obtained (through market research) similarities or preferences-as geometric relationships among points in a multi-dimensional space.

Thus, psychological dissimilarity is represented as geometric distance. The axes of the space are often (but not necessarily) assumed to represent the psychological bases or attributes, along which the respondents compare stimuli.

Many different kinds of MDS procedures exist. A few are briefly discussed below. The input data arrangement is mostly:

• Either *single mode, two-way data.*

	B1	B2	B3
B1			
B2			
B3			

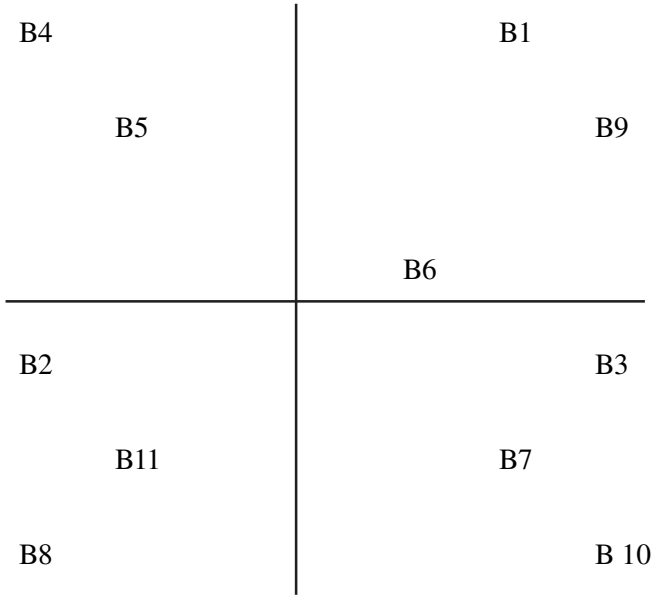
B1, B2 and B3 are three brands. There can be more, according to the number of brands included in the research. Here, n (n-1) /2 pairs of brands are evaluated.

• or *two mode, two-way data.*

	A1	A2	A3
B1	*	*	*
B2	*	*	*
B3	*	*	*

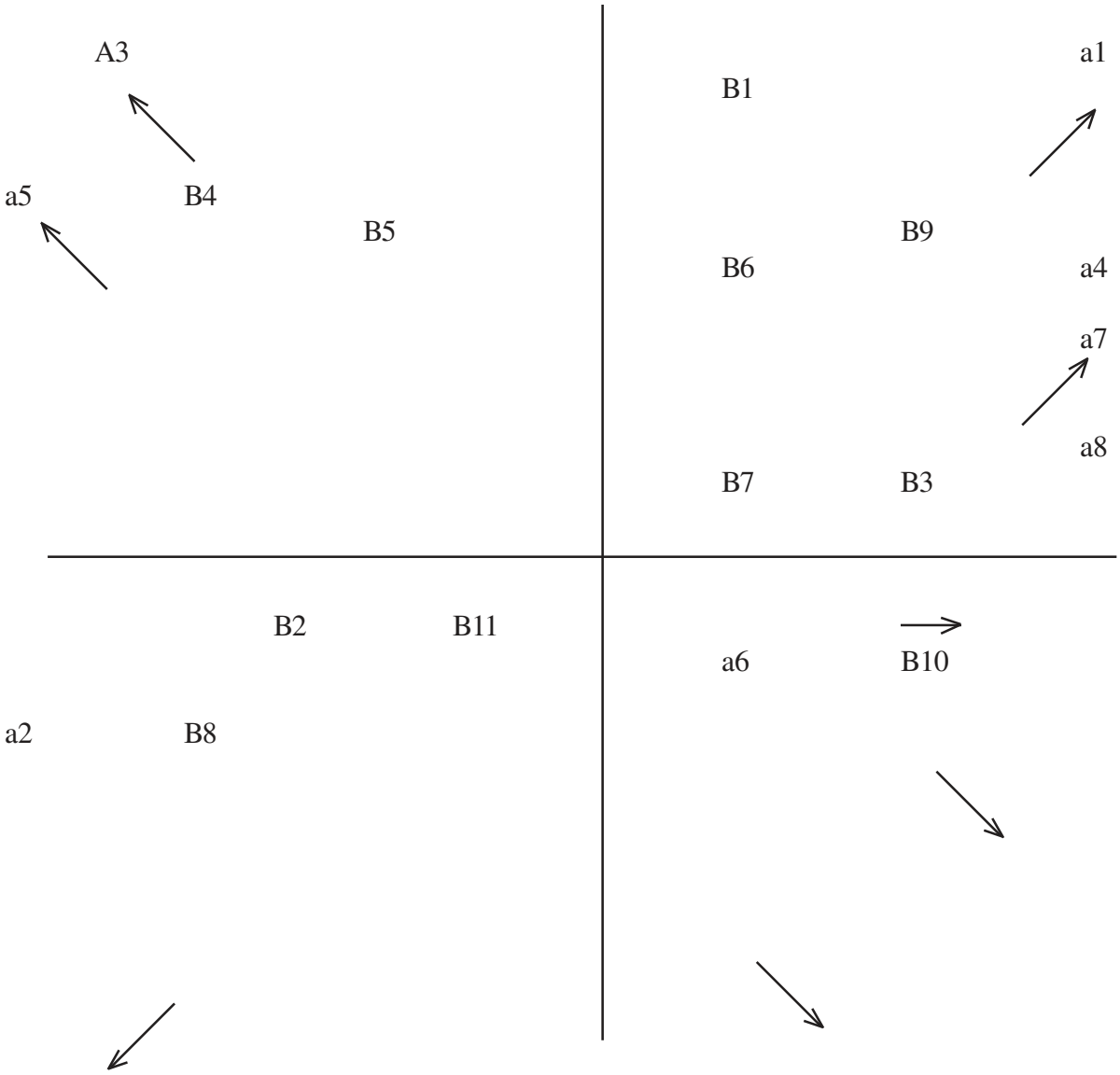
B1, B2 and B3 are three brands, and A1, A2 and A3 are dimensions (parameters of brand associations, i.e., attributes/benefits/features) of psychological relationship. The number of brands and dimensions would be the same as that used in the research.

Single mode, two-way data - The resultant space consists of arrangement of only one set of points (Single mode) -SIMPLE space. Here points (brands) close together are similar, and vice-versa. So, research data is converted into geometric distance, and brands arranged in the space. The closer the two brands, the more similar they are, and vice-versa



B1... B11 are eleven brands, B4 and B5 are similar to each other, and distinctly different from other.

Two mode, two-way data The resultant space consists of an arrangement of two different sets of points (two-mode)-JOINT space.



Here, the brands are located on attribute vectors. The further outward the brand is projected in the direction of the attribute vector, the more associated is the brand with that attribute; e.g., B4 is most associated with a3 and a5 and B11 is less associated with a2 than B8.

A variety of issues are involved in using MDS. Some of them are as follows:

- The input for an MDS analysis can be similarities or preference data. With preference data, consumers rank brands in terms of their preference for them. The theory underlying MDS analyses of preference data is that brands near each other in preference rating are similar on the dimensions a consumer uses in forming those preferences. Preference based models will thus provide dimensions related to preference or choice. Similarities data, however, are likely to reveal more comprehensive structures, and they are most widely used.
- The more objects evaluated, the more precisely the derived map will reflect the actual perceptions.
- Selection of scaling method and the input method are interdependent

- Most MDS programmes will extract any number of dimensions from 1 to N-1, where N is the number of objects being evaluated. The general objective is to achieve a good fit using as few dimensions as possible. Fit will generally improve with each added dimension. In practice, researchers often produce solutions in one through four or five dimensions. The best number of dimensions may then be determined subjectively as the map that provides the best interpretation.

11.3 Self-Assessment Questions:

Q1: Explain conjoint analysis?

Q2: What are the limitations of conjoint analysis?

Q3: What is the full form of MDS?

Q4: Briefly explain the multi-dimensional scaling?

11.4 Summary

Conjoint analysis and multidimensional scaling are two very important techniques of analysis. Multidimensional scaling is used for obtaining spatial representations of respondents' perceptions and preferences. Perceived or psychological relationships among stimuli are represented as geometric relationships among points in a multidimensional space.

Conjoint analysis is based on the notion that the relative importance that consumers attach to salient attributes, and the utilities they attach to the levels of attributes, can be determined when consumers evaluate brand profiles that are constructed using these attributes and their levels.

11.5 Glossary:

Conjoint: Combining all or both people or things involved.

Analysis: The process of breaking a complex topic or substance into smaller parts in order to gain a better understanding of it.

Scaling: The procedure of measuring and assigning the objects to the numbers according to the specified rules.

Multidimensional: Involving several dimensions.

Attribute: It is a quality or characteristic given to a person, group, or some other thing.

11.6 Answers to self-check questions:

Q1: Refer to 11.2.1

Q2: Refer to 11.2.2

Q3: (MDS) Multi-Dimensional Scaling.

Q4: Refer to 11.2.3

11.7 Terminal Questions

1. Clarify the concept of conjoint analysis and discuss its utility.

2. Describe the procedure for conducting conjoint analysis.

3. What do you understand by multidimensional scaling? How is it used?

4. With the help of suitable examples, discuss the use of multidimensional scaling.

5. Discuss the basic concepts of conjoint analysis and contrast it with MDS.

11.8 Suggested Readings

1. S.P. Gupta, "*Statistical methods"* Sultan Chand & Sons publication, New Delhi
2. R.P. Hooda, "*Statistics for Management and Economics*" McMillan India, New Delhi.
3. Donald S. Tull and Del S. Hawkins, *"Marketing Research - Measurement and Meihod*', Prentice Hall of India Pvt. Ltd., New Delhi.
4. Wiiliam G. Zikmund, "*Exploring Marketing Research",* Thomson South-Western Publication, Singapore.
5. Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Delhi.
6. Naresh K Malhotra, "Marketing research - An Applied orientation", Pearson Education (Singapore), Pte. Ltd., Delhi.

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Lesson - 12
Research Applications

Structure

12.0 Introduction

Research is nothing but a careful, critical enquiry or examination in seeking facts or diligent investigation in order to ascertain something. Research is very useful in all walks of life but is very important for modern day business. It helps managers in understanding the problem situation and also helps taking better decisions. Research provides us knowledge and information otherwise we have to rely on our intuition or judgment, it improves planning, implementation, and control as exercised by a manager. This lesson highlights a few application of research in the context of business. The objectives of the lessons are as follows:

12.1 Learning Objectives:

After studying this lesson, you will familiarize with following concepts:

- Concepts of research
- Significance of research
- Application of research

12.2 Presentation of Contents

12.2.1 Concept of Research

Research, simply put, is an endeavor to discover intellectual and practical answers to problems through the application of scientific methods. It is a critical and exhaustive investigation or experimentation for determining facts. It is a systematic attempt to push back the boundaries of comprehension and seeking beyond the horizons of our knowledge to find some truth, some reality.

It can also be understood as the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge to aid in construction of theory or practice, it gives us knowing the unknown.

The obvious function of research is to add new knowledge to our existing store. Its power of cleansing our minds of cliches and removing the rubbish of inapplicable are equally important. Research in social sciences focus o the discovery and interpretation of social processes, patterns of behaviour, similarities and dissimilarities of social phenomena and social systems.

12.2.2 Significance of Research

"All progress is born of inquiry. Doubt is often better than over-confidence, for it leads to inquiry, and inquiry leads to invention" is a famous maxim in the context of which the significance of research can well be understood. Increased amounts of research make progress possible. Research inculcates scientific and inductive thinking and it promotes the development of logical habits of thinking and organization.

The role of research in several fields, whether related to business or to the economy as a whole, has greatly increased in modern times. The increasingly complex nature of business and government has focused attention on the use of research in solving operational problems. Research, as an aid to economic policy, has gained added importance, both for government and business.

Research provides the basis for nearly all government policies in our economic system. For instance, government's budgets rest in part on an analysis of the needs and desires of the people and on the availability of revenues to meet these needs. The cost of needs has to be equated to probable revenues and this is a field where research is most needed. Through research we can devise alternative policies and can as well examine the consequences of each of these alternatives.

Decision-making may not be a part of research, but research certainly facilitates the decisions of the policy-maker. Government has also to chalk out programmes for dealing with all facets of the country's existence and most of these will be related directly or indirectly to economic conditions. The plight of cultivators, the problems of big and small business and industry, working conditions, trade union activities, the problems of distribution, even the size and nature of defense services are matters requiring research. Thus, research is considered necessary with regard to the allocation of nation's resources.

Another area in government, where research is necessary, is collecting information on the economic and social structure of the nation. Such information indicates what is happening in the economy and what changes are taking place. Collecting such statistical information is by no means a routine task, but it involves a variety of research problems. These days nearly all governments maintain large staff of research technicians or experts to carry on this work. Thus, in the context of government, research as a tool of economic policy has three distinct phases of operation, viz. (i) investigation of economic structure through continual compilation of facts; (ii) diagnosis of events that are taking place and the analysis of the forces underlying them; and (iii) the prognosis, i.e.., the prediction of future developments.

Research has its special significance in solving various operational and planning problems of business and industry. Operation research and market research, along with motivational research are considered crucial and their results assist, in more than one way, in taking business decisions. Market research is the investigation of the structure and development of a market for the purpose of formulating efficient policies for purchasing, production and sales. Operations research refers to the application of mathematical, logical and analytical techniques to the solution of business problems of cost minimization or of profit maximization or what can be termed as optimization problems. Motivational research is carried out for determining why people behave as they do and is mainly concerned with the determination of motivations underlying the consumer behavior. All these are of great help to people in business and industry who are responsible for taking business decisions.

Researches with regard to demand and market factors have great utility in business. Knowledge of future demand helps industry to adjust its supply schedule within the limits of its projected capacity. Market analysis has become an integral tool of business policy these days. Business budgeting, which ultimately results in a projected profit and loss account, is based mainly on sales estimates which in turn depend on business research. Once sales forecasting is done, efficient production and investment programmes can be set up around which are grouped the purchasing and financing plans. Research, thus, replaces intuitive business decisions by more logical and scientific decisions.

Research is equally important for social scientists in studying social relationships and in seeking answers to various social problems. It provides the intellectual satisfaction of knowing a few things just for the sake of knowledge and also has practical utility for the social scientist to know for the sake of being able to do something better or in more efficient manner. Research in social sciences is concerned both with knowledge for its own sake and with knowledge for what it can contribute to practical concerns. On the other hand, because of its social orientation, it is increasingly being looked to for practical guidance in solving immediate problems of human relations.

In addition to what has been stated above, the significance of research can also be understood keeping in view the following points:

a) To professionals in research methodology, research may mean a source of livelihood;

b) To philosophers and thinkers, research may mean the outlet for new ideas and insights;

c) To literary men and women, research may mean the development of new styles and creative work;

d) To analysts and intellectuals, research may mean the generalisations of new theories.

Thus, research is the fountain of knowledge for the sake of knowledge and an important source of providing guidelines for solving different business, government and social problems. It is a sort of formal training which enables one to understand the new developments in one's field in a better way.

12.2.3 Applications of Research in Business & Industry

Let us know discuss the application of research in various areas of business:

(i) Consumer Research: Consumer research seeks answers to a variety of questions in respect of consumer characteristics and behaviour. The aim of this research is to develop an understanding about consumers, both current and potential, and the level of satisfaction expected and derived by them from company's products. Broadry, the areas of consumer research include the following:

- Determining the demographic characteristics of both existing and potential consumers.
- Identifying the consumer needs and product expectation levels.
- Identifying the factors influencing purchase decisions.
- Ascertaining the levels of consumer satisfaction.
- Finding out what they buy? Whey they buy? When they buy? How they buy? How much they buy? How often they buy? Etc.

(ii) Market Research: Market research answers questions in respect of different markets. The purpose of this research is to gather facts about markets and the forces operating therein, like competitors and government, so as to enhance the competitive strength of the company in the market place. The areas of market research broadly include:

- Determining the size of both current and potential market.

- Assessing the market trends.
- Ascertaining the strengths and weaknesses of competitors' marketing strategies.
- Determining the impact of current and contemplated legislative actions of the state on the marketing effort of the company.
- Demand and sales forecasting.

(iii) Product Research: Product research addresses itself to the questions associated with the products of the company and competitors The purpose of this research is to find out the product image which will be compatible with the self-image of consumers and to ascertain whether the former really fits into the latter or not. Product research thus becomes an important vehicle for implementing the marketing concept. The areas of product research include:

- Evaluating performance of company's products in terms of sales, profits, and market segments.
- Determining modifications in the existing products.
- Determining consumer acceptance of new products.
- Undertaking comparative studies of the competitive products.
- Evaluating new competitive products.
- Determining current or new uses of existing products.
- Market- testing of new products.
- Testing package and label designs.
- Appraising diversification and simplification plans.
- Developing brand names and branding strategies

(iv) Service Research: There are many services which are offered both to individuals/households, to industries, and institutional buyers. The buying practices, buying behaviour etc. of organizational buyers in the industrial marketing are equally applicable to marketing of industrial services. The broad areas of research in services include:

- Selecting service attributes tailored to the needs of selected target markets that are equal to or superior to competitive offerings.
- Tailoring location and timing of service availability to consumer needs and preferences.
- Developing an effective communication mix to inform prospective customers about the service and persuade them in order to promote the use of that service.
- Setting prices in line with competitive strategy, which the customer can afford and, which will leave a profit margin to the supplier to the service.

(v) Sales Research: Sales research attempts to answer questions relating to the sales of company's products. The purpose is to find out the sales potential and appraise sales performance of company's products. The broad areas of sales research include:

- Determining and appraising sales methods.
- Establishing and revising sales territories.
- Measuring sales performance in terms of volume and profits.
- Analysing the operations and appraising the performance of sales personnel.

- Determining sales quotas. and other standards of performance for different market segments and sales personnel,
- Determining the mode of compensating sales personnel.
- Determining routing patterns and territorial coverage.

(iv) Distribution Channel Research: In channel research, researchers address themselves to the questions relating to channels and intermediaries engaged by the company to transfer ownership of products to consumers. The purpose of this research is to identify the appropriate distribution channels and intermediaries and to ascertain whether they help the company in meeting the consumer needs or not. The broad areas of channel research include:

- Identifying the existing and potential distribution channels and appraising their relative strength and weaknesses in the context of consumer needs.
- Identifying the appropriate intermediaries for products and determining their number and type.
- Measuring and evaluating the performance of the channels and different intermediaries.
- Determining the needs of the dealers and the actors governing their behaviour.

(vii) Advertising Research. Advertising is one of the important marketing areas in which marketing researchers are involved these days. The purpose of this research is to make the company's product and other allied messages worthy of effective reception at the consumer-end so that consumers are induced to act in the manner desired by the company. The areas of advertising research broadly include:

- Determining the advertising messages and appeals in the light of consumer research findings.
- Comparing the probable effectiveness of the alternative advertisement copies.
- Selecting the advertising media.
- Evaluating the advertising effectiveness.
- Media planning and scheduling.

(viii) Pricing Research: In pricing research, answers are sought to questions relating to the ability of consumers to pay. The purpose of this research is to find out the price expectations of consumers and their responses and reactions to them. The researches here focus on studying factors affecting prices and deciding pricing methods and strategies. The areas of research broadly include:

- Determining the price expectations of consumers in the different market segments.
- Comparing the price strategies of the competitors.
- Determining the factors affecting the prices of products.
- Testing the alternative price strategies.
- Evaluating the consumer reactions and responses to the company prices.

(ix) Physical Distribution Research: In physical distribution research, researchers address themselves to problems connected with the holding, handling and transportation of finished products. The purpose of this research is to explore the possibilities of cost reduction in any of these areas and enhancing the time and place utilities of products. The areas include:

- Determining the optimum inventory levels.
- Determining the design and location of distribution centers.

- Considering the economics of the different modes of materials handling and transportation and determining their suitability.

(x) Global Marketing (Export-import) Research: The complexity and diversity of international environment and market place, the differences that exist from country to country, and the frequent lack of familiarity with foreign markets underscore the importance of international marketing research. Before making initial market entry decision, product positioning or marketing mix decisions, accurate information is needed about the market size, market needs, competition and so on. Research is necessary to avoid the costly mistakes of inappropriate strategy and the possibility of lost opportunities and to determine how international operations can be coordinated to take advantage of the potential synergies arising from foraying in a global environment.

Special cultural and other environment factors, political and legal constrains to market entry, and other unfamiliar influences require market survey be thoroughly designed. The multi phase approach in export research involves:

- Initial screening of countries or areas which appear to offer potentially attractive opportunities for market development!
- Identifying specific sectors or segments of markets.
- Evaluating market opportunities against corporate resources and objectives.
- Deciding best modes of entering foreign markets.
- Deciding marketing programmes for foreign countries

(xi) Financial Research: Business research techniques can be used for making better decisions in the field of financial services/schemes of a company, a bank, finance house, leasing and hire purchase organizations etc. Financial research includes investor research and the following:

- Mobilization of funds using financial schemes.
- Estimation of demand side, in the form, of investor profiles and their investing patterns.
- Capital budgeting and Project funding and management » Working capital management
- Taxation decisions and planning
- Budget preparation and revenue/expenditure estimation
- Portfolio management and dividend/interest decisions

12.3 Self-Assessment Questions:

Q1 Explain the concept of research?

Q2: Briefly explain the significance of research?

Q3: Write a short note on Global marketing research?

Q4: Briefly discuss about the applications of research in business & industry?

Q5: Define financial research?

Q6: What is distribution channel research?

12.4 Summary

Research is a critical and exhaustive investigation or experimentation for determining facts. Research is very useful in all walks of life but is very important for modern day business. It helps managers in understanding the problem situation and also helps taking better decisions.

The role of research in several fields, whether related to business or to the economy as a whole, has greatly increased in modern times. The increasingly complex nature of business and government has focused attention on the use of research in solving operational problems. Research, as an aid to economic policy, has gained added importance, both for government and business.

Application of research includes consumer research, product research, advertising research, financial research, sales research, export/import research, pricing research etc.

12.5 Glossary:

Research: It is creative and systematic work undertaken to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications.

Application: It a formal request to be considered for a position or to be allowed to do or have something, submitted to an authority, institution, or organization.

Business: A person's regular occupation, profession, or trade.

Industry: It is a sector that produces goods or related services within an economy.

Prognosis: The likely course of a medical condition.

Diagnosis: The identification of the nature of an illness or other problem by examination of the symptoms.

Endeavour: Try hard to do or achieve something.

12.6 Answer to self-check questions:

Q1: Refer to 12.2.1

Q2: Refer to 12.2.2

Q3: Refer to 12.2.3

Q4: Refer to 12.2.3

Q5: Refer to 12.2.3

Q6: Refer to 12.2.3

12.7 Terminal Questions:

- Clarify the concept of research and discuss its significance.
- Discuss the application of research in various business areas.
- Write a detailed note on the significance and application of research in the context of business.
- Explain how researches can aid managers.

12.8 Suggested Readings

1. T.S. Wilkinson, and P.L. Bhandarkar, "Methodology and techniques of Social Research", Himalaya Publishing House, New Delhi.
2. S.P. Gupta, *"Statistical methods"* Sultan Chand & Sons publication, New Delhi.
3. Donald S. Tull and Dei S. Hawkins, *"Marketing Research - Measurement and Method',* Prentice Hall of India Pvt. Ltd., New Delhi.
4. William G. Zikmund, *"Exploring Marketing Research",* Thomson South-Western Publication, Singapore.
5. Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Limited, Delhi.

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Assignments:

Attempt 75%

Q 1 Discuss the importance of research methodology.

Q 2 Discuss the research design process.

Q 3 Write a detail note on measure of Central Tendency.

Q 4 Discuss the different methods of collection of data.

June - 2006
M.B.A. Examination

Attempt any Five Questions in all, selecting one question from each unit, all questions carry equal marks.

Unit-I

1. Define research. Explain the nature and scope of the research methodology. (12)
2. What is research process? Describe the different steps involved in a research process. (12)

Unit-II

3. You have to collect the opinion of students on various aspects of teaching in your department. Give an outline of this study showing all the major points of the research plan. (12)
4. Explain the meaning and significance of a research design. (12)

Unit-III

5. What are the various methods of data collection, in research? Discuss in detail their advantages and limitations. (12)
6. What is motivational research? Discuss its various techniques. (12)

Unit-IV

7. Why is sampling necessary in statistical investigation? Explain the important methods of sampling commonly used. (12)
8. What is meant by a statistical table? State clearly the essentials of a good table. What precautions would you take in tabulating data? (12)

Unit-V

9. Explain factor analysis along with its merits and limitations. (12)
10. What is the significance of using multiple discriminant analysis? Explain in brief the technical details involved in such technique. (12)

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MBA Examination
Research methodology
Paper-207

Attempt any Five Questions in all, selecting one question from each unit, all questions carry equal marks.

UNIT-I

1. "Problem definition and statement of objectives is one of the most important steps in the research process", justify the above by giving suitable examples.
2. Write about the research process in detail, making a flowchart and enumerating each step in the process in detail.

UNIT-II

3. Dos exploratory research require certain special research techniques? Write about some research techniques used in exploratory research. What is a focus group interview, in what cases should it be used?
4. What is a completely randomized experimental design? When can it be used? Give examples.

UNIT-III

5. What are attitudes? Can attitudes be measured? Explain the nominal, ordinal, internal and ratio scads.
6. Explain in detail the sample survey method. Also explain what you understand from the terms consumer part and retail audit.

UNIT-IV

7. Differentiate between probability and non probability sampling methods. Write about the various probability methods in detail.
8. What is the importance of editing and coding of data? What are the various methods of presenting data graphically? Write about bar charts, pie charts and histograms.

UNIT-V

9. What is multidimensional scading? Write in detail about its application in business research.
10. How can research be used for segmenting the market? Write detail.

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